DIABETES EDUCATION TRAINING MANUAL

FOR

SUB-SAHARAN AFRICA

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INTERNATIONAL DIABETES FEDERATION
AFRICA REGION

International Diabetes Federation

WORLD DIABETES FOUNDATION

Developed by

IDF AFRICA REGION TASK FORCE ON DIABETES EDUCATION

For

IDF AFRICA REGION

With support of

WORLD DIABETES FOUNDATION

July 2006

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FOREWORD

The incidence of diabetes throughout the world, and in particular in sub-Saharan Africa, is increasing at an alarming rate and contributes significantly to the growing human and public health costs of diabetes. Such costs can be decreased by incorporating active participation of people with diabetes in their own treatment. That participation, however, can only be accomplished by adequate motivation and education of these people by well trained personnel in the health care team. As such, a parallel increase in the development of diabetes education, as a specialty, is essential to meet this growing demand. Thus, an urgent need exists for health professionals in Africa to have access to first-class professional education in diabetes that is culturally relevant. ith this educational resource, diabetes healthcare professionals anywhere in the Africa can teach other health professionals about diabetes care using consistent, evidence-based research and information.

As Chair of the IDF Consultative Section on Diabetes Education and a Vice-President of IDF, it is my sincere hope that these educational resources will enable increased numbers of healthcare providers to establish programmes to enhance the knowledge and skills of their colleagues. Only then, backed by sufficiently large numbers of diabetes-aware skilled health professionals, will we be able to face the demands of the global diabetes epidemic.

I would like to extend my most sincere congratulations to Professor Kaushik Ramaiya and his very dedicated multidisciplinary team, who spent many hours developing each module.

Marg McGill
IDF Vice President
Chair, IDF Diabetes Education Consultative Section

ACKNOWLEDGEMENTS:

ACKNOWLEDGEMENT.

The IDF Africa Regional Council Meeting held on 3rd May, 2005 in Zanzibar, Tanzania unanimously approved the appointment of a Task Force on Diabetes Education with the terms of reference to develop and implement up-to-date Diabetes Education Training Manual, taking into consideration the limited resources available in the Region.

The members of the Task Force on Diabetes Education were:-

- Mrs. Patricia Fokumlah - Cameroon (Chair)
- Dr. Carla Matos - Mozambique
- Dr. Marguerite Declerk - Democratic Republic of Congo
- Ms. Atieno Jalango - Kenya
- Ms Estelle Nagel - South Africa
- Dr. Gaman Mohamed - Kenya
- Dr. Maria Mupanomunda - Zimbabwe

During the development of the guidelines, the Task Force worked closely with IDF Africa Region Task Force on Type 2 Diabetes Clinical Practice Guidelines.

The members of the Task Force on Type 2 Diabetes Clinical Practice Guidelines were:-

- Prof. N.S.Levitt - South Africa (Chair)
- Prof. E.Ohwovoriole - Nigeria
- Dr. Tossou Komlan - Togo
- Dr. Ahmed Twahir - Kenya
- Dr. Kaushik Ramaiya - Tanzania
- Prof. J.C.Mbanya - Cameroon

On behalf of IDF Africa Region, we would like to gratefully acknowledge the contribution of time and efforts by all the members of the Task Force.

Acknowledgements are also due to:-

- Dr. Alieu Gaye - Gambia
- Dr. C.E.F.Otieno - Kenya
- Dr. Ali Salim Ali - Zanzibar
- Dr. Faiza Kassim - Zanzibar

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Dr. Kaushik L. Ramaiya

Chair

IDF Africa Region

INTRODUCTION

The International Diabetes Federation estimated that 194 million people had diabetes in the year 2003, and about two-thirds of these people lived in developing countries. In 1901 it was reported that diabetes was rather uncommon but very fatal in sub-Saharan Africa [Cook, 1901]. Diabetes continued to be regarded as rare in the region for the following 50-60 years but has since become increasingly common over the past few decades. Although communicable diseases continue to present the greatest disease burden in the region, non-communicable diseases, including hypertension and diabetes, are contributing significantly to a pattern of multiple disease burdens. Even though the HIV/AIDS epidemic is unfolding in sub-Saharan Africa, it is clear that the relative importance of non-communicable diseases will rise, driven by an ageing population, increasing urbanisation and other risk factors, such as tobacco smoking, obesity and physical inactivity.

The few epidemiological studies conducted in Africa have demonstrated that diabetes is frequently undiagnosed (2-3 undiagnosed cases for every known case). In most cases it is one of the complications of diabetes that prompts the patient's first presentation. Type 2 diabetes often occurs as part of the metabolic syndrome, in company with hypertension and dyslipidaemia, although, the latter has not been a prominent feature in the region so far, a situation that is likely to change in the future.

Diabetes is a major cause of morbidity and premature mortality and as such is a costly disease to the individual, family and society. Much of the morbidity of diabetes is preventable by good glycaemic control, good blood pressure (BP) control and regular examination for complications and timely intervention.

Health-care systems in Africa are traditionally geared to the management of acute illnesses and infectious diseases, such as tuberculosis, malaria and gastroenteritis. The HIV-AIDS epidemic has further strained the available but inadequate resources. Non-communicable diseases, thus, have a low priority.

One of the important components of diabetes management is Diabetes Education. The cadre of diabetes educators in sub-Saharan Africa was almost non-existant (except in Republic of South Africa) till 1998, where the first PADEG Leadership Course for diabetes nurses was held in Tanzania in May 1998. The success of this Anglophone representation ensured the commitment of the Francophone affiliates during the second PADEG course, held in Cameroon in March 1999. The purpose of these courses was to train diabetes educators to organise, manage and train other diabetes educators working in primary healthcare systems in sub-Saharan African countries. There were 54 educators trained and who in turn were expected to train other educators in their countries. Due to lack of funds and other resources there was no review of this process.

There was therefore a need to ensure that quality diabetes education-training programme is developed that will allow in built review processes and best practices to be identified.

A clear role for diabetes educator within the Region also needs to be identified and these educators have to be prepared for advanced level of training so as to promote optimum diabetes care.

It is against this background that the IDF Africa Region has initiated a project to develop and implement Diabetes Education Training Manual taking into consideration the limited resources available in the region.

Mrs. Patricia Fokumlah
Chair
IDF Africa Region Task Force on Diabetes Education

TABLE OF CONTENTS

MODULE 1

MODULE 1-1: THE ROLE OF THE DIABETES EDUCATOR

Overview: Diabetes educators are an integral part of the diabetes management team. The role of the educator is to enable people with diabetes to manage their diabetes related health to the best of their abilities, to allow them to make choices and take actions based on informed judgment, and to enhance the quality of life of the person with diabetes. Diabetes educators may come from a variety of health professions and other backgrounds. While they will primarily practice within their professional role, there needs to be some overlap with other team members. This means that some skills will be common to all team members

Goals: Educators will understand that they are part of a team, which includes the person with diabetes at its centre, and that their role is to work with other team members to improve the health and quality of life of their patients.

Objectives

At the end of the module, the participant will understand the role of the diabetes educator within the management team of people with diabetes.

Specifically, the participant will be able to:

1. Describe the role of the educator;
2. Describe knowledge and skills required of an educator;
3. Describe methods of maintaining and increasing skills and knowledge;
4. Discuss the expanding clinical role of the diabetes educator.

Introduction

The diabetes educator in the African region is an up-coming professional, who is little known, and therefore underused. In countries where there is some awareness, diabetes educators are recognised as important members of the diabetes care team. These professionals are well known in the developed world and the profession is governed by licensing authorities. In the African region, the situation is quite different. The awareness and availability of diabetes educators need to be expanded and spread throughout the region to avail all people with diabetes and their families with the valuable services

these professionals can offer.

The role of the diabetes educator is to enable people with diabetes to understand and manage their diabetes-related health to the best of their abilities, to allow them to make choices and take actions based on informed judgment and to enhance their quality of life. Therefore, a diabetes educator can be any health care provider who has specific skills and diabetes knowledge, and may come from a variety of health professions and other backgrounds.

Diabetes education has been shown to be effective, and is now considered an integral part of diabetes care and several interventions that have been shown to be cost saving. These include interventions that address prevention of diabetes, diabetes in pregnancy, and those that shift the initiation of insulin therapy from inpatient to outpatient settings. In acknowledging the critical importance of education, the International Diabetes Federation (IDF) established the Diabetes Education Consultative Section (DECS) to address the education needs of IDF member associations. At the level of the African region, a Task Force has been set up to develop a diabetes education programme for diabetes educators to ensure that their knowledge of diabetes is of an acceptable level, and to provide them with a patient education programme and materials which can be used to improve patient knowledge and care.

Content

1. Describing the role of the diabetes educator ?

    - Facilitating empowerment of people with diabetes through teaching recommended/accepted diabetes knowledge skills that translate into behaviour change.
    - Being part of the interdisciplinary health-care team.
    - Liaising with other health-care personnel and referral services.

2. Describing knowledge and skills required of a diabetes educator

    - Broad-based knowledge of diabetes, pathogenesis, diagnosis, prevention, complications, and management.
    - Technical skills such as injection technique, blood glucose monitoring, and foot care.
    - Interpersonal skills, such as empathy, communication, assertiveness, flexibility, and resourcefulness.
    - Presentation, writing, and interviewing skills, understanding the education process for adults and children.
    - Understanding of behaviour change and education strategies.

3. Maintaining and increasing knowledge and skills

- Continuous practice in working with people with diabetes and the community.
- Attending training and update courses.
- Assess and evaluate knowledge, and practice.
- Potentially to be part of a research team (evidence-based for diabetes practice).
- Adapting knowledge and skills to local realities.

4. Expanding role of the diabetes educator ?

- Lobbying for advantages for people with diabetes (policies, cost of care, non discrimination).
- Encouraging support groups as well as diabetes associations.
- Increasing community awareness.
- Increasing awareness of the importance of diabetes education.
- Promoting diabetes education as an independent profession.

Tools
These include books, statistical data, participation in leadership courses, and education programmes that include the use of team-care management.

Evaluation The various methods of evaluation include brainstorming, question and answers, pre- and post- knowledge and skills tests, role-playing, simulation, and demonstrations in actual clinical settings with persons with diabetes.

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MODULE 1-2: TEAM MANAGEMENT

Overview: This module aims to provide participants with the opportunity to consolidate their understanding of the social, educational, dietary and psychological requirements of people with diabetes and how they need to be met using an interdisciplinary approach. The module focuses on the professional roles required for true interdisciplinary care. It emphasizes the need for team members to have blended rather than discrete roles and discusses the need to extend traditional roles if specialized team members, such as dieticians or podiatrists, are not available. The module also emphasizes the importance of ongoing education in diabetes care for all team members and establishing common protocols and management goals.

Goals: To provide participants with an understanding of the special need for interdisciplinary care in the management of diabetes.
To highlight the expanded roles of health professionals involved in providing diabetes care.
To emphasize the blended and overlapping nature of roles in a truly integrated team.

Objectives

At the end of the module, the participant will have an understanding of the importance of interdisciplinary care in the management of diabetes.

Specifically, the participant will be able to:

1. Discuss the team approach to diabetes care;
2. List ideal members of the team;
3. Understand the different roles of members of the team;
4. Describe how to function with available members;
5. Demonstrate the use of the team approach in different settings;
6. Illustrate the ability to refer as necessary;
7. Discuss the importance of interdisciplinary communication, including team meetings;
8. Identify the need for continued education for team members.

Introduction

The diabetes care team is made up of many people with special expertise, the person with diabetes being at the centre. The person with diabetes is the one who chooses whether to follow a treatment plan and makes decisions about every day care.

The members of the diabetes care team help people with diabetes to monitor and manage their care, help them to set treatment goals and time lines to reach those goals. They can outline what treatment choices people with diabetes have, teach them self-care skills, help them solve problems and evaluate how their diabetes treatment plan is working.

The composition of the diabetes care team will differ in different locales and at different levels of care depending on availability.

Diabetes educators need to be aware of the availability of the human resources of their locale and establish a working network with them. They also need to appreciate professional attitudes and behaviours. Shortly after diagnosis, the person with diabetes will meet different members of the health-care team: doctors, nurses, chiropodists, dieticians, ophthalmologists and many more. The attitudes expressed by these contacts will have a profound effect on the attitude of the person with diabetes; therefore, it is essential for all these workers to express no conflict in attitudes, views, or information. Conflicting opinions between members of the health-care team could cause confusion, loss of trust and co-operation on the patient's side. There must be understanding, sympathy and enthusiasm, but very importantly, an attitude of optimism and a firm belief in an improved standard of health and well being.

Content

1. Discuss the team approach
    - Person with diabetes at the centre.
    - Team concept: group of professionals working with people with diabetes and their families for their care.
    - Identify professional attitudes and behaviours that are helpful/harmful to people with diabetes.
    - Recognize difficulties/barriers, attitudes/biases, doctor-nurse interactions/friction.
    - Overcoming barriers through communication, education, and demonstration of abilities.
2. List ideal members of diabetes care team
    - Attending physician/general practitioners.
    - Diabetes specialist, e.g. endocrinologist, diabetologist.
    - Diabetes nurse educator.
    - Dietician/Nutritionist.
    - Exercise specialist.

- Social worker/psychologist.
- Pharmacist.
- Ophthalmologist.
- Podiatrist.
- Nephrologist.
- Urologist.
- Cardiologist.

3. Understand the roles of different members of the team
   - Professional abilities of different members of the team.
   - Respect limitations of team members.
4. Describe how to function with available team members
   - The need to adapt to new situations.
   - Expanded roles according to the situation.
   - Acquisition of broader knowledge.
   - Acquisition of broader skills.
5. Demonstrate the use of the team approach in different settings
   - Community services.
   - Health centres.
   - Hospitals.
   - Private practice.
6. Illustrate the ability to refer as necessary
   - Recognition of personal ability and limitations.
   - Knowledge of the patient's situation.
7. Discuss importance of interdisciplinary communication, including team meetings
   - Harmonise protocol to ensure that all members of the team work towards the same goal and use a common framework to avoid confusing a person with diabetes, duplicating care, or miscommunication.
   - Establish methods for communication and documentation.
8. Identify continued educational needs of team members
   - Awareness of available training/in-service courses in locale for different professionals and non-professionals.
   - Auditing of diabetes service.

Tools

These include books, statistical data, and participation in leadership courses including the use of team-care management.

Evaluation

The various methods of evaluation include brainstorming, question and answers, pre- and post- tests, role-playing, simulation, demonstrations in actual clinical setting with people with diabetes.

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MODULE 1-3 (a): TEACHING AND LEARNING

Overview: Teaching skills are integral to the role of the diabetes educator. Diabetes educators should do more than hand out information; they should have a good understanding of the principles of the education process and apply these principles in practice.

Education is an ongoing process of assessment, planning, implementation, and evaluation. This process is not dependant on the availability of 'high-tech' resources, but requires a knowledgeable person with excellent communication skills.

Goals: TTo provide the participant with the knowledge and skills of the education process.

Objectives

1. Explain the benefits of patient education.
2. Differentiate between teaching and learning.
3. List elements of the teaching/learning process.
4. Discuss barriers to teaching and learning.
5. Discuss the three domains of learning: cognitive, affective, and psychomotor.
6. Discuss learning styles.
7. Discuss adult learning.
8. Discuss methods of learning.
9. Discuss the different teaching methods.
10. Discuss the advantages and disadvantages of different teaching methods.
11. Discuss learning in children and adolescents – Refer to Module 4-1.

Content

1. Explain the benefits of patient education.

> Said but not heard
> Heard but not understood
> Understood but not accepted
> Accepted but not put into practice
> Put into practice but for how long
>
> KONRAD LORENZ

An important advance in diabetes care has been the recognition that the most important person in the health-care team involved in care giving is the person with diabetes. The purpose is not to force patients into taking a particular course of action, but rather to advise what, in the light of current knowledge and experience, would be the best course for the patient's well being. If the person with diabetes is to accept responsibility for his or her own health care rather than to rely on others, a new responsibility falls upon the health-care team and diabetes educator, i.e. to provide educational facilities matched to the abilities of those people with diabetes and their capacity to learn.

Although patient education does not necessarily produce behavioural change, education coupled with support from the health-care team can improve glycaemic control, achieve reductions in hospital admission rates, and keto-acidosis and amputation rates.

The value or aims of patient education would therefore be to:

- Encourage and empower the person with diabetes to accept responsibility for his own health care.
- Empower the person with diabetes to acquire the necessary information.
- Empower and motivate the person with diabetes to change his/her behaviour and attitude and successfully manage their diabetes.

2. Differentiate between teaching and learning.

   To achieve these outcomes, it is important to consider the basic principles of the learning and education process.

   LEARNING can be defined as the acquiring of knowledge to achieve a change in behaviour/attitude of the individual/s, which makes them more capable of dealing with their environment.

   LEARNING can thus be described as:

   - Acquiring knowledge and skills.
   - Committing to memory.

- A change in behaviour.
- The development of new knowledge, or old knowledge to acquire new qualities.

3. List elements of the teaching/learning process.

Assessment:

Describe how to undertake a learning need assessment.

Planning:

- Discuss how to develop an effective learning programme.
- Discuss the need for programme content to be culturally sensitive.

Implementation:

- Demonstrate active listening skills.
- Demonstrate use of open-ended questions.
- Demonstrate positive feedback.
- Discuss how to manage group dynamics.

Evaluation:

Refer to Module 1-6

TEACHING or education could be defined as "the activities directed at providing the knowledge, skills, moral values, and understanding required in the normal course of life". Teaching or education tends to prepare the individual for life, as seen in the long term.

Education/teaching refers to the basic knowledge or facts in a specific field or activity. Knowledge refers to the cognitive or thinking process that a participant is engaged in when acquiring new knowledge.

Education/teaching concentrates on literacy and numeric tuition, as well as subject knowledge, life skills, natural laws, personal development, creativity, communication skills, etc. Education/teaching, therefore, is viewed as a basis on which to build skills and from where an individual can develop.

[1]Erasmus, B.J. & Van Dyk, P.S. 1999. Training Management in South Africa. 2nd ed. Halfway House: International Thomson. in: Meyer, M. 2001. Outcomes-based education: Back to the basics or a new paradigm for training staff? [On line]. Available: http://www.astd.co.za/ASTD-OBE.htm [2005, 18 November].

SKILLS refer to the psychomotor activities of an individual, which involves the coordination between the limbs and the brain.

As can be seen from the above explanation, diabetes education requires the skills of learning and teaching, in order to equip the person with diabetes with the knowledge and skills to manage their life with diabetes effectively.

4. List and explain potential barriers that include:

Motivation and attitude:

Motivation is the first and very vital step on the road to self-care and self-sufficiency. The person with diabetes should be motivated to achieve a healthy and happy life.

Physical barriers:

- Poor eyesight, hearing, and physical handicaps could act as barriers in the teaching and learning process.
- Poor health could result in a reduced attention span, and education needs to be limited to shorter sessions.

Emotional barriers:

The person newly diagnosed with diabetes might not be ready for the learning process, because of not coming to terms to living with diabetes. It is common for the person with diabetes to go through the different stages of the grieving process: denial, anger, depression, and then adaptation. While this person is still entrapped in the phases of denial, anger and depression, the learning process becomes a challenge to both educator and the person in question.

Fear:

Fear and worries about the long-term effects of diabetes apply. The person might think of diabetes as a disaster or burden, and might not feel able to cope with the required change in behaviour and lifestyle Financial concerns:

- Economic concerns on how to deal with financial barriers in the management of diabetes, e.g. costs involved in buying special foods, medication and insulin, lack of transport to medical facilities, managing doctor's and hospital expenses. ? Concerns about the possible impact of diabetes on the ability to continue with an existing job or career.

Social concerns:

Lack of family or social support at home or fear of social stigma on being diagnosed with diabetes could act as a barrier to learning.

Cultural differences and myths:

- Strict religious or cultural codes could dictate the behaviour of the person with diabetes.

- The attitude of the educator towards cultural differences can act as a barrier to teaching.

Language and social class differences:

- Do not assume or take for granted that all words have the same meaning to all people – be aware of attitudes towards social differences.
- Differences in language could be a barrier to both teaching and learning.

Age differences:

Education methods need to be individualised to match the age and experience of the person being educated. Educational skills:

Lack of reading and numerical skills could act as a barrier to teaching and learning

Poor memory:

- Education methods and material must be carefully designed to provide back up to education.
- Develop strategies to assist participants with memory differences.

Self-image:

- Some people with poor self-image may need frequent confirmation of their competence.
- Lack of confidence could result in unwillingness to participate in training sessions with groups.
- Diabetes educators should offer sympathetic management and awareness of these difficulties.
- Confidence boosting exercises could be introduced, highlighting the good points of such participants.

Personality differences:

A flexible education and management style is required to cater for the different personality styles, different interest, and boredom levels.

5. Discuss the three domains of learning.

DOMAINS OF LEARNING:

It is suggested that there are three domains of learning:

- Cognitive domain: focuses on thinking and knowledge.
- Affective domain: focuses on feelings or attitudes.

- Psychomotor domain: focuses on doing things or manual skills.

It is important to remember that these domains interlink with one another and are not mutually exclusive. 'Skills', on the other hand, do not only apply in a manual context; but we also refer to concepts, such as listening skills, facilitation skills and analytical skills.

The following levels exist in the cognitive domain:

Knowledge:	The ability to remember or recall previously learned facts.
Comprehension:	The ability to understand the facts or principles learned.
Application:	The ability to apply knowledge to new situations, i.e., using what has been learned.
Analysis:	The ability to breakdown a whole into its component parts, and identify the relationship between the parts.
Synthesis:	The ability to put parts together to form a new whole, e.g. create, design, plan, and construct.
Evaluation:	The ability to judge the value of things according to specific criteria. This is the highest level of the cognitive domain.

Consequently, the ability to remember/recall facts or information is necessary to understand.

Understanding must exist to be able to apply or use knowledge.

One must be able to apply knowledge in order to analyse, which in turn is necessary for synthesis.

Finally, all prior levels need to be acquired before one can evaluate.

THE LEARNING PROCESS – PRINCIPLES

Once interest has been aroused and the person with diabetes is motivated to improve his/her own standard of health care, it is important to present educational material in such a way that their attention is gained and maintained.

6. Discuss learning styles.

LEARNING STYLES: We all learn differently. As people, we use our primary senses of hearing, seeing, touching and of smell, to gather information. Each person has a definite preference about which senses are used to learn and in what combination. It is important to identify what the preferred learning style of each participant is.

Select teaching or learning methods that will be most appropriate for the person.

The following learning styles have been identified:

a. Visual learners learn through looking at things. They need to create visual pictures or

images to learn. It would be helpful to draw pictures, create diagrams, etc. in the learning process.

b. Tactile learners learn through touching and handling materials. They might find it helpful to use highlighters and pencils to underline text or hold material or handouts in their hands, instead of placing them on a table.

c. Auditory learners learn through listening. It could be helpful for them to read learning text aloud, and audio tapes could be helpful.

d. Kinaesthetic learners utilize the whole body in the learning process and would be prone to pick up material and walk around and participate physically.

When teaching, it is important to vary methods of teaching to incorporate all the various learning styles of the participants in a group.

7. Discuss adult learning.

ADULT LEARNING: The differences between adult learners tend to be more noticeable because of their differences in previous experiences, concerning work, life experiences, and differences in age, educational background, and personal interests.

The following factors should be considered regarding adult participants:

1. Physical factors

- Poor co-ordination and slower reactions might be expected.
- A decline in ability to adapt quickly to environmental changes might occur.
- Decline in muscle strength and stamina might occur.
- A decrease in acuteness of perception, e.g. seeing and hearing might be present.

Therefore, ensure that:

- A good physical and social environment is provided for learning.
- Pay attention to physical comfort, e.g. heating and ventilation.
- Visual materials should be large and clear.

Mental factors

- Some decline in speed of thought processes might occur, requiring increased time to learn.
- Short-term memorizing capacity might be diminished.
- Comprehensive skills and ability to organize material might be enhanced; experience

may benefit retention and recall abilities, e.g. through association.

- More difficulty in handling complex and unfamiliar information.

To achieve the best learning outcomes:

- Ensure that the pace of learning is appropriate.
- Where possible allow participants to progress at their own preferred rate.
- Avoid using techniques that rely heavily on short-term memory.
- Use appropriate learning aids.
- Work towards achieving tangible and realistic goals.

Life/work experiences:

- Pre-existing ideas, prejudices, and beliefs may affect learning.
- External issues and concerns may affect learning, e.g. domestic problems, financial problems, and various other adult concerns.
- Role conflicts may occur, e.g. role of participant vs. role of breadwinner.

It is important to:

- Recognize and use previous experience and knowledge.
- Expect to be challenged.
- Try to identify existing assumptions and beliefs that might interfere with learning.

Personality factors:

- Adult participants might lack confidence.
- Might be anxious and fearful of making mistakes.
- Could be extremely self-conscious and self-critical.

Assist adult participants by:

- Allowing generous practice to reinforce skills.
- Encouraging active participation.
- Providing honest and constructive feedback.
- Being tactful and sensitive when correcting errors.

- Helping to preserve a positive self-image.

Motivation

- Adults are highly motivated and could set unrealistic high personal targets, which could be counter-productive.

Therefore, it is important to:

- Encourage self-assessment to enable adult participants to recognize achievements.
- Reward success and positive contributions.
- Repeat, summarize, emphasize, and recap, as necessary.

8. Discuss methods of learning.

METHODS OF LEARNING: People learn by two processes:

Observing and contributing:

a. Learning by observing: offers minimal opportunities for participant involvement and offers low retention rates. Processes, which could be utilized, include lectures, videos, and films, demonstrations of a task, procedure, or equipment.

b. Learning by contributing: involves participants in some kind of activity that leads to learning. If used properly, this process can enhance excitement, stimulation, and active group learning; the learning processes are dependant on interaction among people. Examples include:

Brainstorming: helpful to explore attitudes, help with problem solving.

Discussions: helpful to change attitudes, compare experiences, develop commitment, etc.

Role-play: the individual practices a face-to-face situation that presents real life; practicing occurs in a safe environment and participants can gain insight into their own and other's behaviours or needs.

Exercises: participants are asked to perform certain tasks or activities in a small group or individually. This could meet several learning objectives.

9. Discuss the different teaching methods.

TEACHING METHODS: Information and education can be presented in several ways. The following teaching methods are available:

a. Group-based training.

This could be small or large groups. Many people are used to this method of training.

Examples could be lectures, videos and films, demonstrations, brainstorming, discussions, role-play, and exercises.

Formal lectures:

A formal lecture is a presentation given to an audience with little interaction or feedback. This method allows for education of large groups of participants, and a large amount of information is conveyed in a short period.

Limitations: could be a lack of participation, a passive form of learning, difficult to assess if learning outcomes are achieved.

Group discussions:

Knowledge, ideas, and opinions on a particular subject are freely exchanged between participants and the educator.

Useful in most learning programmes and allows for open flexible learning.

Can be useful to change attitudes or obtain feedback on participants' level of understanding and ability to apply knowledge.

Limitations: discussions may become unfocused, one person may dominate discussions, and interpersonal attitudes may influence the flow of discussions. This form of learning could allow some participants to withdraw and not participate fully, personality clashes could occur.

Demonstrations:

A demonstration is a session where a skill is learned, following a formal procedure, e.g. description/demonstration of a skill under supervision. This is suitable to teach skills and can be broken down into small stages, e.g. injection techniques, urine or blood glucose testing techniques, foot care, etc.

It is important that the demonstration is clearly visible to all participants.

Limitations: this does not guarantee that learning will take place, unless consolidated by practice as soon as possible after the demonstration.

Brainstorming, discussions, role-play, and exercises:

Allow for group interaction and participation to take place. These sessions need to be well guided.

Group-based teaching could be suitable to teach people with diabetes and their families about diabetes, healthy eating habits, foot care, managing a diabetes diary, managing every day life with diabetes, sick days, exercise, lifestyle changes, etc.

b. One-on-one training.

Individual training:

Offers the trainer the opportunity to encourage the participant to acquire new skills and habits in a practical way, under the trainer's supervision.

One-on-one training facilitates a more personal exchange of opinion and feedback.

It allows participants to progress at their own pace.

Useful for reviewing progress and discussing specific matters or subjects. Provides an opportunity for individual counselling and guidance. Availability of time might be a limitation.

This form of teaching is suitable when teaching the person with diabetes on individual eating plans, insulin injection techniques, storing of insulin, etc.

c. Text-based training.

The use of the printed word in the form of handouts, posters, wall charts etc. To stimulate the person with diabetes to acquire knowledge has little value in handing out printed sheets of information in the hope that the educational process will proceed automatically. However, it could be used effectively as an adjunct to other teaching methods.

When teaching the person with diabetes, handouts, insulin diaries, eating plans and information on foot care, could be text based.

Charts and pictures could be displayed in the clinic setting. Posters should give an instant clear message. Lettering should be large and clear enough to be read at a distance. Words, illustrations, and diagrams can be used to convey the message.

d. Technology-based training.

- Computer-based training: advanced computer technology allows for computerised graphics, animation, and sound, which allows increased participant interaction.
- Interactive video coupled to the computer, with the possibilities of full-motion video, digital sound and photograph quality images, provides exciting new ways of exploring and communicating information, and provides opportunities for participant interaction
- The compact disc (CD) is an emerging force in computer technology, because of its ability to store vast quantities of data.
- E-LEARNING: Also known as Internet-based training or Web-based training allows learning anywhere and at anytime as long as a properly configured computer is available. This allows participants to learn at their own pace and own time.

Limitations: a prerequisite for technology-based training is computer literacy, and access to a

computer and/or Internet facilities, which could exclude certain participants and patient groups, e.g. those with low literacy levels, low socio-economic status, living in rural areas with poor electricity supply, etc.

10. Discuss the advantages and disadvantages of different teaching methods.

THE LEARNING PROGRAMME: To ensure effective learning, it is essential to design a learning programme to achieve specific outcomes or competencies.

A learning programme could be defined as "sets of learning activities in which the learner will become involved in working towards the achievement of one or more outcomes". Competency can then be defined as a skill or cluster of skills carried out within an indicated range or context, to specific standards.

Competency therefore requires the integration of knowledge, skills, and attitude (values) that an individual can demonstrate to a defined standard in a specific context.

What should be taken into consideration when designing a learning programme?

a. Identify the need of the participant, to eliminate unnecessary training or learning that is not related to the need of the participant.

Use the following formula to identify the participant's needs:

DESIRED KNOWLEDGE - EXISTING KNOWLEDGE = LEARNING NEED.

This can also be applied to skills and attitudes:

DESIRED		EXISTING		LEARNING NEED
Knowledge	-	Knowledge	=	Learning gap
Skills	-	Skills	=	Skills gap
Attitude	-	Attitude	=	Attitude gap

b. Identify learning prerequisites, necessary to cope with the learning process, e.g.:

- Physical requirements: good eyesight is required for the person with diabetes to be able to inject insulin with a standard insulin syringe and needle.
- Previously learned skills: the ability to read, write and calculate if the person with diabetes is to manage his/her diabetes at home with a multiple-injection insulin regimen.
- Previously learned knowledge: most persons with diabetes will have no or little biology background. To enable the understanding of diabetes, some knowledge of basic functioning of the body and its systems might be required. Basic knowledge of a specific language might be required.

- Previously learned attitudes: for example, the value of patience, courtesy, self discipline, motivation to learn, ability to accept being corrected and given advice, ability to learn in a group, etc.

c. Identify the specific tasks that have to be learned or learning objectives that have to be met.

   For example, the person with diabetes needs to learn specific skills, such as eating for a healthy lifestyle, self-monitoring that includes urine tests or blood glucose testing, recording of the test results, foot care, eye care, treatment with oral medication or injections with insulin, etc.

d. Decide in which order or sequence the learning objectives will be facilitated to ensure maximum learning in the shortest time. Before the participant can achieve competence in the complex skills, the enabling skills must be mastered. For example, the person newly diagnosed with diabetes cannot be expected to learn everything about diabetes in the first education session. It might be vital to learn how to inject insulin, and how to recognise and treat the symptoms of hypoglycaemia in the first education session.

The learning process should be a step-by-step process.

Considering the above concepts, there are three ways to approach the learning process:

- From general to specific
  - The participant is first given a broad overview of the topic before the specific parts to learn are introduced.
- From specific to general
  - The participant is led through specific learning experiences towards the general end-result.
- From the known to the unknown
  - The sequence starts with material or concepts that are familiar to the participant, and then moves on to the new or unknown.

e. Assemble, field test and revise the learning programme:

   After completion of the learning programme, it could be of value to test the learning material on participants for their comments on appropriateness and time taken to complete the

[2] Bellis, Ian. 2001 (2nd edition) Skills Development – a practitioner's guide to SAQA, the NQF and the Skills Development Acts. Knowledge Resources.

programme. The necessary changes should be made before embarking on the formal learning programme.

f. Develop an appropriate assessment instrument for each learning outcome, to decide if the participant is competent in the acquired skill or learning outcome.

For example, the educator can ask the person with diabetes to demonstrate how he/she measures the insulin dose, injects the insulin, stores the insulin, tests urine, or blood for glucose, etc.

Simple questionnaires or tick lists can be utilised to assess knowledge on foot care, suitable eating plans, self-care principles, etc.

g. Implement an evaluation system to monitor the effectiveness and success of the learning programme continuously.

h. Ensure that the programme is culturally sensitive:

- It is important to apply equal opportunity practices in the learning process to ensure non-discriminatory practices and a suitable climate for learning.
- Take cultural differences, such as language, backgrounds, experiences, and religious beliefs into consideration.
- Avoid using language that discriminates against groups or individuals on the ground of race, gender or other characteristics.
- Ensure a non-threatening environment, which enhances the learning process.
- Encourage participation of all members in the group.
- Avoid stereotyping people.
- Avoid sexist practices, e.g. always referring to individuals in general as masculine.

DEMONSTRATE ACTIVE LISTENING SKILLS: Effective communication allows for two-way communication. An effective educator/teacher should always listen to what participants are telling them:

- This requires concentrating on the other person talking, followed by a suitable response.
- You need to listen to what you HEAR the speaker is really telling you, without interrupting.
- You might only need to LISTEN sympathetically – being a good listener enables you to judge whether the speaker wants you to respond verbally.

The following gestures would enhance effective listening:

- Provide/support an environment where the speaker feels comfortable.

- Make supportive eye contact.
- Use encouraging body language.
- Repeat key words and the other person's views to clarify uncertainties.
- Show interest.
- Ask open-ended questions.
- Notice non-verbal or unintentional messages.
- Allow everyone who wants to speak a chance to do so.

DEMONSTRATE THE USE OF OPEN-ENDED QUESTIONS: A good way to ensure effective two-way communication is to ask questions. By asking questions, the educator/teacher could determine how much background participants have, and how much learning is taking place. In this way, participants feel involved in the learning process.

Closed questions often requires a "yes" or "no" response. They could be useful as a revision aid or assessing promptly what a participant knows; often used before an open-ended question. Closed questions alone do not provide much stimulus or involvement of participants on their own.

Open questions, on the other hand, are used to gain explanations and information from the participant, and usually start with "why, what, how, where or when". Correct questioning techniques are of great value in helping the participant to develop and gain confidence in learning. The following techniques could be of value:

- Pausing: giving time to participants to assemble their response.
- Prompting: giving a hint at the kind of answer you are looking for by asking a supplementary question, e.g. "Have you thought about…".
- Refocus: if the answer leads away from the point of discussion, lead the group back to the point of origin, e.g. "That is very interesting. Now what about…".
- Seek clarification: should the answer be unclear, ask more guiding questions on what the participant thinks and why, e.g. "Are you saying…"; "Do you mean that…".
- Accept: always treat every response with value and without rejection seek further for the correct answer.

DEMONSTRATE POSITIVE FEEDBACK: It is important to be able to give constructive and positive feedback in the learning process, to ensure a favourable environment for learning to continue. The following steps should be considered when giving positive and constructive feedback:

Analyse the current situation: be clear in your mind on good performance, as well as

problems that need addressing.

Make a decision on the desired outcomes and objectives:

- Construct an action plan for the feedback session around the desired outcomes objectives – be specific.
- Focus on what needs to be achieved, not on what is wrong.
- Decide what you could do to assist the participant.
- Make sure that your relationship with the participant is not harmed by your feedback.

Consider receptiveness of participant: remember that people differ in their ability to accept and absorb feedback. This ability might change daily, depending on how people feel:

- Some people are ready and able to receive feedback, and desire to know about their progress.
- Others might feel insecure and doubt their own abilities to improve; they should be approached carefully and at a slower pace.
- Pay close attention to the participants' reactions and listen carefully to their response during the feedback session – adjust the pace and content accordingly.

Create the right environment: establish a positive and supportive climate of trust, openness, and mutual respect for giving and receiving feedback. Ensure there are no interruptions during the process.

Communicate effectively: use effective communication skills, and maintain awareness of the three ways that a message is conveyed:

- What words say (7%).
- How these are said, e.g. tone of voice (38%).
- Body language (55%).

Discuss the actions or behaviour that needs changing:

- Concentrate on behaviour and performance that needs changing, and avoid comments on personality.
- Stay with the facts.
- Beware of putting the participant down or using language or behaviour that causesan emotional reaction and defensiveness.

Clearly describe the desired behaviour or outcomes that need to be achieved.

Make suggestions and seek a solution together.

Focus on successful outcomes: Alternate positive and negative messages by using the Feedback Sandwich Model:

POSITIVE
NEGATIVE
POSITIVE

- A good message opens the participant to effective communication.
- The negative message is then conveyed to influence improvement of the behaviour.
    - End with a final good message to leave the participant in a positive frame of mind.

Get agreement: the participant cannot be forced to make changes, but instead should be supported and motivated to change the current behaviour to achieve the desired goals/outcomes.

MANAGE GROUP DYNAMICS:

To achieve learning outcomes, it is important that educators/teachers understand how groups and individuals operate and how they should apply their practical skills and knowledge.

The responsibility of the educator/teacher is to facilitate the following processes:

- Keeping the group/participant focused.
- Defuse conflict.
- Remain neutral and objective.
- Acting in the best interests of the group/participant.
- Help discover the real issues and hidden conflicts.
- Help establish objectives and criteria for measuring progress and success.
- Handle difficult people and redirect energies in a constructive manner.
- Assist with problem identification and problem solving.
- Help establish ground rules and agreements.
- Treat all people with respect.
- Identify and improve one's own weaknesses as an educator/teacher.

Therefore, it is vital to pay attention to any warning signs of amounting tension, personality clashes, or potential problems. Occasionally, participants can withdraw their co-operation and

loose interest resulting in a breakdown of relationships.

The following behaviour could result in dissatisfaction within the group

- Participants who show minimal interest and lack of effort to participate in group activities.
- Participants who constantly challenge others to prove that their knowledge are superior.
- Aggressive and argumentative participants.
- Participants who prefer to talk about irrelevant topics.
- Participants who constantly disrupt group activities by having their own conversations during sessions.
- Participants who demand attention all the time.

Some hints on handling difficult participants/people:

The quarrelsome type: do not become involved in arguments, stay neutral, and refer questions to the rest of the group.

The shy type: ask questions and involve in activities to increase confidence.

The hijacker (someone who takes over the training session): interrupt tactfully and limit speaking time.

The "know-it-all": do not criticize or argue; rather use the, "Yes, but…"-technique.

The persistent questioner: pass questions back to the group.

The un-cooperative rebel: give recognition to his/her knowledge and play on his/her ambitions.

The grump: involve in conversations and ask his/her opinion.

The effectiveness of teaching and learning in a group context depends largely on the ability of the educator/teacher to manage group dynamics. Without harmony and order, effective learning cannot occur.

An effective teaching and learning process aims at changing behaviour, and motives the person with diabetes towards living a full, normal life. The complexity of changing behaviour requires the educator to understand the psychosocial and behavioural approaches in diabetes.

MODULE 1-3 (b): THE PSYCHOSOCIAL ASPECTS OF DIABETES: THE IMPACT ON THE PATIENT AND FAMILY

Overview: Diabetes mellitus is a chronic condition that has a major impact on the lives of people with diabetes and their families and may complicate family functioning. People with diabetes are faced with the challenges to self-regulate their diabetes, live a full and normal life, while facing the other responsibilities and stresses of life, which is psychologically complex and burdensome. Diabetes is a life-long condition, and as such, affects many aspects of a person and family's life. Some of these are:

- The need for a regular schedule.
- Change in eating habits.
- Daily medication and monitoring.
- Possible changes in occupation and recreational pursuits.
- Possible changes in relationships with people.

It is important for the person to identify/acknowledge himself/herself as someone with diabetes. A decision has to be made on who else should know and why, e.g. family, school, employer, responsible adult, etc. The person with diabetes is often concerned how others will react on knowing about their condition.

Feelings and emotions: everyone has feelings about having diabetes, which might differ from day to day:

- Fear and worry about long-term effects of diabetes.
- It is normal to go through the grieving process: denial, anger, depression, and adaptation.
- Feelings and increased stress levels affect the person's blood glucose levels, which in turn could have a negative effect on moods and ability to cope with stress.
- Thoughts influence feelings, which influence motivation and behaviour. For example, people who think of diabetes as a disaster or burden might be less motivated to cope or change behaviour. Consequently, it is important to evaluate the influence of thoughts on behaviour.
- It is important to recognize the person and family's need for support.

Goals: To provide participants with the knowledge and skills to enhance the psychological well being of people with diabetes using a patient-centred approach.

Objectives

Describe the psychosocial affect of diabetes and its treatment on the person with diabetes and family members to recognize that:

- Adjustment to diabetes is ongoing.
- Diabetes requires changes to one's lifestyle that are difficult for most people.
- People with diabetes experience higher rates of depression.
- Diabetes-related stress is common; particularly fear of hypoglycaemia and long-term complications.
- Different cognitive and behavioural change strategies can be used to cope with the demands of diabetes and treatment related to stress.

2. Discuss support systems available to people with diabetes.

Content

1. Description of the psychosocial affect of diabetes and its treatment on the person with diabetes and their family members

   Adjusting to diabetes is ongoing

   Coping with the physical adjustments needed by people with diabetes to live well with this condition is a long-term, up-hill struggle. Because of the biological changes that have already taken place many changes are required. The reactions to the diagnosis vary with each individual. The members of the team, especially the diabetes educator, have to be prepared for just about any response. Most authors agree that the general reactions are similar to the grief process described by Elisabeth Kübler-Ross in her book On Death and Dying. She describes the stages as Denial, Anger, Bargaining, Depression, Acceptance, and Hope. This has been adapted by many to understand the nature of people with diabetes coming to terms with living with diabetes. In Learning to Live Well with Diabetes, the steps are described as Denial (disbelief), Fear, Anger, Guilt, Depression, and Acceptance.

   Africans have even more adjustments to make within their particular cultural settings. They have to combat superstition and other cultural beliefs. Their cultural diets and other practices could offer even more challenges to living well with diabetes.

   Each person's ability to live with and adjust to diabetes depends on his/her beliefs and attitudes concerning the disease and health in general. Time must be taken to explore these in detail and correct any misconceptions.

The expectations of a newly diagnosed person should firstly be considered: most people believe that the responsibility for their treatment lies with the health-care team. This belief is counterproductive as it is essential for persons with diabetes to undertake their own management. Life-long education in diabetes is necessary; regular follow-up sessions will help to maintain the original standards and to introduce new objectives. Long-term reinforcement is essential if motivation is to be maintained. Not only newly diagnosed persons with diabetes need to attend education sessions, but particularly those with some years of diabetes who usually think they "know it all", are in great need for re-education seeing that knowledge about diabetes is constantly advancing.

Living with diabetes requires changes to one's lifestyle that are difficult for most people

It is difficult to explain why some people with diabetes are able to accept and comply with the major adjustments in lifestyle demanded by diabetes, whereas others are not. As previously discussed, attitudes and beliefs about the disease, and lack of accepting responsibility for self care could have a great influence. Other reasons could be a lack of comprehension or appreciation of the need to change their behaviour, reluctance to self-monitor and fear of hypoglycaemia.

Motivation might be poor in those who do not perceive themselves as threatened by diabetes or its complications. Denial is particularly frequent among teenagers

The request for intensified testing will only be accepted by patients who perceive this as necessary and not by those who consider themselves as already well controlled, even if this is hopelessly optimistic. People with diabetes reluctant to test, may fabricate records to increase the number of tests apparently done, or to improve on the results obtained. Even those who monitor themselves often fail to make any adjustments in insulin, meals, or lifestyle.

Other barriers to change one's lifestyle could be the need for regular meals, prohibition of certain activities, the need for daily exercise, and lack of willpower.

Diabetes and depression

People with diabetes are more likely to develop depression than those without the condition. Depression in people with diabetes is associated with a higher mortality rate, with more than 50% likely to die over a ten-year period compared to people without diabetes. Depression negatively affects a person's ability to manage his/her diabetes and follow the appropriate diabetes care.

- Identifying signs and symptoms of depression in the person with diabetes
    - Loss of pleasure: no longer taking interest in doing things one used to enjoy.
    - Change in sleeping patterns: having trouble falling asleep, waking often during the night, or wanting to sleep more than usual, including during the day.
    - Early to rise: waking up earlier than usual and not being able to get back to sleep.
    - Change in appetite: eating more or less than one used to, resulting in a quick

weight gain or weight loss.

- Trouble concentrating: not being able to watch a TV programme or read an article because other thoughts or feelings get in the way.
- Loss of energy: feeling tired all the time.
- Nervousness: always feeling so anxious and not being able to sit still.
- Guilt: feeling one "never does anything right" and worried about being a burden to others.
- Morning sadness: feeling worse in the morning than the rest of the day.
- Suicidal thoughts: feel like dying or thinking about ways to hurt oneself.

If three or more of these symptoms, or if just one or two are present but the person has been feeling bad for two weeks or more, it's time to get help.

- Diabetes-related stress is common; particularly fear of hypoglycaemia and long-term complications

Hypoglycaemia is an important cause of people with diabetes losing confidence in their ability to control their diabetes. This is particularly true for nocturnal hypoglycaemia, since they may be less able to deal with a developing episode themselves, and because third party assistance may be less reliable or available. Many of these people are afraid of dying during an episode of hypoglycaemia. Lack of warning symptoms can be particularly devastating and can shatter the individual's confidence. The increased risk of hypoglycaemia with intensified treatment is a major obstacle towards achieving normal blood glucose levels.

Chronic hyperglycaemia is clearly associated with the development of long-term diabetes complications in persons with either type 1 or type 2 diabetes. Despite the irrefutable outcomes of long-term studies that intensified blood glucose control reduces the risk of developing these complications, one cannot guarantee that everyone with diabetes will have a lifetime of freedom from cardiovascular or microvascular damage. Even if they are relatively well-controlled, other factors than blood glucose control, also play a role in the development of complications. Furthermore, the attainment of blood glucose control within the target levels comes with some cost, not only in terms of hypoglycaemia, but also to personal lifestyle. As a result, some people with diabetes feel that the price of commitment is too high. Many patients fall victim to "learned hopelessness" feeling that all their lifestyle adjustments will have no or little effect on the outcome of the disease. Long-term complications and their treatment place an enormous burden on patients, their families, and health-care resources.

- Different cognitive and behavioural change strategies can be used to cope with the demands of diabetes and treatment related to stress

Most problems can be solved by paying attention to the attitudes and beliefs of the person with diabetes, not only at diagnosis but also throughout this person's life. Beliefs and behaviour can

be changed for the good, if opportunities are provided that can be expressed and explored.

2. Describe strategies to support the psychosocial needs of people with diabetes.

Stress management

- Stress relievers
  - Exercise: elevates the mood and helps relax tense muscles.
  - Writing: just getting it out on paper can make one's problems seem more bearable (do not worry about spelling or grammar -- this is just for oneself).
  - Relaxation exercises: things like yoga, deep breathing, or tensing and relaxing one muscle at a time.
  - Distraction: having an evening out, renting a video or getting lost in a good book.
  - Massage: this is a great way to relax.
  - Meditation or prayer: taking care of one's spiritual side.
  - Visualization: is another technique that could be helpful. The person with diabetes visualizes him/herself as successful at meeting goals. This is done by closing one's eyes and picturing oneself in the future when these goals have been met. Visualize how you would look, physically feel, and how your family, and friends would feel about you, and how you feel about yourself. This action could be repeated with regular intervals, especially when feeling discouraged.

Tools

Posters, group presentations, workshops on practical implementation of concepts taught in this module, physical demonstrations on effective use of training equipment.

Evaluation

Practical demonstrations by participants, questionnaires.

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Summary of empirical studies documenting the impact of parental involvement in children's diabetes management through puberty.

MODULE 1-3 (c): MODELS FOR FACILITATING BEHAVIOUR CHANGE

Overview: Because of the complexity of changing behaviour, educators need not only teaching skills but also skills in approaches to behavioural change and motivational interviewing. To be successful, diabetes self-management training must be focused on the promotion of positive behaviour change. In years past, education programmes typically targeted an increase in diabetes knowledge as the critical outcome variable. Through countless studies, however, we have learned that knowledge alone does not have a potent impact on clinical outcomes such as glycaemic control. Clinical improvement is likely only when knowledge prompts a positive change in self-care behaviour. Without doubt, behaviour change is the major mediating variable linking diabetes self-management training and positive clinical outcomes. In sum helping people change behaviour involves establishing clear, specific, and reasonable goals that are focused on concrete actions (rather than outcomes). Such goal setting requires honesty and a respectful two-way collaboration between the clinician and people with diabetes. It is critical that clinicians be sensitive to the personal obstacles to behaviour change of these people, and address these before setting goals.

Goals: To provide participants with information on behaviour change strategies and models.

Objectives

1. Describe elements of behaviour change and goal setting.
2. Discuss readiness to learn.

Content

1. Describe elements of behaviour change and goal setting.

   The idea of behaviour change seems straightforward, yet clinicians make common conceptual mistakes when attempting to promote positive changes in diabetes self-care actions. When setting goals for people with diabetes, for example, a focus on self-care behaviour should not be confused with expecting changes in self-care outcomes. Successful behaviour change means that the individual is doing the following:

   - taking new positive actions (e.g., Exercise)

- increasing the frequency or intensity of positive actions
- ceasing destructive actions (e.g., Smoking)
- continuing to maintain positive actions at an acceptable level.

In contrast, setting a goal for weight loss or a reduction in blood pressure is targeting a clinical outcome, a hoped-for result of positive self-care action (or actions), not a direct behaviour as such. This distinction is critically important, especially if motivation is to be respected and encouraged regarding people with diabetes. Consider that a person with diabetes may succeed in enacting new self-care actions (e.g., reducing portion sizes), but still be unable to reach expected outcomes (e.g., 4.5 kg weight loss) because of biological or medical constraints (e.g., high daily does of insulin). In this situation, if the clinician and individual have focused on a "behavioural" goal of weight loss, both parties are likely to become discouraged. If the targeted goal was actual behaviour change, the person with diabetes can be congratulated on his/her success and, consequently, plans for additional behaviour change are more likely to be enacted and supported.

Behavioural goals should be clear and specific (rather than vague) and reasonable (rather than unrealistic or unachievable). An example of a clear and specific goal is "Over the next week, I will go for a 1 mile walk 3 times. I will plan on going right after breakfast on Monday, Thursday, and Saturday." In comparison, a vague goal is "I am definitely going to start exercising." Specific goals target concrete actions to take, not esoteric changes in attitude (e.g., "I need more willpower"). Goals tied to clear and specific actions are more likely to be undertaken because the person with diabetes can imagine more easily how to initiate those goals. As a consequence of their specificity, such goals are easily measurable and time-limited. These qualities allow the person with diabetes and clinician to more accurately determine whether or not the goal has been reached.

An example of a reasonable goal might be, "I will check my blood glucose levels 3 times a week over the next month." Of course, whether or not this is reasonable depends on the unique perspective of the individual, including their previous history of blood glucose monitoring. If this person with diabetes typically monitors twice a day, an additional blood test each day might be quite realistic. However, if this is someone who quit monitoring several years ago and is no longer sure how to use a blood glucometer, then the goal – given the his/her current circumstances – may be unreasonable and unachievable at this time.

In some cases, the most effective approach is to develop a realistic goal that targets actions that seem minimal in scope (e.g., the chronically sedentary person who agrees to walk to the end of their driveway and back several days a week). When this person with diabetes reaches the goal, he/she will feel more confident about taking positive actions and will be more enthused about committing to new, more challenging behaviour changes. In contrast, when the clinician pushes for more formidable goals that are unrealistic for the individual at the time, discouragement and feelings of failure are the result.

Rewarding: This is a proven way of changing habits – the person with diabetes should reward him/herself when achieving objectives towards a set goal. This reward could be as simple as taking time to do something enjoyable, such as reading or spending time on a hobby.

Making a list of short - and long-term goals related to diabetes, as well as set objectives/actions towards achieving these goals is a constructive way towards changing behaviour patterns and making a commitment towards change. The educator could assist the person with the setting of realistic timeframes for each objective, considering the costs and benefits of any action or change.

2. Discuss readiness to learn

It is important to assess the person's readiness to learn, before embarking on the education process. When barriers to learning still exist, these barriers need to be addressed. Appropriate teaching strategies need to be developed, considering these barriers to ensure that effective learning can take place. For example, if the person with diabetes is still in anger or denial, initial education sessions should be focused on need-to-know and survival strategies, and possible psychotherapy, rather than embarking on lengthy discussions on management strategies.

Tools

Group presentations, workshops on practical implementation of concepts taught in this module; role-playing; demonstrations on effective use of training equipment.

Evaluation

Practical demonstrations by participants, prepare examples of behaviour goals.

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MODULE 1-4: PROMOTING COMMUNITY AWARENESS, EXISTING AFRICAN MYTHS AND BELIEFS

Overview: The nned to increase community understanding of the special needs of people with diabetes is essential. Diabetes health professionals should also promote strategies for the primary prevention of Type 2 diabetes. Many of the strategies used to meet these goals are designed not only to bring about positive change in an individuals behaviour, but also to increase the understanding of the community and to dispel myths surrounding diabetes. Change occurs most readily myths surrounding diabetes. Change occurs most readily and permanently when people's environment, home, work and recreation enable them to reinforce change.

Goals: To provide participants with an understanding of the community's knowledge and attitudes towards diabetes.
To provide participants with an understanding that community strategies need to reflect the differences between Type 1 and Type 2 diabetes.
To provide participants with strategies for health promotion and primary prevention of type 2 diabetes

Objectives

1. Understand community's perceptions and beliefs about diabetes.
2. Explain what type 1 and type 2 diabetes is, and clarify myths and misconceptions about the disease.
3. Discuss the burden of diabetes in Africa and the need for prevention of the disease and its complications. Discuss primary, secondary, and tertiary prevention.
4. Discuss approaches to health promotion in the community.
    a. Medical and behavioural changes
    b. Patient/local organisation-centred
    C. Education
    d. Societal and public policy change.

Introduction

The public has a major role to play in the awareness and prevention of diabetes and its complications. The educator has to understand the community's beliefs, cultural and social values to enable promotion of community awareness of the disease. Intervention is only possible when communities undertake certain changes in lifestyle and social behaviour that promote diabetes. Mobilisation of political wills, human resources, and promotion of health through simple preventative measures may help prevent serious morbidity and mortality associated with diabetes.

1. Diabetes in the local community

   Understanding and evaluating the concepts of diabetes within the community are vital when trying to increase awareness in the community. Culture refers to the way of life which characterises a given community. Culture determines beliefs and judgment about what is good, what is desirable and has an influence on health-seeking behaviour and attitudes. Culture may influence views on diseases, and their healing and prevention. In some communities in Africa, obesity is considered as a sign of good health and prosperity. This may influence eating patterns and increase the risk of diabetes and may create some difficulties when education and creating awareness on diabetes. Other beliefs, Myths, and misconceptions influence the acceptance and adherence to self-care skills, such as the relation of diabetes and witchcraft among African nations.

2. The following misconceptions and myths regarding diabetes may exist in African countries; these should be considered and addressed:

   CAMEROON

   - Witchcraft
   - Being poisoned
   - Eating too much sugar
     - Use Honey instead of sugar
     - Eat green plantains only
     - Drink Guinness only
     - Drink and eat bitter leaves to neutralise the blood sugar
     - Traditional healers can cure diabetes
     - Alternative therapy preferred over scientific therapy.

   ETHIOPIA

   - Diabetes is a communicable disease
     - Take honey on an empty stomach

- Drinking a lot of whisky will cure diabetes and lower the blood sugar
- Drink urine to get cured
- Eat bitter things, such as the bile of sheep and cows
- Take holy water on an empty stomach.

GHANA

- Eating too much sugar
- Having sexual intercourse with a person with diabetes
- Stepped on a JUJU trap
- Being bewitched
- Being cursed
- Punishment by the gods
- Diabetes is a disease of the white man and the rich
- People relate to poisonous ingestion
  - Hospital has no cure but herbalist can cure diabetes.

KENYA

- Diabetes is the result of eating too much sugar
- Diabetes is the result of a curse
- If you look fat/obese you are healthy despite having diabetes
  - Diabetes gets cured after a while
  - Diabetes is cured through prayers since it is brought on by evil spirits
  - Ozone therapy is a cure for diabetes
  - GNLD (Herbalife products) can cure diabetes.

NIGERIA

- Witchcraft
- Contagious
- Fatting room before marriage

- They have diabetes because ants have passed over their urine
- Diabetes is the disease of the rich people.

SOUTH AFRICA

- No such a thing as diabetes: curse; bewitched; ancestors angry with the family
- Eating too much sugar and sweets
- Diabetes is "catching" or infectious
- Diabetes is for old people
- Impotence caused by spouse jealousy
- Walking barefoot cools extremely hot feet
    - Diabetes can be cured by bitter foods: aloe, sour drinks to lower blood sugar
    - Rhubarb herb can cure diabetes
    - Use of emetics such as dagga (marijuana) can cure diabetes ? Buchu can lower the blood sugar
    - Traditional and faith healers can cure diabetes
    - If one urinates in a hollow pineapple and bury it, this can cure diabetes
    - Drinking African beer (Umqomboti) can cure diabetes
    - Copper pennies under dorsum of foot cures peripheral neuropathy
    - Salted coca cola is acceptable for diabetes
    - Honey and brown sugar are acceptable for persons with diabetes.

SWAZILAND

- Diabetes is caused by being bewitched
- Diabetes is caused by eating too much sugar and tinned meats
- Diabetes is infectious
- Diabetes is a condition which affects only the elderly
- A diabetes diet is a carbohydrate, meat, and salt free diet.

TANZANIA

- Diabetes is a bewitched disease

- Disease of the family
- Diabetes is an obstacle for marriage
- During illness medication should be stopped
- Operation should be avoided as diabetes wounds do not heal
- Diabetes mothers deliver diabetes babies
- Persons with diabetes are not allowed to give birth
- They have to omit their treatment during fasting
- Diabetes is infectious especially for couples
- They have to fast before blood and urine testing
- Salt diet is restricted
- Fruits are not allowed
    - Treated by traditional healers
    - Diabetes is controlled by eating only vegetables and protein food.

UGANDA

- Denial
- Disease of rich/wealth
- Witchcraft
- Disease of obesity
- Familial disease
- Eating too much sugar
- Curse from God
- Contagious disease.

ZAMBIA

- Eating too much sugar
- Inherited
- Just an illness

- Witchcraft
- Too many bees where a person suspected of having diabetes urinates
- Many people didn't know about it
    - Honey is a treatment for diabetes
    - Wearing a gold bangle is the treatment for diabetes
    - Stopping intake of sugar is part of the treatment
    - Certain herbal roots called Munyoko can treat diabetes.

Diabetes awareness and clarification

The community should be made aware of diabetes by using simple and effective methods of education. Uncomplicated brochures and posters in local languages would be useful. Awareness could also be created in plays at schools and churches. Subject areas that should be addressed include:

- What is diabetes and the types of diabetes (refer to Module 2-2: diagnosis, classification and presentation of diabetes).
- Risk factors associated with diabetes.
- Complications of diabetes.
- Prevention of diabetes.

3. Burden of diabetes in Africa and the need for prevention of the disease

In the 15 years leading to 2010, diabetes in Africa will increase by 93% (IDF, 2003). The morbidity and economic cost of the disease is enormous and the community should be made aware of this. Diabetes is a "serious but controllable disorder". Undetected, untreated, or poorly controlled diabetes can result in devastating long-term complications, such as blindness, amputation, and kidney disease, as well as life-threatening short-term complications, such as ketoacidosis, or severe hypoglycaemia. Awareness on the impact of diabetes and it complications may help society embark on preventative measures to decrease the incidence of diabetes.

In Africa, changes in lifestyle where replacement of traditional foods, which are high in fibre and low in fat, coupled with decreased physical activity may be related to the increase incidence in diabetes.

In view of the significant rise in the prevalence of diabetes in Africa, as well as the well recognised morbidity, premature mortality and increasing health costs of diabetes, prevention is of paramount importance. The major risk factors for diabetes are:

MODIFIABLE	NON-MODIFIABLE
Obesity: general Central	Age (> 40 yr)
Physical inactivity	First degree relative with diabetes
Impaired glucose tolerance / Impaired fasting glycaemia	Previous gestational diabetes
Hypertension	Ethnicity
Dyslipidaemia	

Evidence from large trials conducted in China, Finland, and the USA has shown that the onset of diabetes can be delayed by active lifestyle modification in people at high risk of the condition. It is currently unknown whether this intervention can totally prevent the onset of diabetes.

The components of lifestyle modification and their aims should include, but not be limited to the following list:

- Weight loss of 5% - 10%.
- Reduction in fat intake < 30% of calories.
- Reduction in saturated fat intake < 10% of calories.
- Increase in fibre intake > 15 g/1000 kcal (traditional African diets are high fibre).
- Increase in physical activity levels. This type of exercise (e.g. brisk walking) should last for at least 30 minutes and should be undertaken at least three times a week.
- Formal assessment of sedentary adults for underlying physical conditions that may limit the degree and duration of exercise that will require a structured prescription.
- Reduction in high levels of alcohol intake to less than one drink/day of any type of alcohol.
- Stopping smoking.

4. Health promotion and awareness

   a. Medical and behavioural change

      Diabetes often causes severe complications that can include heart disease and stroke, blindness, lower extremity amputations, kidney failure, dental disease, and increased susceptibility to infections. Diabetes may affect anyone, however, persons with risk factors, i.e. obese persons, persons with sedentary lifestyle, those with a family history of diabetes, or women with a history of giving birth to children above 4 kg must be advised to have regular screening and undertake lifestyle changes.

      Lifestyle changes include:

      - Weight loss o Increased physical activity

- Decreased fat and calorie intake in the diet. Emphasis on return to traditional foods, which are low in fat and calories, would be useful.

b. Patient/local organisation-centred

- Develop a diabetes-screening programme with the help of local diabetes organisations or medical facilities.

Screening may be planned during routinely at local medical centre or special outreach screening programmes during special days, such as World Diabetes Day, or other special community occasions may be planned. During these screening programmes, persons with diabetes may participate to promote awareness and dispel misconceptions about the disease.

- Develop a diabetes health-care team with an interdisciplinary approach.

c. Education

- Training of diabetes educators

  Persons trained could offer advice and promote awareness among the community and offer specialised advice to persons with diabetes.

- Develop a Public Awareness Campaign on diabetes and its complications. The campaign may use various tools, such as posters, plays, and talks at church or other gatherings. The campaign should include:
  - clear, accurate and consistent messages
  - information about the risk factors of diabetes and complications of diabetes
  - encourage those at risk to be screened and to change their lifestyle.

d. Societal and public policy change

- Make diabetes everybody's business

This is an advocacy issue, which combines the notions of individual, community, social and corporate responsibility. It argues that diabetes affects everybody in some way, and therefore everyone (e.g. individuals; communities; health and all government sectors including agriculture, transport, education, sport, tourism; small business, industry and other corporations) should be responsible to address the determinants of diabetes and related chronic diseases and conditions.

- Mobilisation of resources

Mobilisation recognises that the likelihood of substantial new resources to dedicate to diabetes is limited in many countries and advocates an approach that is truly integrated to address infectious and chronic diseases threats simultaneously. This means, for example, that all primary care workers should be equally and adequately skilled to provide risk reduction and basic care for diabetes as well as HIV/AIDS. It also advocates for clear prioritisation, and health professional

and service role delineation to reduce waste through duplication and fragmentation.

- Media

The media serve as important partners in promoting diabetes prevention messages. The following are steps that members of the media can take to help spread the word about how to prevent type 2 diabetes:

- Promote public awareness about the importance of diabetes prevention and the benefits of maintaining a healthy weight with regular physical activity and a healthy diet.
- Disseminate credible and accurate messages that encourage healthy habits and discourage risky behaviours.
- Collaborate with medical professionals, local governments, and private-sector community entities to help the public understand the importance of preventing diabetes.

- Political advocacy

Encourage governments and local area decision makers to ensure diabetes becomes a health priority and to support preventative measures.

Tools

Brochures, charts, and interactive community workshops.

Evaluation

Demonstration and field work.

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MODULE 1-5: RESEARCH AND EVALUATION

Overview: The purpose of this module is to introduce research as a core component of the role diabetes educator. The module should be designed to cater to participants with little or no research training. It should emphasize the role of research in diabetes education and management and as an agent for change, and encourage students to reflect on their practice and develop skills in critical thinking.

The module is included with the knowledge that the majority of students will not be formally involved in conducting research, but that they will need research skills to be assess research papers and use the information in their practice. The role of research for individual study should be discussed with respect to:

- Professional development
- Increasing knowledge
- Developing project management skills
- Developing critical appraisal and reflective practice skills
- Improving practice
- Making presentations and/or publishing

Goals: To provide the participant with an understanding of research principles.

To provide participants with skills to read and critically analyse scientific literature.

Objectives

After completing the module, the participant will be able to:

1. Discuss the three major research methods: qualitative, quantitative, and quality management/audit.
2. Identify the major steps in the research process, including reviewing the literature.
3. Critique research literature, including assessment of bias.
4. Discuss questionnaire development.
5. Describe ethical issues in research, including informed consent.
6. Interpret basic statistical results.
7. Write basic research reports and communicate results.

Introduction

Research is a scientific method of gathering information, which is then used to answer a specific question or support a hypothesis. Information gathered from well-conducted research improves knowledge of the disease process, contributes towards advances in therapy, and ultimately improves the quality of life of affected individuals. As a diabetes educator, you may find yourself being part of a research team. More often, you will find yourself using, information that is derived from other people's research. Therefore, it is important that as a diabetes educator you should understand basic research principles and be able to read and critically analyse scientific literature. Research in diabetes mellitus is a scientific method aimed at seeking new knowledge that will contribute towards the improvement of quality of life and care of people living with this condition.

1. Research provides an evidence base for medical practice

There are three major research methods:

i. Qualitative research

ii. Quantitative research

iii. Quality management/audit.

"Qualitative approach takes the view that reality is not a fixed entity and exists within a context which has many interpretations" (Polit & Hungler, 1997). "Quantitative approaches start from the perspective that there is a reality out there which can be studied and understood" (Polit & Hungler, 1997).

Quantitative investigation often lays the basis to good quantitative research especially in areas that have had only limited investigation (Pope & Mays, 1995).

Contrasts between quantitative and qualitative research approach (Mouse & Field 1996)

QUANTITATIVE	QUALITATIVE
Emphasis on testing theories/establishing relationships	Emphasis on developing theory
Setting is controlled; possibly artificial	Takes place in the individuals' natural setting
Control study variable as much as possible to reduce bias and increase precision	Emphasis on understanding human experience through analysis of beliefs, value, meanings, etc.
Data collection is primarily objective and measurable	Primarily rich subjective, descriptive data collected
Narrow limited focus: exclusive	Generally broad focus: inclusive
Follows logical series of predefined steps	Information collection and analysis can occur concurrently
Attempts to generalise beyond study participants	Less emphasis on generalisability

Quality management audit

Audit involves an examination of the diabetes clinic or practice records to determine whether they are meeting the minimum standards of care. Data may be collected to assess the frequency of blood pressure measurement in people with diabetes, their levels of blood pressure control, lipid monitoring, or the percentage of people with diabetes with abnormal HbA1c levels. The results are analysed and presented to various stakeholders and fed back to individual clinics or practices and can be used to formulate working standards. The aim of the audit is to reinforce good practices and to promote positive changes in practice. Audit should be repeated at regular intervals to maintain a high profile of diabetes and to maintain quality of care.

The choice of method depends on the nature of the problem, the objective for collecting data, available resources, time, capacity, and experience. Some studies require the use of multiple methods as each method can look at different aspects of a problem.

2. Types of studies currently used in diabetes research

The two categories of studies that are most frequently reported are experimental and observational (also known as descriptive studies). In experimental studies, the interventions and conditions are strictly defined and controlled. Observational studies describe outcomes in relation to variables of interest, but without intervention on the part of the investigator.

The following is a listing of the most common types of studies:

Experimental studies

The two types of experimental studies are randomised controlled trials and crossover trials:

- Randomised controlled trials: these are the gold standard of scientific enquiry. A group of subjects with similar characteristics is identified and then randomly assigned to intervention or control groups. In this way, the biases of observational studies are avoided because participants have an equal and unbiased chance of being assigned to each treatment under the study. Depending on the intervention, both participants and investigators may be blinded (i.e., double blinded) as to which treatment a participant is receiving, usually with placebo medications. Blinding assists with controlling for potential placebo effects and the effects of a participant's expectation to the benefit. These trials assess the efficacy of the treatment in a controlled setting, which may not reflect its actual effectiveness in a real-world clinical practice setting. Often, these trials use a highly defined patient population, so it may not be correct to extrapolate the results to other patient populations.

- Crossover trials allow subjects to serve as their own controls. Participants are randomly assigned to one treatment arm and later switched to the other treatment arm.

Observational studies

These include longitudinal cohort studies, case-control studies, case reports, and case series:

- Longitudinal cohort studies: begin with a defined group of subjects (e.g. individuals of a particular age, or people who work in a particular industry) called the cohort. This cohort is then followed over time for a variety of outcomes. Commonly, data are collected in a similar manner on all participating subjects at the beginning of the study (i.e. baseline data) and at set intervals during the follow-up. Cohort studies are usually prospective or retrospective, but the evidence from prospective cohort studies is considered stronger because data on exposures are collected before outcomes occur.

- Case-controlled studies commonly commence with an outcome of interest, and then compare the characteristics of individuals with the outcome (cases) and without the outcome (controls).

- Case report and case series are descriptions of the experience of a single patient or series of patients. These reports are useful in bringing new diseases or phenomena to the attention of the clinical and scientific community and for generating new hypotheses. However, without further study, case reports can only be considered suggestive.

Meta-analysis

This is an analytical technique used to pool the results from many smaller studies, which has the effect of increasing the sample size to gain statistical power. Specific criteria are established to determine which studies will be included in the analysis. It must be remembered that any biases present in the contributing studies will be present in the meta-analysis.

All research is selective: there is no one way a researcher can capture the literal truth of events. Research involves collecting particular sorts of evidence by various methods each with its pro and cons: thus, descriptive studies using qualitative approaches will assist in applying evidence of effectiveness in practice. Combining assessment of literature from a range of methods helps one take a more holistic approach to decision making.

3. Steps in designing a research project

As with all scientific research, there are guiding principles that researchers should adhere to for maintaining high ethical standards. The starting point is a review of the literature on a selected topic of diabetes. The literature review leads to formulation or testing of a new hypothesis. A method of testing the hypothesis or study design is carefully selected. The study is carried out, the results analysed, and a conclusion is drawn.

The following steps can be used as a guide to carry out research:

a. Observation of a phenomenon.

b. Postulation of a theory to account for the observation.

c. Prediction of a result based on the theory.

d. Experiment/study designed to test the prediction.

e. Analysis of experimental results.

The process of research is aimed to:

- Generate new knowledge.
- Provide results that can be generalised (applicable to similar patients or situations).
- Challenge the current situation or practice.
- Inform policy makers and service delivery practitioners.

4. Critical literature appraisal

This is a systematic way of considering the truthfulness of a piece of research, and the results to determine how relevant or applicable they are. One must be open to new ideas and ready to challenge previously held beliefs to eliminate bias: bear in mind that no research is perfect, so there will be flaws in the papers one reads. One needs to consider whether these flaws are important enough to make them question the conclusion from the research.

The assessment should be balanced and constructive; lessons can always be learnt and research improved upon.

Critical research appraisal can be developed through professional education and problem-based learning (use of case studies resembling those in clinical practice).

5. Questionnaires

These are useful for data collection on simple and well-defined issues. Their design should be carefully planned to ensure they provide:

- The required data.

- Data can be analysed and used.
- An unbiased response.

6. Ethical considerations including informed consent

Before carrying out the study, a research proposal should be submitted for approval by the appropriate ethics committees of the Ministry of Health and the Medical Research Council or equivalent.

Where the research involves human subjects, informed consent should be obtained. The researcher is responsible to explain the nature of the research in detail to the subject, and to design a consent form. The signed consent form is kept with the rest of the records pertaining to the research.

7. Interpreting basic statistical results

Statistics are vital:

- for aiding data description to provide general observations referred to as descriptive statistics.
- for allowing conclusions or comparisons to be made from the population or sample referred to as inferential statistics.
- Descriptive statistics

One of the simplest forms is use of percentages (%).

Other common measures used are:

- Mean (or average): add all values; divide by the number of measurements, a drawback is all the outliers (any extreme values) included in the data. Therefore, the mean will not be reflective of the point where most values lie.
- Median: is the mid point of a set or ordered data (central value).
- Mode: used in categorised data, e.g. social class, to describe the most frequent category.
- Range: indicates the difference between the highest and lowest values.
- The standard deviation summarises the average distance of all scores from the mean set of data. The larger the standard deviation, the larger the spread of numbers observed.
- Tables, graphs, pie charts are ways of presenting data to enable one to get an overview of the results.

Inferential statistics

For feasibility, research relies on a sample of a population: ideally, sampling should be random so that each individual has an equal chance of being selected.

In order to use inferential statistics, a null hypothesis needs to be defined: this states that there is no difference between the interventions being compared in the study groups and that any observed relationship is on account of a play of chance.

The level of significance is used to indicate how confident the researcher can be that the results are not because of chance. This is commonly presented in papers as the P-value Convention usually means that the level of significance is 0.05. This can be expressed as a number e.g. P = 0.23 or with < / > 0.05.

Statistical tests are then selected to test the null hypothesis. They are determined by a number of factors, e.g. the research question, variables being compared, sample size etc. The value obtained is used to determine the level of significance in order to accept or reject the null hypothesis (the researchers should explain their choice of tests in the research paper).

Statistical vs. clinical significance: P-values do not indicate the size of effect or importance of results to the clinical population.

To assess clinical significance we require value judgments. This may be from patients, carers and practitioners in the area, who are able to decide in the clinical change, make a valuable contribution to an individual's quality of life.

Relative risk (RR): Results of epidemiological studies and clinical trials are often presented as relative risk. Relative risk is the rate of disease in a group exposed to a potential risk factor, divided by the rate of the disease in the unexposed group. Example: If the annual rate of myocardial infarction in women who smoke is 220 per 100 000 and the annual rate in women who do not smoke is 110 per 100,000, the relative risk associated with smoking would be determined as follows:

Relative risk equals the rate in exposed people divided by the rate in those not exposed:

$$RR = \frac{220}{100\,000/\text{year}} \div \frac{110}{100\,000/\text{year}} = 2.00$$

This means that compared with unexposed women, the rate of myocardial infarction is twice that of non-smoking women.

The RR tells the estimated magnitude of the change in risk related to the presence vs. the absence of a factor of interest.

A RR less than 1.0 (<1) means that the factor lowers the risk. Example: a RR of 0.50 means that there is a 50% reduction in risk among those with vs. those without the factor. A RR of 0.3 means a 70% reduction in risk.

A RR greater than 1.0 (>1) means that the factor increases the risk in the group with vs. those without the factor. Example: a RR of 1.2 means that there is a 20% increase in risk, whereas a RR of 2.0 means doubling the risk.

Applicability and clinical benefit

The confidence interval (CI) provides an estimate of whether evidence is strong or weak, and is given as 95% CI. This provides an upper and lower value within which one can be 95% certain that the true result for any population lies.

The narrower the CI, the more certain one can be about the true result.

Studies that fail to demonstrate a beneficial effect should not be ruled out.

The odds ratio (OR) provides a measure of benefit.

An OR of 1: means there is no difference between the intervention and control groups, if less than 1: means there is less of an outcome.

A new measure of benefit is number needed to treat (NNT), which is the number of patients to prevent an outcome.

8. Presentation of a research report

Components of the written paper

- Introduction
- Research design and methods
- Statistical analysis
- Results
- Conclusion.

Oral presentation techniques: Key factors

- timing
- attention span
- personal approach
- practice
- evaluation
- consider the audience makeup
- theme should be short and direct
- keep the slides simple and legible, minimise words and list key points.

Tools

Handouts, copies of practice audits, and practical workshops on evaluation of clinical trials.

Evaluation

Evaluation of situational studies and questionnaires.

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MODULE 1-6: MONITORING AND EVALUATING DIABETES EDUCATION CARE

Introduction

Surveillance, monitoring, and evaluation serve different functions in diabetes programmes but they do overlap. However, they all play a role in providing information to help determine the links between programme endeavours and resources allocated/available, and the goals of the programme.

The issues involved include inputs vs. outputs, and then consequently, effects or outcomes of the diabetes care programme being implemented. The short-term outcomes lead to the long-term impact of the programme.

Defining terms

Monitoring: Is a routine tracking of priority information about a programme and its intended outcomes. This includes monitoring inputs and outputs through record keeping and regular reporting systems, health facility observation, personnel performance and client surveys. The most important aspect of monitoring is linkage in data interpretation from different sources, especially looking at several indicators.

Surveillance: Is the routine tracking of disease (or risk factors) using the same data collection system over time. Surveillance helps describe trends and contributes to predicting future trends and targeting needed priority interventions.

Evaluation: Is a collection of activities designed to determine the value or worth of the diabetes care programme or intervention. This involves three levels/phases of evaluation:

process evaluation – for content, extent and validity,

outcome evaluation – for successes (failures) of the programme in achieving the intended objectives through the specific intervention, and

impact evaluation – for long-term value of such care/intervention programme.

Diabetes Education: Relevance of monitoring and evaluation

Several levels of diabetes education require monitoring, (surveillance) and evaluation. Diabetes education is given to health-care providers in diabetes care as well as to people with diabetes. The health-care providers are given accurate knowledge to enable them to provide good care to people with diabetes, as well as enable them to pass on the knowledge of diabetes and skills for self-care practices to these people. The health-care providers and people with diabetes alike can be monitored during the training to maintain relevance, content, and viability of methods of training to the target groups. The health-care providers have different levels of knowledge of diabetes and therefore they will be taught to varying depths, even with varying methods.

The target groups can be evaluated, at the short-term on their levels of knowledge of diabetes and even skills of diabetes self-care. Checklist of specified skills, e.g. insulin injection, foot examination, etc., can be used during the evaluation process, or more so, demonstration of such skills.

Questionnaires are useful tools for the evaluation process, but must be validated for construct, and contents to ensure that it is able to measure what is intended. Validated questionnaires also are reproducible and can be adapted.

Therefore, monitoring and evaluation will/should be done on:

- Inputs: Money, staff time etc.
- Outputs: Facilities, information materials, trained staff levels of knowledge.
- Outcomes: Quality of self-care numbers of staff achieving targets of training, number of dedicated staff.
- Impact: Such as reduced acute complication rates, e.g.:
    - Hospitalisations for diabetes ketoacidosis (DKA)
    - Microvascular complication rates
    - Macrovascular complication rates
    - Mortality attributable to diabetes
    - Acceptability of care etc.

Monitoring and evaluation is even more imperative in resource poor settings where cost-benefit analysis of interventions is needed most.

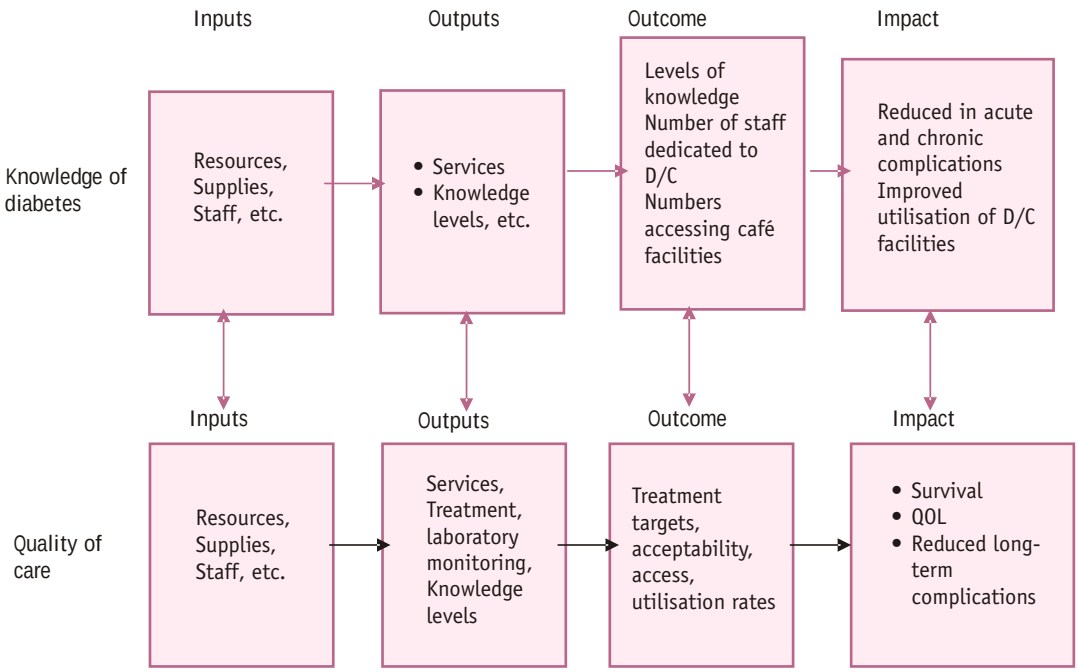
It is suggested that monitoring and evaluation of diabetes education be done at all levels/stages of training that include:

i) Initial diagnosis, with clinical and laboratory investigation, e.g. by whom, where, what time, risk factors. Symptoms, access, etc.

ii) Stage of definitive management by whom, access, acceptability, affordability, availability, of oral hypoglycemic agents (OHAs), insulin, laboratory, etc.

iii) Periodic follow-up and review by whom, tests done, targets achieved, complications, etc.

Framework for monitoring and evaluating diabetes education



The methods of training can be evaluated for their viability, validity, and effectiveness. The participants can give their opinions in a structured manner. Alternatively, the teaching/training programmes can be evaluated through peer review and/or experts. The impact of diabetes education is to ultimately improve long-tem outcomes in the patients and improve proficiency in diabetes care among the dedicated staff. The evaluation process should be acceptable and friendly, devised to improve people and programmes rather than antagonise them.

The indicators for monitoring and evaluating diabetes education need to be relevant to the programmes, easy to collect, interpret, and for tracking changes, and preferably universal for comparability within units, regions or countries.

Tools

Data collection instruments: Socio-demographic questionnaire, health facility assessment, WHO Eight-Item Diabetes management satisfaction questionnaire.
Sensitive indicators of the education programme.

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MODULE 2

MODULE 2-1: PATHOPHYSIOLOGY OF DIABETES

Introduction

Diabetes is a chronic condition characterised by hyperglycaemia. This is caused by deficient insulin production, resistance to insulin action, or a combination of both. Knowledge on the functioning of the ß-cell, the relationship between glucose, insulin and counter regulatory hormones and glucose homeostasis is important in understanding these defects and the resulting abnormal glucose and fat metabolism.

Chronic untreated hyperglycaemia results in multiple complications which affect the whole body. This module will give a brief overview on relevant organs and structures to enhance the understanding of the complications of diabetes.

Goals: To provide participants with an understanding of normal pathophysiology and the defects that lead to abnormal glucose metabolism

Objectives

After completing this module the participant will be able to:

- Describe the relationship between blood glucose and insulin in healthy people, including gluconeogenesis, glycogenolysis, lipolysis and ketogenesis.
- Describe normal insulin synthesis and secretion.
- Understand the hormonal, metabolic and neural control of insulin production and secretion.
- Discuss insulin action.
- Discuss the effects of insulin and counter-regulatory hormones on fuel homeostasis.
- Describe the results of insulin deficiency, its effects on lipid and protein metabolism as well as carbohydrate metabolism.
- Describe the pathophysiology involved in type 1 and type 2 diabetes.
- Understand the natural history of type 2 diabetes.

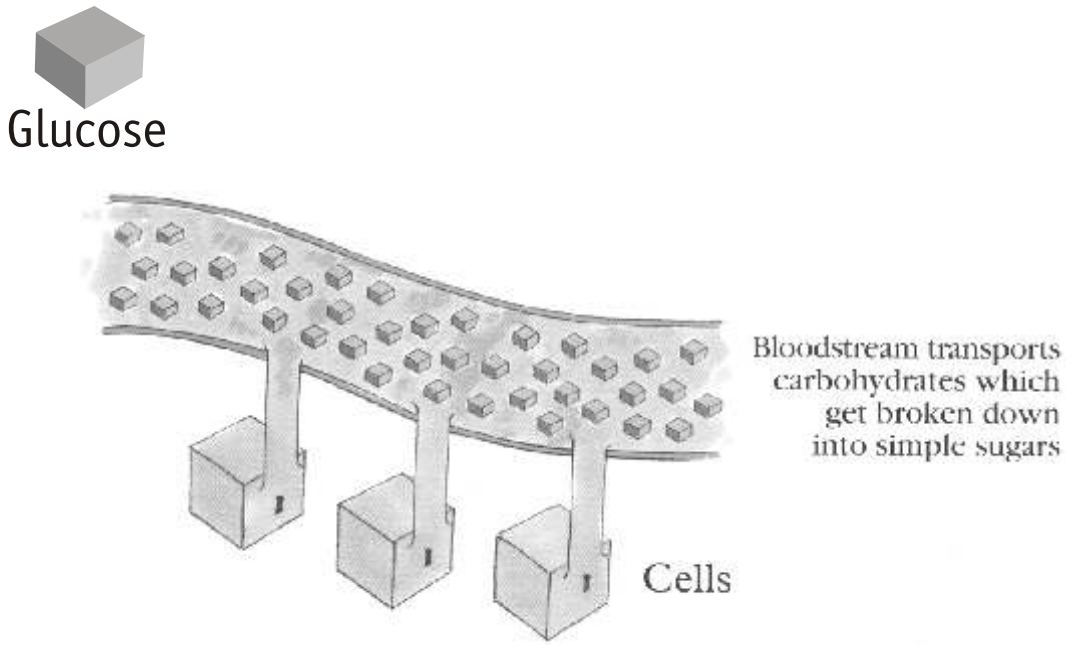
NORMAL GLUCOSE METABOLISM

- The body derives energy from food sources such as CARBOHYDRATES, PROTEINS and FATS.

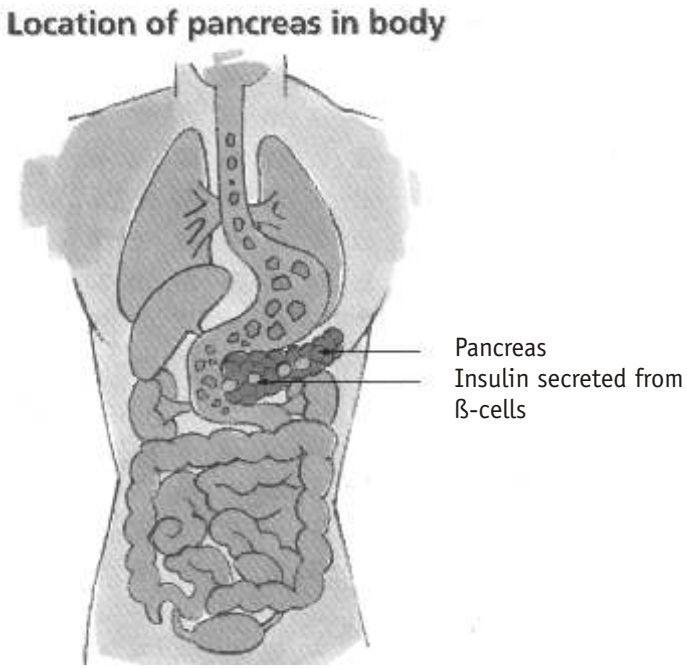
  After eating, food is chemically broken down by enzymes into smaller units in the intestines:

  - CARBOHYDRATES { Glucose;
  - PROTEINS{amino acids;
  - FATS { fatty acids and glycerol.

The glucose, amino acids, fatty acids, and glycerol are then absorbed through the intestinal wall and transferred to the bloodstream.



The rise in plasma glucose levels stimulates the release of insulin from the pancreas.

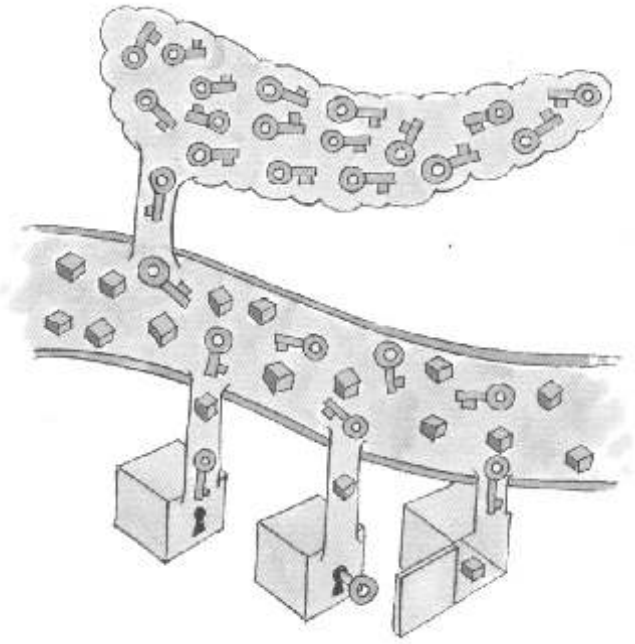


Insulin is a hormone that acts to lower blood glucose.

WHAT ARE HORMONES?

- A hormone is a substance secreted by a cell, which acts as a chemical messenger that affects the function of another cell or cells.
- The actions of hormones are restricted to their target cells and operate by binding themselves to specific parts of the cells called receptors.
- Because hormones are very potent substances, their release by endocrine cells must be regulated precisely for the amounts released to balance with the amounts used in the body.

Insulin = Key to glucose utilisation

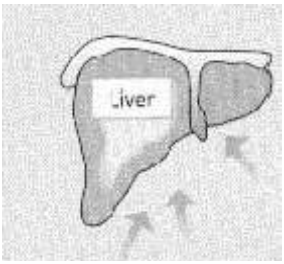


Pancreas-secreting insulin

Insulin acts as a key to promote glucose uptake by cells

ACTIONS OF INSULIN

Insulin is secreted in response to high blood glucose levels:



a. Insulin stimulates the liver to:

- Convert and store glucose as glycogen, an inactive form of glucose.
- Inhibit the conversion of non-carbohydrates into glucose (gluconeogenesis).

b. Insulin promotes facilitated diffusion of glucose through the membranes of cells that possess insulin receptors, e.g. skeletal muscles, cardiac muscles, adipose tissues.

c. Protein metabolism:

- Promotes the transfer of amino acids into cells, thereby enhancing the synthesis of proteins especially in muscle tissue.

d. Lipid metabolism:

- Stimulates the adipose cells to synthesise and store fat.
- Reduces the release of fatty acids from adipose tissue.

↓

Through its actions insulin lowers blood glucose concentration

THE ROLE OF INSULIN ANTAGONISTS

A number of hormones are secreted in response to low blood glucose. These activate glycogen conversion to glucose (glycogenolysis) and conversion of fats and amino acids into glucose (gluconeogenesis), thus increasing blood glucose concentrations.These hormones, which tend to counter the effects of insulin, are:

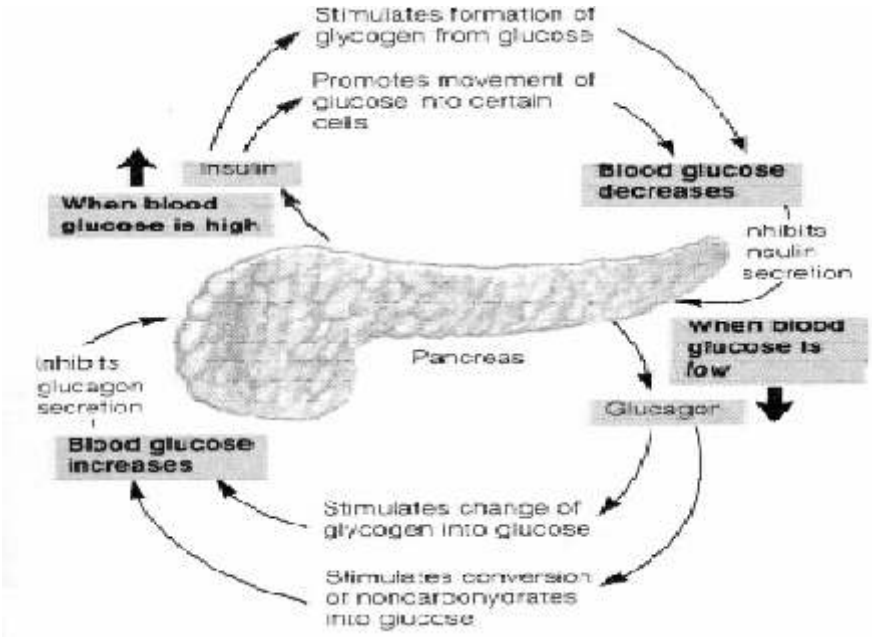
Glucagon which is produced by alpha cells in the pancreas to:

1. Convert glycogen to glucose.
2. Convert non-carbohydrates, e.g. amino acids into glucose.
3. Stimulate the breakdown of fats into fatty acids and glycerol (lipolysis).

- Glucagon will act to increase blood glucose levels through glycogenolysis and gluconeogenesis

As insulin levels fall between meals or during normal overnight fasting, the secretion of glucagon is activated.

As blood glucose levels rise, glucagon is no longer secreted.



INSULIN/GLUCAGON INTERACTION

Growth hormone (GH):

This hormone is secreted by the anterior pituitary gland in rhythmic pulses, especially during sleep.

Growth hormone enhances uptake of amino acids into cells and increases the rate at which cells convert these molecules into proteins.

- GH increases blood glucose levels through increases in the rate of fat breakdown in cells.
    - More GH is released during periods of protein deficiency and abnormally low blood glucose concentrations; conversely, when blood protein and glucose concentrations increase, GH secretion decreases.
    - Secretion of GH increases with stress, to mobilise energy sources, and increase blood glucose

levels through gluconeogenesis (fatty acids and glycerol) and to stimulate uptake of amino acids in cells to facilitate the repair of injured tissue.

Cortisol:

This hormone is secreted by the adrenal cortex, especially during stressful conditions.

- Cortisol increases blood glucose levels through gluconeogenesis:
  - It stimulates liver cells to form glucose from non-carbohydrates, such as circulating amino acids and glycerol, thus promoting an increase in blood glucose concentration.
  - Physical and psychological stress factors could increase the secretion of cortisol.

Cortisol also acts to block the effects of the inflammatory process in the body.

Adrenalin, "the fight or flight hormone":

- Adrenalin is released under conditions of stress, and in the face of a physical emergency.
- Adrenalin raises the blood glucose levels by promoting the conversion of glycogen into glucose, thereby increasing the blood glucose levels, to assist the body in the "fight" or "flight" mode.
- Adrenalin intensifies all the responses of the sympathetic nervous system.

THE CONSEQUENCES OF A LACK OF INSULIN

Blood glucose levels rise because:

- Glucose is not converted to glycogen, to be stored for energy purposes.
- Uptake of glucose into muscle and adipose tissue is reduced.
- The absence of glucose in cells for energy purposes results in breakdown of amino acids and lipids as alternative sources of energy.
- This results in ketogenesis, and because ketones and hydrogen accumulate in the cells, ketoacidosis occurs, which could be life threatening.

RELEASE OF INSULIN

Release of insulin from the pancreatic ß-cell can be in response to:

1. An increase in plasma glucose: this is the most important stimulus.
2. Chemical stimulation: amino acids, sulphonylureas, and other drugs that stimulate the release of insulin from ß-cells.
3. Neuronal stimulation: sympathetic nervous stimulation can decrease glucose release into the bloodstream, whereas parasympathetic stimulation increases glucose release into the

bloodstream.

4. Hormonal stimulation: gastro-intestinal hormones, glucagon, and GH can increase glucose release into the bloodstream.

ß-CELL FUNCTIONING

Insulin release in response to glucose stimulation is biphasic:

- The rapid first phase lasts 5-10 minutes.
- Then a prolonged second phase will last for the duration of the stimulus.
- The half-life of insulin is 4-5 minutes in the bloodstream, when bound to the receptors, this effect lasts longer.
- The ß-cells respond to blood glucose concentrations from 5 mmol/l up to approximately 9 mmol/l.
- Above 9 mmol/l, the hyperglycaemia exerts a toxic effect on the ß-cells.

Pathogenesis of diabetes mellitus

TYPE 1 DIABETES

1. Autoimmune type 1 diabetes

The ß-cells are destroyed by the autoimmune system:

- In genetically predisposed people, a triggering factor sets off the production of islet cell antibodies.
- The islet cell antibodies destroy the ß-cells. Insulin production decreases as the ß-cells are destroyed.
- When insulin production falls to a critical level, the development of diabetes occurs.
- Markers of immune destruction include islet cell antibodies, found in newly diagnosed persons with diabetes: Studies have shown an association of type 1 diabetes with HLA genes DR3 and DR4, located on chromosome 6.
- Other markers include autoantibodies to insulin or Glutamic acid decarboxylase, also known as GAD65, present in 85-90% of persons with type 1 diabetes who present with fasting hyperglycaemia.
- These patients may often present with other autoimmune diseases e.g. Addison's disease, Hashimoto's disease or Graves disease.

Triggering responses have been identified as follows:

- Viruses, as well as other environmental agents have been implicated as being trigger factors in the autoimmune process.
- The viruses may damage the ß-cells by direct invasion or by triggering an autoimmune response.
- Implicated viruses are as follows: mumps, intrauterine rubella, coxsackie b virus, echo virus, cytomegalo virus, and herpes virus.
- Certain chemical substances have been shown to induce diabetes in animals, and these include alloxan, streptozotosin and dietary nitrosamides present in some smoked meats.

2. Idiopathic type 1 diabetes

- This form of type 1 diabetes has no known aetiology.
- Persons with this diabetes have permanent insulinopaenia and are prone to ketoacidosis.
- This form is frequently inherited, lacks immunological evidence for ß-cell autoimmunity, and is not HLA-associated.
- This form of diabetes is more common among African and Asian individuals.
- Another form of idiopathic diabetes is found in Africans, where the absolute requirement for insulin replacement therapy may come and go, and these persons may periodically develop ketoacidosis.

Type 1 diabetes mellitus is regarded as less common among black Africans in Sub-Saharan Africa than among other peoples living in the same region.

The peak age of onset of type 1 diabetes among black African subjects is 23 years, which is almost a decade later than that reported for the other groups.

It is thought that prolonged breast-feeding may protect people against the development of type 1 diabetes, since early exposure to cow's milk may predispose them to the development of type 1 diabetes.

The prevalence of GAD antibodies and IA-2 antibodies was found to be significantly lower in black adolescents, which might suggest that more of these persons could have a non-autoimmune form of type 1 diabetes.

TYPE 2 DIABETES

The exact cause or causes of type 2 diabetes still need to be identified, but several predisposing factors have been identified:

- A striking feature common to type 2 diabetes seems to be its genetic component, which is much greater than in type 1 diabetes. However, specific genetic defects have not been identified for type 2 diabetes.

- Environmental factors are also important: changes in the composition of the diet, particularly higher levels of fat and refined carbohydrate intake, and lower physical activity levels, frequently observed in urbanised societies. These risk factors greatly favour the development of type 2 diabetes in people with genetic susceptibility, which predispose them to obesity (especially "central" or apple-shaped obesity) and the development of insulin resistance. Type 2 diabetes is thought to occur because of a combination of impaired insulin secretion from the ß-cells and insensitivity of target tissues (cells with insulin receptors) to insulin known as insulin resistance:

ß-CELL MALFUNCTION

Incorrect secretion patterns

The first phase release of insulin is noted to be deficient in some persons with type 2 diabetes. This leads to elevated postprandial (after meals) blood glucose levels.

Other abnormalities that could impair insulin secretion from the ß-cells include:

- Abnormal amounts of inactive insulin being secreted (pro-insulin ratio disturbed).
- Congestion of the ß-cells with amyloid deposits, a waste product from insulin production which impairs ß-cell functioning.
- Slow, but progressive destruction of the ß-cells.

INSULIN RESISTANCE ON PERIPHERAL CELL LEVEL

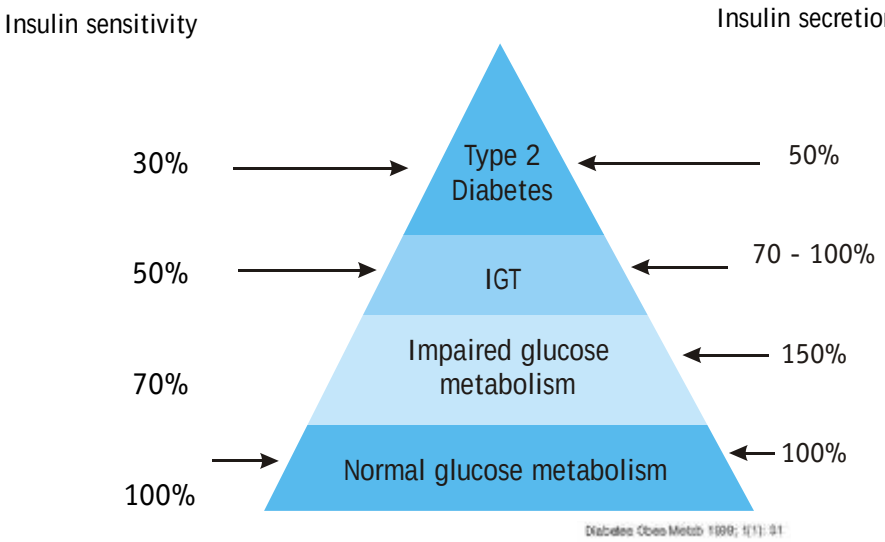
Malfunctioning of the insulin receptors and their activities could occur in the peripheral cells, which could include insensitivity to the actions of the insulin molecule, or abnormalities within the cell. These abnormalities cause an uptake of glucose into these cells that is reduced and sluggish, resulting in elevated circulating blood glucose levels.

What are the implications of insulin resistance?

Insensitivity of insulin receptors in muscles and liver to insulin will tend to cause blood glucose levels to rise, and this will stimulate the pancreatic ß-cells to secrete more insulin. As a result, hyperinsulinaemia occurs; in many insulin resistant states there is decreased insulin clearance, and numbers of insulin receptors on the cell surfaces are often reduced (down regulation). In people with severe insulin resistance, marked degrees of hyperinsulinaemia are required to maintain normoglycaemia and fasting and stimulated insulin concentrations of > 50 ?IU/ml and 300 ?IU/ml respectively may be found.

In time, a decline in ß-cell function occurs because the ß-cells lose their ability to secrete enough insulin to overcome target tissue resistance – this is the prelude to worsening hyperglycaemia and the appearance of clinical diabetes.

The natural history or development of type 2 diabetes can be summarised as follows:



Tools

Charts and posters.

Evaluation

Questionnaires.

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MODULE 2-2: DIAGNOSIS, CLASSIFICATION AND PRESENTATION OF DIABETES

Introduction In the past, diabetes was considered a single condition. However, it has become clear that diabetes is a heterogeneous metabolic condition caused by a variety of mechanisms. The classification of diabetes is now based on differences in cause, natural history, and clinical characteristics.

Goals: To provide participants with a sound knowledge of the different metabolic disorders of glucose metabolism, pathogenesis, clinical characteristics, and diagnostic criteria.

Objectives

After completing this module, the participant will be able to:

- Define diabetes mellitus.
- Understand the WHO diagnostic criteria for different disorders of glycaemia.
- Identify the laboratory investigations used in the diagnosis of diabetes and their appropriate use (e.g. fasting blood glucose, postprandial blood glucose, oral glucose tolerance test).
- Discuss the incidence and prevalence of diabetes globally and locally.
- Understand the difference between type 1 and type 2 diabetes in relation to the clinical presentation, patient characteristics, and pathogenesis.
- Describe the role of various factors in the development of type 1 and type 2 diabetes.
- Describe the emerging trend of type 2 diabetes in young people.
- Describe the signs and symptoms of type 1 and type 2 diabetes.

Definition: What is diabetes mellitus?

- The most characteristic feature of diabetes mellitus is persistently high levels of glucose in the blood, referred to as “hyperglycaemia”.

[1] WHO working group definition. Diabetes Medicine

- When glucose cannot be metabolised by the cells, it remains in the bloodstream.
- As the glucose level rises significantly, some of the glucose is excreted in the urine.
- This leads to a commonly known phenomenon called sugary urine or glucosuria. Hence the name "diabetes", which means, "to run through" and "mellitus", which means sweet, or with a taste of honey.

Why does this happen?

- In persons with diabetes mellitus, insulin is lacking or present in insufficient amounts.
- Moreover, the sensitivity of cell receptors towards insulin could be decreased in varying degrees.
- These disturbances lead to abnormally high glucose levels.

- Diabetes mellitus can thus be defined as a metabolic disorder of multiple aetiology characterised by:
  - Chronic hyperglycaemia.
  - Disturbances of carbohydrate, fat, and protein metabolism, which result from …
  - Defects in insulin secretion or in insulin activity or both.
- The effects of diabetes mellitus include long-term damage to various organs, including the eyes, nerves, heart, kidneys, and blood vessels. Furthermore, untreated diabetes could result in ketoacidosis or a non-ketonic hyperosmolar state, which may finally lead to the development of stupor, coma, and death.

The World Health Organization (WHO) classification of diabetes mellitus

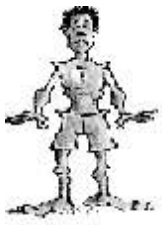
The classification of diabetes is based on the pathogenesis of the disease, and not on the insulin therapy needed or its dependence. For this reason, the WHO working group has eliminated the terms 'insulin dependant diabetes mellitus (IDDM)' and 'non-insulin dependant diabetes (NIDDM)', as these terms were confusing and frequently resulted in patients being classified on treatment rather than pathogenesis.

1. Type 1 diabetes mellitus
   - Autoimmune induced
   - Idiopathic
2. Type 2 diabetes mellitus
   - Obese person with diabetes
   - Non-obese persons with diabetes

3. Gestational diabetes mellitus (GDM)
4. Other types of diabetes associated with certain conditions and syndromes.

The three most common types of diabetes are type 1, type 2, and gestational diabetes.

What are the differences between these types of diabetes?



1. Type 1 diabetes

- This condition develops primarily due to destruction of the ß-cells in the pancreas.
- This class includes all cases attributable to an autoimmune process, including destruction of the ß-cells but also patients prone to ketoacidosis where no pathology or aetiology is known – idiopathic.
- No other forms of ß-cell destruction or failure because of specific causes are included in this classification.
- This can develop at any age, but tends to develop in younger age groups.
- Most of these persons are diagnosed before the age of 35 years, i.e. typically the younger population.
- The rate at which destruction of the ß-cells takes place varies – it could be rapid in some individuals or slow in others.
- Therefore, the onset of the disease is often acute or sub-acute.
- The slower progressive form usually occurs in adults, and is referred to as latent autoimmune diabetes in adults (LADA).
- Persons with type 1 diabetes are usually of normal weight, or underweight.
- Undiagnosed persons, particularly children and adolescents, may present with diabetic ketoacidosis and/or coma.
- People with type 1 diabetes are dependent on insulin for survival, to prevent rapid and severe dehydration, catabolism, ketoacidosis and death.

Clinical features

- Typical symptoms of hyperglycaemia could include

- Polyuria

Polydipsia

Polyphagia

Weight loss

Malaise

Tiredness

Blurred vision

Tingling of hands and feet

Repeated infections

- Type 1 diabetes usually presents acutely.
- Ketones are usually found, and can lead to the symptoms of abdominal pain, nausea, and vomiting.
- Other symptoms, such as blurred vision and repeated infections may occur if the onset is not acute.
- Moderate fasting hyperglycaemia can develop rapidly into severe hyperglycaemia and ketoacidosis in the presence of infections and stress.
- During the diagnosis of type 1 diabetes, there are usually no chronic complications present. In most countries, mortality is high as many people with type 1 diabetes die before being diagnosed.

Incidence and prevalence of type 1 diabetes

- The incidence of type 1 diabetes peaks at about 11-14 years of age.
- Although it develops mainly in children and young adults, it may be seen in all age groups; however, most persons with type 1 diabetes present at a youthful age, with only about 10% being older than 65 years.
- Type 1 diabetes has been seen to occur on all continents, but with considerable variations with regard to geographical and ethnic groups.

- Estimated data on prevalence of diabetes throughout the world and in Africa (age 20-79 years) can be summarised as follows:
  - Worldwide 2003: it is estimated that 5.1% of the population have diabetes, with Europe and the western Pacific regions having the highest number of people with diabetes.
  - The world estimate for diabetes is expected to increase to some 6.3% in the adult population by 2025, with the greatest number of persons with diabetes expected to be in the south-east Asian region.
  - In Africa, with an estimated population of 295 million, 7.1 million people have diabetes, which is about 2.4% of the total population. In Africa, the population with diabetes is expected to escalate to 541 million in 2025, with an increase in the incidence rate of 2.8%.

- Type 1 diabetes mellitus is regarded as being less common among black persons in Sub Saharan Africa than among white persons living in the same region.
- The peak age of onset of type 1 diabetes among black African persons is 23 years, which is almost a decade later than that reported for Europeans.
- It is thought that prolonged breast-feeding may protect people against the development of type 1 diabetes, since early exposure to cow's milk may predispose them to the development of type 1 diabetes.
- The prevalence of GAD antibodies and IA-2 antibodies was found to be significantly lower in black adolescents, which might suggest that more of these persons could have a non autoimmune form of type 1 diabetes.

Diabetes in Africa takes its toll on health resources of the developing countries of Sub-Saharan Africa because of the chronic nature of the disease, as well as the progressive development of diabetes complications. Of the 49 least developed countries in the world, 33 are in Sub-Saharan Africa, where the economic cost of diabetes cannot be met by most individuals and their families, as incomes are often insufficient to purchase insulin, oral hypoglycaemic agents, or other supplies such as healthy foods, essential for diabetes management. The rate at which new cases of

diabetes emerge, places an additional burden on these countries whose budgets are already stretched to limit by common life-threatening infections, such as malaria, tuberculosis, and HIV/AIDS.

Risk of diabetes in children of persons with type 1 diabetes

A higher risk of inheritance is seen in families, indicating a genetic susceptibility:

General population with diabetes:	0.5%
Siblings and children of parents with diabetes:	5-10%
Father with diabetes:	9%
Mother with diabetes:	3%
Both parents with diabetes:	30%

It is significant that adult males seem to carry a considerably higher risk than females.

2. Type 2 diabetes

- Type 2 diabetes usually develops in people older than 40 years – but is now also being seen more commonly in younger people. Type 2 diabetes in children and adults is acknowledged as a very important and growing problem.
- In contrast to type 1, these persons do not necessarily depend on insulin for survival. Although impaired, the ß-cells still produce insulin, but they may also experience insulin resistance.
- Traditionally, they are treated with diet, exercise, and tablets known as oral hypoglycaemic agents (OHAs).
- In many people, this type of treatment fails after several years. In this situation, known as secondary failure, insulin is needed to obtain good metabolic control.
- According to the WHO classifications, people with type 2 diabetes can be divided into two groups: the obese and the non-obese.
- The proportions of these groups vary between races and countries:
    - Among Europeans and Americans, obese type 2 diabetes constitutes up to 80% of these

persons.

- In Asia, the proportion of obese to non-obese type 2 persons is about equal.
- In a South African survey, prevalence of overweight and obesity was 19.4% and 9.1% respectively for men, and 25.5% and 29.4% respectively for women.

- Type 2 diabetes mellitus is frequently undiagnosed for many years because hyperglycaemia develops gradually and in the earlier stages is often not severe enough for the person to be aware of any classic symptoms of diabetes.
- An epidemic of type 2 diabetes has emerged in developing countries, to the extent that type 2 diabetes is now recognised as the most common type of diabetes worldwide.
- It is predicted that there will be a dramatic increase in the incidence of type 2 diabetes in Africa, but this may be modified by factors relating to the current HIV/AIDS epidemic.

Clinical features in type 2 diabetes:

Only approximately 53% of patients present with classic diabetes symptoms.

Many patients do not complain about obvious symptoms of diabetes, and the disease is detected:

- accidentally (e.g. screening or at medical examinations, in about 30% of cases);
- or because of the presence of infections (e.g. intercurrent genital or urinary tract candidiasis infections);
- or diabetic complications, such as foot problems, gangrene, myocardial infarction, peripheral vascular disease or microvascular disease, e.g. Retinopathy.

Obesity is a major predisposing factor and is often present at the time of diagnosis.

Significant hyperglycaemia may be present on average for about 5-7 years before diagnosis.

Ketoacidosis is rarely seen in persons with type 2 diabetes.

A hyperosmolar non-ketotic state could be the first manifestation of type 2 diabetes, and those affected may rarely present with a stroke or peripheral neuropathy.

Incidence and prevalence of type 2 diabetes

- Type 2 diabetes is predominantly, although not exclusively, a disease of the middle-aged and elderly population; in Europe and the USA, most persons are older than 55 years, with the average age of diagnosis about 60 years.
- The prevalence of type 2 diabetes increases with age in all population groups; in Europe and

[2] Department of Health. 2000. South African Demographic Health survey 1998.

the USA, it affects approximately 10% or more of the population over the age of 70 years, with an overall higher incidence of 3:2 occurring in males vs. Females.

- The prevalence of type 2 diabetes varies greatly between populations:
    - very high in the Pima Indians of North America, and
    - very high in migrant populations, e.g. the Asians in South Africa: the incidence in the South African Indian is approximately 8% to 9%.
    - Type 2 diabetes is almost twice as common in the South African Indian population as in the other local populations.
    - The prevalence is higher in urban than rural communities; associated factors are a westernised lifestyle, i.e. a diet high in fat, and low in carbohydrates and fibre, high stress levels and very little exercise.

Risk of diabetes in children of parents with type 2 diabetes

There is a very strong possibility for inheriting type 2 diabetes:

One parent:	1 in 2 (some say 1 in 4)
Both parents:	3 in 4
Brother or sister:	1 in 2.

Risk of type 2 diabetes in children:

- Type 2 diabetes mellitus is not such a rare disease in children and adolescence as in previous years, and now has become an emerging problem worldwide.
- The age of onset for type 2 diabetes is becoming increasingly younger: Japanese, African American, and Asian American persons are presenting as high-risk groups.
- It is thought that genetic and environmental factors are involved with the increasing prevalence of obesity, which is a major factor, in childhood.
- MODY is an unusual subgroup of maturity onset diabetes in young people, and is characterised by an early onset and dominant inheritance.
- Often children with type 2 diabetes may present with clinical features indistinguishable from those of type 1 diabetes:
    - Children with type 1 diabetes may be obese.
    - Approximately 33% of children with type 2 diabetes may have ketosis and 5-20% may have ketoacidosis.
    - Features suggestive of childhood type 2 diabetes are obesity, acanthosis nigrans, slow onset, and belonging to a high-risk ethnic group.

[3] Prof Martin Silink, EASD 2000

Differences in clinical features between type 1 and type 2 diabetes

Characteristic	Type 1	Type 2
Onset	Sudden, acute or sub-acute	Slow, insidious onset, progressive disease. Patient could be undiagnosed for years.
Age	Usually < 30-35 years; exception of LADA.	Older patients, > 40-45 years; exception of MODY.
Typical symptoms	Yes, mode rate to severe symptoms of diabetes present	Person often asymptomatic because of slow onset of the disease; asymptomatic glucosuria present.
Weight	Lean, often rapid weight loss before diagnosis	Normal to overweight
Insulin secretion	Insulin deficient, needs insulin for survival	Deficient ß-cells insulin secretion patterns and or insulin receptor abnormalities
Chronic complications present at diagnosis	Less frequent	Yes, because of later diagnosis
Insulin resistance	No	Yes
Ketosis	Yes, often diagnosed in Ketoacidosis	Not as common as in type 1
Immune markers	Yes; autoim mune disease: anti-GAD, ICA, 1A-2.	Absence of auto-immune markers
Genetic involvement	Genetically linked	Stronger genetic link and higher inheritance risk
Metabolic syndrome	No	Yes; a cluster of cardiovascular disease risk factors often present, e.g. hypertension, dyslipidaemia, abdominal obesity, insulin resistance, microalbuminuria, and hypercoagulability.
Treatment options	Insulin therapy	Initially: lifestyle changes +/- oral hypoglycaemic agents. As ß-cells failure progresses, insulin therapy will be required.
Complications of diabetes:	More prone to microvascular complications	High risk for macrovascular complications; also develops microvascular complications as disease progresses.

3. Gestational diabetes

WHO definition: Carbohydrate intolerance resulting in hyperglycaemia of variable severity with onset or first recognition during pregnancy.

This definition applies irrespective of whether or not insulin is used for treatment, or if the condition persists after pregnancy.

Gestational diabetes can develop at any time during pregnancy, but most commonly this appears after the middle of the second trimester or into the third trimester.

- Typically, the prevalence of GDM is estimated to be 1-3% of all pregnancies. (USA 12.3%).
- When persons with type 1 diabetes become pregnant, they are not classified as GDM, but pregnant women with diabetes.
- GDM is associated with increased perinatal complications: foetal size and mortality in women who have been discovered to have mild diabetes during pregnancy are still greater than usual.
- Furthermore, the mothers have increased risk of developing diabetes within 5-10 years after delivery.
- Maternal GDM may also have surprisingly long-term consequences for the offspring: foetuses exposed to GDM are at increased risk of developing diabetes in adult life.
- Early detection and vigorous treatment of GDM is vital to prevent the complications as discussed.

Which persons are at risk?

- Persons with a family history of diabetes
- Previous pregnancy complicated by gestational diabetes
- Persons who have given birth to a previous large baby
- Obesity
- Age over 35 years
- Certain ethnic groups, e.g. the Asian population groups.

4. Other types of diabetes mellitus

4.1 Diabetes as a result of pancreatic diseases

Any process that diffusely injures the pancreas can cause diabetes.

In conditions, such as pancreatitis (inflammation of the pancreas), trauma, infection, cancer of the pancreas and pancreatectomy (surgical removal of the pancreas), secretion of insulin may be impaired or non-existent, hence leading to the clinical signs of diabetes.

Chronic or recurrent pancreatitis, cystic fibrosis, and haemochromatosis will also damage ß cells and cause impaired insulin secretion.

[3] GDM and impaired glucose tolerance during pregnancy: Diabetes 1985

4.2 Diabetes because of endocrine diseases

Some diseases cause abnormally high concentrations of hormones that antagonise the effects of insulin on blood glucose levels, e.g. growth hormone, cortisol, glucagon, and adrenalin. The following diseases may therefore induce diabetes:

- In Cushing's syndrome, there are high levels of corticosteroids;
- In phaeochromocytoma, there is an excessive amount of adrenalin
- In acromegaly, there is excessive secretion of growth hormone.
- Other hormonal diseases may also be associated with diabetes.
    - Hyperaldosteronism
    - Thyrotoxicosis
    - Glucagonoma
    - Polyglandular autoimmune syndrome
    - Tumours of endocrine, pancreas, or gut.

4.3 Diabetes as a result of drugs, chemicals and toxins

Many drugs can impair insulin secretion. These drugs may not cause diabetes by themselves, but they may precipitate diabetes in persons with insulin resistance. Certain drugs, such as corticosteroids, or toxins, such as pyriminil, can cause glucose intolerance and disclose diabetes in susceptible persons. This condition will persist even after the drug or toxin has been eliminated from the person. Certain toxins, such as rat poison and Pentamidine can permanently destroy the ß-cell function.

Other drugs that influence insulin secretion include:

Glucocorticoids and adrenocorticotropic hormone (ACTH)

Diazoxides

Diuretics (thiazides)

Phenytoin

Pentamidine

Pyriminil (rodenticide).

4.4 Diabetes as a result of abnormalities of insulin action or its receptors

There are some unusual causes of diabetes that result from genetically determined abnormalities of insulin action, resulting in mutations of the insulin receptor. Resulting

effects may range from hyperinsulinaemia to symptomatic diabetes. Some of the individuals with these mutations have acanthosis nigricans, which appears as hyper-pigmented, velvety skin areas in apposed and flexural locations; the palms and soles are usually not affected. The severity of acanthosis nigricans correlates with the degree of insulin resistance. Women may present with virilisation and have enlarged, cystic ovaries.

Insulinopathies.

Receptor defects.

Circulating anti-receptor antibodies.

4.5 Genetic defects of ß-cell function

4.5.1 Maturity onset of diabetes in the young

This is an unusual sub-group of several forms of a diabetic state and is characterised by an early onset of mild hyperglycaemia at a young age, generally before 25 years. These forms of diabetes (i.e. MODY) are characterised by impaired insulin secretion with minimal or no effect on insulin action. Abnormalities at four genetic loci on different chromosomes have now been identified. Genetic abnormalities include the inability to convert pro-insulin to insulin; mutations of the glucokinase gene have been identified as the cause of ß-cell dysfunction and hyperglycaemia in some cases. These forms of diabetes are usually inherited in an autosomal dominant pattern. The proposed criteria for defining this condition are as follows:

- Early diagnosis of diabetes – before age 25 years in at least two family members.
- Non-insulin dependant, which is demonstrated by the absence of insulin treatment 5 years after diagnosis, or alternatively by significant circulating C-peptide concentrations.
- Autosomal dominant inheritance through vertical transmission of diabetes by at least three generations, ideally, with the same phenotype in cousins or second cousins.

When applying these criteria, the prevalence of MODY is estimated at about 0.5% to 1% of persons with type 2 diabetes.

Persons with glucokinase MODY have an early onset of impaired glucose tolerance, which gradually deteriorates with age, to become diabetes at mid-life according to WHO criteria.

Mild hyperglycaemia rarely needs treatment other than diet until old age, when oral agents are usually adequate.

During pregnancy, persons with diabetes may need insulin to obtain strict control of glycaemia.

It is often difficult, but essential to differentiate between type 1 diabetes mellitus and MODY.

4.5.2 Late onset of diabetes in adults (LADA)

LADA is a form of autoimmune diabetes mellitus, where ß-cell destruction is slow and progressive, and generally occurs in adults. Here adults may retain residual ß-cell function, sufficient to prevent ketoacidosis for many years. Individuals with this form of type 1 diabetes eventually become dependant on insulin for survival and are at risk for developing ketoacidosis. At this stage, there is little or no insulin secretion as determined by low or undetectable levels of plasma C-peptide.

Islet cell antibodies and/or autoantibodies of insulin and GAD65 antibodies are present at diagnosis. Other autoimmune disorders may also be present (Grave's disease, Hashimoto's thyroiditis, and Addison's disease).

Diagnosis of diabetes

There are several ways of determining diabetes, such as:

Signs and symptoms of diabetes.

Blood glucose determination.

Oral glucose tolerance test (OGTT).

- Most people are suspected to be suffering from diabetes at first when they show signs and symptoms of the disease.
- This is usually confirmed by the doctor with a blood glucose determination.
- If the symptoms and blood glucose are at borderline, an OGTT will be performed.

Urine tests for glucose are not recommended for diagnosing diabetes. This test should never be utilised for diagnosis of diabetes if there is any possible alternative!!

Clinical signs/symptoms

In most instances, diabetes is diagnosed by clinical signs and/or symptoms such as:

- POLYURIA
- THIRST
- HUNGER
- WEIGHT LOSS
- MALAISE
- TIREDNESS
- BLURRED VISION
- POOR WOUND HEALING
- ABOVE SYMPTOMS ACCOMPANIED BY PERSISTENT HYPERGLYCAEMIA.

Severe hyperglycaemia

When severe hyperglycaemia is detected under conditions of acute infective, traumatic, circulatory, or other stress factors, this may be of a transient nature and, therefore, should not be regarded as diagnostic of diabetes. It is advisable to treat the hyperglycaemia appropriately and review the person's glucose tolerance status only after full recovery. However, a significant proportion of persons with diabetes mellitus may present with acute illness as ketoacidosis or non-ketotic hyperosmolar state for the first time; under these circumstances the diagnosis of diabetes is not difficult.

Blood glucose level

- When diabetes has fully evolved, the fasting plasma glucose level will be equivalent to or exceeding 7,0 mmol/l (126 mg/dl)
- The random plasma glucose level will be equivalent to or exceeding 11,1 mmol/l. (200 mg/dl)
- In some instances where diabetes is asymptomatic and the blood glucose level is inconclusive, an OGTT is necessary
- The diagnosis of diabetes in an asymptomatic person should never be made based on a single abnormal blood glucose level, but only after the plasma glucose concentration within the range of diabetes has been found at a second different time. This second sample may be obtained either in the fasting state, or randomly, or by an OGTT. Should these samples fail to confirm the diagnosis of diabetes mellitus, it is advisable to continue with periodic re-testing until the diagnosis becomes clear.
- Glycated haemoglobin (HbA1C) which reflects the average blood glucose over a period of weeks is not recommended as a diagnostic test for diabetes mellitus, as this procedure is currently not adequately standardised.

Oral glucose tolerance test?

- The major indication for an OGTT is to exclude or diagnose diabetes in cases not clarified, and where clinical signs and fasting or random blood glucose measurements are inconclusive.
- This test can be performed after three days with an unrestricted diet and physical activity.
- The test requires the patient to fast overnight for 8 to 14 hours (water may be taken) After collection of a fasting blood sample, the person then takes an oral glucose load of 75 g (adults). In children, 1,75 g/kg body weight is used.
- 2 hours after the glucose load, blood glucose is tested.
- The biochemical diagnosis of diabetes mellitus and other categories of hyperglycaemia can be made as follows:

    1. using a random venous plasma glucose sample
    2. using a fasting venous plasma glucose sample

3. using a 2-hour venous plasma glucose sample or the 2-hour OGTT after 75 g glucose load.

- The diagnostic criteria in children are the same as for adults.

WHO diagnostic crit eria for diabetes:

	Glucose concentration, mmol/l (mg/dl)		
	Whole blood		Plasma*
	Venous	Capillary	Venous
Diabetes mellitus			
Fasting	≥ 6.1 (110)	≥ 6.1 (110)	≥ 7.0 (126)
or			
2-hour post glucose load	≥ 10.0 (180)	≥ 11.1 (200)	≥ 11.1 (200)
or both			
Impaired glucose tolerance			
Fasting concentration (if measured)	≤ 6.1 (110)	≤6.1 (110)	≤ 7.0 (126)
and			
2 hours after glucose load	6.7-9.9 (120-179)	7.8-11.0 (140-199)	7.8-11.0 (140-199)
Fasting hyperglycaemia			
Fasting	5.6-6.0 (100-109)	5.6-6.0 (100-109)	6.1-6.9 (110-125)
2 hours (if measured)	≤ 6.7(120)	≤ 7.8 (140)	≤ 7.8 (140)

Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG)

IGT and IFG refer to a metabolic stage intermediate between normal glucose homeostasis and diabetes mellitus. The WHO has reclassified "impaired glucose tolerance" as a stage of impaired glucose regulation, since it can be observed in any hyperglycaemia disorder, and is not diabetes as such. Many individuals with IGT have normoglycaemia during their daily lives. IGF and IGT, in the absence of pregnancy, are not clinical entities in their own right, but rather risk factors for future diabetes and cardiovascular disease. Although IGT is often associated with the metabolic syndrome, it may also occur as an intermediate stage in the pathogenesis of the various forms of diabetes. If an OGGT is performed, some individuals with IFG will have IGT and some may have diabetes.

Insulin resistance

Insensitivity of insulin receptors to insulin in muscles and liver will tend to cause blood glucose levels to rise, which will stimulate the pancreatic ß-cells to secrete more insulin, resulting in hyperinsulinaemia. In many insulin resistant states, there is decreased insulin clearance and often, reduced numbers of insulin receptors on the cell surface (down regulation). In people with severe insulin resistance, marked degrees of hyperinsulinaemia are required to maintain normoglycaemia, and fasting and stimulated insulin concentrations > 50 Mu/l and 300 Mu/l, respectively, may be found.

In time, a decline in ß-cell function occurs because the ß-cells lose their ability to secrete enough

insulin to overcome target tissue resistance – this is the prelude to the deterioration of hyperglycaemia and the appearance of clinical diabetes.

The metabolic syndrome

This is a cluster of cardiovascular risk factors:

- abdominal obesity
- atherogenic dyslipidaemia
- raised blood pressure
- insulin resistance and or glucose intolerance
- pro-inflammatory state
- prothrombotic state.

WHO diagnostic criteria for metabolic syndrome

Insulin resistance identified by one of the following:

- type 2 diabetes
- impaired glucose tolerance
- urinary albumin excretion rate = 20 ng/min or albumin: Creatinine ratio = 30 mg/g.

Tools

Posters; Visits to diabetes clinics.

Evaluation

Questionnaires.

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MODULE 3

MODULE 3-1 (a): SELF-MANAGEMENT

Introduction

Self-management is the cornerstone of overall diabetes management. Persons with diabetes will achieve optimal outcomes only if they are willing to and capable of managing their condition adequately on a daily basis.

Self-care imposes various social, emotional, and economic challenges to the person, especially in view of the increase in self-care technology.

Access to high quality services, and care information from health care professionals is a fundamental right. People with diabetes should be well educated and motivated effectively to take responsibility of their care. Follow-up is thus important on a regular basis, and access to advice whenever necessary.

The transition from paediatric to adult care is crucial and must be handled effectively by the health-care personnel, the family, and the young person.

Goals: The primary goal is to improve the quality of life in persons with diabetes. This will also assist in understanding:

- The burden of diabetes (personal, economic, and psychosocial costs).
- The needs of effective self-management skills.
- Ways to facilitate access to services.
- Ways to facilitate transition of care from childhood to adulthood.

Good self-management reduces costs of care by reducing morbidity. The diabetes educator must aim at being an advocate for children/people with diabetes to reduce discrimination against them at school, the workplace and in society.

Objectives

After completing this module, the participant will be able to:

- Discuss the impact of living with diabetes (refer to module 1-3).
- Recognise barriers to self-care.
- Promote self-care as integral to effective management.
- Assist a person with diabetes in becoming competent with self-care behaviours appropriate to his/her needs, e.g. urine and blood glucose monitoring, and the need for regular complication assessment.
- Inform the person with diabetes of his/her personal targets for treatment, e.g. blood glucose, lipid values, blood pressure, HbA1C, albumin secretion status, meal-planning activity. ? Recognise and assess barriers to self-care (refer to module 1-3, psychosocial behavioural approaches).
- Adopt a flexible approach to the education and management of individuals (refer to module 1-3).
- Recognise that individuals manage their diabetes in different ways (refer to module 1-3).
- Prepare the young person for transition from the paediatric setting to the adult environment (refer to module 4-1).
- Teach people the importance of regular contact with both the medical practitioner and members of the health-care team.
- Realise the need for regular education updates (refer to module 1-3).
- Establish a link of mutual confidence.
- Give the person the self-confidence to advocate for their rights when dealing with health professionals.

- The impact of living with diabetes Diabetes mellitus is a chronic condition that has a major impact on the lives of people with diabetes and their families, which could complicate family functioning. People with diabetes are faced with the challenges to self-regulate their diabetes, live a full and normal life, while facing the other responsibilities and stresses of life, which is psychologically complex and burdensome. Refer to Module 1-3 for a discussion on the impact of living with diabetes.

- Barriers to self-care

The educator must be able to recognise and assess barriers to care, and make appropriate referrals if needed. These could include:

- peer pressure, e.g. adolescents and teenagers

- lack of familial support
- beliefs/taboos
- economic factors
- depression and anxiety
- old age
- poor health, poor eyesight
- poor motivation
- mental factors: inability to comprehend the impact of diabetes on quality of life
- distorted/incorrect information.

- Self-care is integral to effective management

Refer to module 1-3.

Diabetes is a lifelong condition, which requires lifelong commitment to self-care. Patient education is vital to empower and motivate the patient to:

- Understand diabetes
- Cope with the disease
- Take control of their disease
- Develop survival skills.

It is important to keep discussions on the understanding level of people with diabetes, therefore, principles taught should be simple and in the language of people with diabetes.

To take control of their disease management, education and support the person with diabetes should apply the following principles of self-care:

The diabetes educator should assist the person with diabetes to become competent with self-care behaviours.

Living with diabetes requires lifestyle and behavioural changes, and the need for a regular schedule to achieve good blood glucose control:

- A change in eating habits. A healthy eating plan, which incorporates regular and evenly sized meals, is required for the person with diabetes. This should be individualised (refer to Module 3-5 for principles in nutrition).
- A regular exercise programme is vital to ensure good glucose control, and improve fitness and circulation (refer to Module 3-4 for guidelines on exercise in diabetes).
- Examine the feet regularly.
- Daily medication will be required (refer to Modules 3-2 & 3-3).
- Self-monitoring and use of results:
    - Regular self-monitoring of urine or blood glucose is essential to determine if blood glucose targets are met.
    - Monitoring diabetes gives the person with diabetes information about the effects of the meal pattern and food intake, medication, activity, and stress on blood glucose.
    - Keeping a record of these results helps the person with diabetes and the health care team to keep track of progress towards achieving optimum control of the blood glucose levels.
- Various methods could be used to monitor control:
    - The diabetes educator should be able to teach the person with diabetes on how to test and record the results, using the most suitable/available method for each individual.

- Blood testing is a direct method that tells the person exactly what the blood glucose level is at the specific time of testing, and has largely replaced urine glucose testing.
- Urine testing is an indirect test for glucose. Testing urine is a poor means of assessing blood glucose control. However, in certain clinics this may be the only available tool, in which case the second urine specimen of the day should be tested.
- Testing for ketones in the urine is essential for monitoring blood glucose control, especially in difficult cases.

- The person with diabetes should be taught when to monitor urine/blood glucose levels. This should be individualised according to need and insulin regimen. There are many options when and how frequently to test. These include:
  - One fasting test plus one more test at different hours of the day, which could be either before a meal or 2 hours after a meal, before bedtime or 2-3 am in the morning.
  - Once a day, but at different times each day.
  - More frequent testing may be required if blood glucose is too high or too low, poorly controlled diabetes, during illness or severe stress, in children and adolescents, during pregnancy, brittle diabetes or if on multiple injection regimens.
  - The educator should discuss with the person an individualised and realistic schedule for monitoring, taking into account availability of strips and financial means.
- The diabetes educator should teach the patient on the relevance of ketone testing:
  - Ketones appear in the urine when the body cells have insufficient glucose for energy purposes.
  - Ketones indicate insufficient insulin activity caused by an inadequate dosage or because of illness.
  - If neglected, ketoacidosis can occur.
- Ketone testing is essential when:
  - blood glucose is uncontrolled,
  - insulin dose has been missed, or
  - feeling bad, ill, or under stress.

- Recording and use of test results: all test results should be recorded in a diary and be available at visits to the doctor and health-care team for evaluation.
    - The person with diabetes should understand the benefits of regular monitoring.
    - Monitoring alone will not control blood glucose, but the results could be useful to adjust the eating plan, medicine and exercise programmes, to achieve targets for control.
- Long-term blood glucose control is important to help prevent or delay long-term complications. Of importance is the annual complication assessment:
    - Eyes – Proliferative diabetic retinopathy is often asymptomatic and difficult to detect by non-specialists. Patients should have an ophthalmologic examination at least once a year, or more frequently.
    - Clinical assessment of nerve function annually or more frequently, as asymptomatic patients may have considerable functional impairment.
    - Heart – Electrocardiogram assessment at least annually to detect any abnormalities in heart function.
    - Kidneys – a urea and creatinine clearance annually would detect kidney abnormalities and impairment.
    - Feet examination.
- Inform the person with diabetes of his/her personal targets for treatment, e.g. blood glucose, lipid values, blood pressure, HbA1C, albumin secretion status.
    - The person with diabetes should be empowered towards efficient self-care practices, and must therefore be informed on which targets to achieve.
    - Targets for control should be individualised.
    - The following optimal targets for glycaemic, lipid and blood pressure control should serve as a guideline:

Biochemical indices		Optimal
Blood values	Capillary blood glucose values (finger-prick) Fasting (mmol/l) 2-hour postprandial (mmol/l) Glycated haemoglobin (HbA_{1c}) (%)	 4-6 4-8 < 7
Weight	Body mass index (BMI in kg/m^2)	< 25
Blood pressure (mmHg)	Systolic Diastolic If persistent, dipstick for proteinuria Systolic Diastolic	< 130 < 80 < 125 < 75
Lipids (mmol/ l)	Total cholesterol Low-density lipoprotein (LDL) cholesterol High-density lipoprotein (HDL) cholesterol Triglycerides	< 5.0 ≤ 3.0 > 1.2 < 1.5

- Adopt a flexible approach to the education and management of individuals, as individuals manage their diabetes differently (refer to Module 1-3).
- Prepare the young person for transition from the paediatric setting to the adult environment (refer to Module 4-1).
- Teach people the importance of regular contact with their medical practitioner and members of the diabetes health-care team:

  Self management and monitoring is an essential component of living with diabetes, However, regular follow-up visits to the medical practitioner and contact with the health-care team is critical to evaluate and ensure effective long-term control and treatment of diabetes. Apart from healthy eating habits, regular exercise and frequent self-monitoring, and other important metabolic targets need to be evaluated on a regular basis.

  Monthly assessments of the following parameters are important:

  - Weight
  - Blood pressure
  - Blood glucose
  - Feet pulses
  - Urine tests for ketones.

  Alternatively, 3-6-monthly assessments of the following parameters may be deemed important:

  - HbA1c – to determine average long-term blood glucose control
  - Proteinuria
  - Eye evaluation
  - Lipids.

Once people with diabetes have been empowered with knowledge they will then be able to advocate for their own rights to obtain the best possible care. This will provide them with self management skills and the necessary steps that the health-care team should take to assist in the prevention, detection, and management of long-term complications of their diabetes.

Diabetes mellitus and travelling

[3] Please note that exposure of insulin vials to methylated spirits over extended periods of time will affect the integrity of the rubber cover of vials.

Introduction

For persons with diabetes, travelling requires prior preparation and planning. In Africa, various factors, such as mode of transport and infrastructure, access to medical care and food make travel even more difficult for a person with diabetes. Hence, preparation prior to long distance travel is vital. Travel should be made safe, and as far as possible not restrictive for these persons.

Objectives

- To provide persons with diabetes with vital tips regarding travelling including pre- and post travelling tips to help manage their condition and minimise the risk of acute complications.
- To provide information to enable persons with diabetes to travel safely and easily.

Planning tips before travelling

a) Food

- Extra food/fruits should be carried with patient in case of transport delays/breakdowns.
- sugar/sweets should be carried especially for patients on Insulin.
- Drinks – fresh boiled water/bottled water should be carried.

b) Insulin/medication and syringes

- An extra supply of tablets and insulin should be taken.
- Details of medical services/facilities available enroute and at the destinations should be known.
- Persons with hypoglycaemic unawareness on insulin should preferably travel accompanied by others who are aware about their condition.

c) Appropriate footwear

- When travel involves prolonged walking or prolonged sitting in one position appropriate footwear should be worn (refer to section on the Diabetic foot).

d) Other tips

- A doctor's/medical officer's letter for customs and/or security reasons would be useful when travelling across borders.
- People with diabetes who have glucometers should carry these and ensure they have adequate strips and batteries.
- An identification card/bracelet should be worn by the diabetic person to make people travelling with them aware of their condition.

Important points while travelling

a) Insulin storage

- Travelling by road/car:
  - Insulin should be carried by the person with diabetes, and kept in a cooler bag away from sunlight and not in the dashboard or boot. When using a cooler bag, ensure that insulin vials are not placed directly in contact with ice packs, as to prevent freezing of insulin. Ice cubes or packs should be wrapped in paper or cloth before putting insulin into the cooler bag.
  - Where cooler bags are not available, the insulin vial may be carried in a small improvised container with cotton wool soaked with methylated spirits surrounding the vial. The container should have a cover to ensure the spirits does not evaporate.
- Travelling by air:
  - Insulin and tablets should be carried on the person with diabetes and not in the hold because of sub-zero temperatures.
  - Ensure insulin is at hand in case of delays/luggage losses.
  - The person with diabetes should carry a script from a doctor for extra insulin in the event of any mishaps and replacement of insulin.
  - A letter from the doctor, stating that the person suffers from diabetes should be carried, to authorise possession of needles for injecting purposes, otherwise these items may be removed from the person at the airport security points.

b) Illness while travelling

- If diarrhoea develops the person with diabetes should be advised to continue taking insulin/medication, carbohydrates and fluids.
- When possible self-monitoring of blood glucose would be useful.
- Prompt medical attention should be sought if symptoms persist.

c) Treatment adjustments while travelling

- When travelling by plane involves crossing over time zones, persons on insulin may require treatment adjustments. Conversion to bolus soluble insulin injections prior to meals during the travelling period under advice from the doctor would be useful.

d) Food and nutrition

During travelling, the person with diabetes must ensure adequate intake of food and fluids to avoid dehydration and hypoglycaemia.

e) Exercise

When travelling involves sitting in one position for prolonged periods, people with diabetes should be advised to stretch their limbs periodically during travel stops.

At destination

- Insulin storage:
  - Preferably in a refrigerator if available.
  - If a refrigerator is not available, insulin can be stored in the coolest part of the room or covered with a wet flannel cloth, or in a clay pot submerged in water and protected with plastic wrapping.
- Availability of medical facilities:
  - Persons with diabetes should acquaint themselves with the medical services available at destination in case they do require medical supplies or services.

Medical treatment/Nutrition

- Patients should continue using their normal treatment doses, and should follow nutrition advice that they have been given.

Tools

Posters, eating plan leaflets, patient diaries, blood glucose monitors, urine ketone testing kit, and foot care workshops.

Evaluation

Questionnaires, assignments on development of patient education literature, and practical evaluation on patient education.

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MODULE 3-1 (b): SICK DAY MANAGEMENT

Introduction An inter-current illness can destabilize the metabolic state of a child/adult with diabetes (especially type 1) leading to a hyperglycaemic crisis, e.g. Diabetic ketoacidosis. These can be prevented by certain simple steps highlighted as "Sick Day Management".

Goals: to provide knowledge that aids in prevention of diabetic ketoacidosis.

METABOLIC DISTURBANCE AS A RESULT OF INTERCURRENT ILLNESS

An inter-current illness, e.g. an upper respiratory tract infection, can destabilise the metabolic state leading to a hyperglycaemic crisis. The stress of factors, e.g. infection, inflammatory disease, injury, surgery, and severe emotional disturbances, results in the secretion of stress or counter-regulatory hormones: glucagon, growth hormone, epinephrine, and cortisol. Acting in synergy, these hormones create a state of insulin resistance, causing increased hepatic glucose production and reduced peripheral glucose utilisation. Though calorie intake is low in illness, blood glucose levels increase and ketonaemia and ketonuria may occur.

Unchecked, these metabolic disturbances may progress to full-blown diabetic ketoacidosis. Sick day management thus serves to prevent ketoacidosis.

Principles of treatment

- Never omit insulin injections.
- Treat underlying illness.
- Prevent dehydration.
- Monitor blood glucose and urine ketones every 4 hours.
- Administer supplemental insulin.
- Watch out for symptoms that require hospital care (admission).

Never omit insulin injection

The schedule of insulin should not be changed.

If blood glucose is low, the dose of insulin is reduced.

However, supplemental injections of regular insulin are often required, as blood glucose is usually high and ketonuria frequently present.

Treat underlying disease: Seek medical attention sooner rather than later

Any underlying illness should be treated on its merit e.g. for an infection give antibiotics.

Prevent dehydration

High fluid intake is important to prevent dehydration (see Table 1).

Fluids chosen should contain salt (sodium) and potassium to replace loss of these electrolytes as occurs in uncontrolled Diabetes: if one is not able to follow meal plan, use fluids with sugar to provide carbohydrate. Fluids can be oral rehydration salts broth, bouillon, fruit juice, regular soda (coca cola, ginger ale).

Table 1. Minimum amounts of fluid

		Volume per hour	
Age in years	Weight in kg	ml	oz
5 yrs old	20	45 -90	1.5 - 3
10	30	75 - 120	2.5 - 4
15	55	120 - 240	4 - 8
16	56 +	240 - 300	8 - 10

Adapted from Challenges in diabetes management, Lifescan 1998.

Monitoring every 4 hours (by person with diabetes or relative)

Weight loss is a reliable sign of dehydration so a child/ adult can be weighed several times in a day (3 - 4 times).

Self-monitoring of blood glucose levels done every 3 - 4 hours around the clock.

Urine ketones: checked every 3 - 4 hour around the clock.

One should be advised to rest and avoid strenuous exercise/activity.

Give supplemental insulin (by person with diabetes or relative)

Depending on results of blood glucose monitoring and urine tests for ketones, it may be necessary to administer additional (supplemental).

Regular insulin every 3 - 4 hours until blood glucose < 240 mg/dl (< 13 mmol/l) (see Table 2) generally an additional 10% - 20% of usual daily dose may be safely given.

Table 2. Guidelines for supplemental regular insulin

Blood glucose (mg/dl)	Urine ketones more than trace	Amount of supplemental insulin
Below 80 (4 mmol/l)	Yes or No	Omit regular insulin decrease NPH, Mixtard, Lente by 20% test again in 3-4 hours
80 - 240 (4-13 mmol/l)	No	No extra insulin test again in 3-4 hours
80 - 240 (4-13 mmol/l)	Yes	No extra insulin, carbohydrates ingestion will correct starvation ketosis. Test again in 3-4 hours
240 - 400 (13-22 mmol/l)	No	Give 10% supplement, test again in 3-4 hours and repeat dose if no improvement
240 – 400 (13-22 mmol/l)	Yes	Give 20% supplement, test again in 3-4 hours and repeat dose if no improvement
Above 400 (> 22 mmol/l)	Yes or no	Give 20% supplement, test again in 3-4 hours and repeat dose if no improvement

Adapted from challenges in Diabetes management Lifescan 1988

Signs and symptoms that need hospital care (admission)

If any of the following circumstances pertain, the affected must seen by a physician for admission purposes.

Management at home may not be safe if:

1. The child/adult exhibits only signs of dehydration, e.g. especially in children: dry mouth cracked lips, sunken eyes, weight loss.
2. If the child/adult is unable to consume the recommended amount of the fluid or if vomiting persists for more than an hour or two.
3. If the child or adult develops symptoms of diabetes ketoacidosis, e.g. Nausea, abdominal pain, vomiting, hyperventilation, drowsiness.
4. If high blood glucose (> 240 mg/dl or 13 mmol/l) and or ketonuria persists for more than 12 hours.

Conclusion

Sick day management is vital in minimising the impact of intercurrent illness. In many cases this prevents hospital admission and the accompanying costs, reducing not only the economic burden of diabetes; but also reducing the days lost because of illness.

However, this is limited to those who are able to afford blood glucose machines and urine test strips, as well as those patients who are highly motivated.

With good education and motivation, most sick day episodes can thus be successfully managed at home or in a primary care setting such as a health clinic.

Tools

- Leaflets with information on sick day management.
- Charts for monitoring.

Evaluation

- Testing (practical) of skills in handling glucose meters, ketostrips.
- Case studies.
- Successful handling of a sick day.

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Module 3-2: Glucose-lowering medication

Introduction In type 2 diabetes mellitus there are variable degrees of defective insulin secretion and/or utilisation by the peripheral tissue. Type 2 diabetes ranges from a predominantly insulin resistance with defective insulin secretion to predominantly defective insulin secretion with insulin resistance. Diet and exercise are the first-line therapy in all persons with diabetes. Where diet and exercise alone fail to achieve glycaemic control, oral agents should be commenced. Current evidence suggests that treatment with oral agents early in the course of the disease prevents progression of diabetes and its complications.

Goals: To provide the participant with an understanding of the different oral agents used to treat type 2 diabetes, and why particular agents are chosen in preference to others.

Objectives

After completing the module, the participant will be able to:

- Discuss the role of these medications in the management of type 2 diabetes.
- Identify appropriate treatment aims when using glucose-lowering agents.
- Describe the different oral medications available, their mechanism of action and maximum dosage of secretagogues, biguanides, thiazolidinediones and alpha-glucosidase inhibitors.
- Describe the potential for hypoglycaemia when using secretagogues.
- Describe the need for caution when using long-acting sulphonylureas in the elderly.
- Describe the side-effects and potential problems associated with the use of secretagogues, biguanides, thiazolidinediones and alpha-glucosidase inhibitors.

The role of oral glucose-lowering agents in the treatment of diabetes:

- Oral pharmacotherapy is indicated when individualised glycaemic targets are not met by lifestyle modifications, such as dietary adjustments and a regular exercise programme.
- In many parts of Africa, refusal or failure to prescribe oral therapy soon enough, may cause loss of faith in the system and a resort to parallel therapies.

- Oral therapy may be used as monotherapy or in combination therapy to target different aspects in the pathogenesis of hyperglycaemia in type 2 diabetes mellitus.
- The choice of oral therapy should depend on the characteristics, lifestyle, degree of glycaemic control, access to drugs, economic status of the person with diabetes, and mutual agreement between the doctor and this person.
- Monotherapy should be the initial choice. The stepped-care approach is recommended, as monotherapy is seldom sufficient, because of the progressive nature of the disease. Currently, sulphonylureas and biguanides (metformin) are the agents most widely available.
- If overweight (BMI > 25 kg/m2) biguanides (metformin) should be the first choice; if metformin is contra-indicated, thiazolidinediones may be used.
- Long-acting sulphonylureas should be avoided in elderly patients, because of the risk of hypoglycaemia; short-acting sulphonylureas or glitazones should be used.
- Metformin should be used with care in the elderly (> 75 years old); it is also contra-indicated in people with elevated serum creatinine (kidney impairment), liver disease, and severe respiratory-, cardiac- and peripheral vascular disease.
- Combination therapy using oral glucose-lowering agents with different mechanisms of action is indicated if monotherapy with one of the agents has failed. Never use two drugs from the same class.
- The rapid-acting insulin secretagogues (glitinides) and the alpha glucosidase inhibitors allow for flexibility in the management of glycaemia, but could be relatively expensive.
- When oral combination therapy fails, insulin should be added to the regimen, or, alternatively, replace treatment with oral glucose-lowering agents.

Drugs that stimulate insulin release from the ß-cells

1. Sulphonylureas

- Mechanism of action

Sulphonylureas stimulate basal as well as glucose-mediated insulin secretion, thus resulting in continuous stimulation of the ß-Cell to release insulin.

The action of sulphonylureas requires the presence of functional ß-cells. With progressive ß-cell failure over time, sulphonylureas may become ineffective and additional oral agents or insulin may be required for glycaemic control. Measurement of C-peptide levels gives an indication of residual ß-cell function. Early use of combination agents has been shown to reduce glucose toxicity and preserve ß-cell mass.

- Pharmacokinetics

Sulphonylureas are well absorbed orally. Most reach peak plasma concentration within 2-4 hours.

They circulate by binding to plasma proteins and can potentially interact with other drugs, such as salicylates and sulphonamides that bind to plasma albumin. As elimination is mostly through the kidneys, the half-life can be significantly prolonged in the elderly and those with renal disease. Sulphonylureas cross the placenta and can stimulate foetal ß-cells to secrete insulin.

- Clinical use

Sulphonylureas are indicated for type 2 diabetes where diet alone is insufficient to achieve glycaemic control. Treatment should be commenced at low doses and titrated every 4-7days as needed. They can be used alone or in combination with other oral anti-diabetic agents or with insulin. To preserve ß-cell function it is recommended drugs from other classes of oral anti-diabetic agents be added before a maximum daily dose is reached. Lower-starting and maximum doses should be used in the elderly and those with impaired renal function to minimise the risk of hypoglycaemia.

- Side-effects of sulphonylureas

    1. Hypoglycaemia is the most serious complication and often results from inadequate caloric intake. The risk of hypoglycaemia is increased in the elderly and patients with impaired hepatic or renal function. Long-acting sulphonylureas should be avoided in these groups of patients. The incidence of hypoglycaemia is related to the potency and duration of action of the sulphonylureas. The highest incidence occurs with chlorpropamide and glibenclamide.

    2. Sulphonylurea drugs stimulate appetite and weight gain.

    3. Rare side-effects include gastrointestinal upsets, allergic skin rashes and very rarely, bone marrow damage.

- Contra-indications

    - Type 1 diabetes
    - Pregnancy
    - Hepatic or renal insufficiency
    - Major surgery
    - Severe infections
    - Sensitivity to sulphas.

- Drug interactions with sulphonylureas

The following drugs increase plasma levels of sulphonylureas and increase the risk of hypoglycaemia:

    - Aspirin, fibrates, trimethoprim displace sulphonamides from albumin.

- Alcohol, H2 receptor blockers and anticoagulants reduce metabolism of sulphonylurea.
- Concomitant use of potential hypoglycaemic agents such as alcohol and aspirin.
- Antagonism of counter regulatory hormones, e.g. ß-blockers, and sympatholytic drugs.

The following drugs reduce the anti-glycaemic effects of sulphonylureas:

- Drugs such as barbiturates and rifampicin increase the metabolism of sulphonylureas.
- Diuretics, e.g. thiazide and loop diuretics reduce insulin secretion and or its action.

2. Meglitinides

Repaglinide is a benzoic acid derivative and nateglinide an amino acid derivative which are both insulin secretagogues.

- Pharmacokinetics

These drugs are only taken should the person eat a meal; if a meal should be skipped, the tablet is not taken. It is given directly before meals and is useful for controlling postprandial hyperglycaemia, thus mimicking physiological insulin secretion. Repaglinide is primarily metabolised into inactive metabolites that are secreted through bile. It is the only oral hypoglycaemic agent registered in Europe and America for use in renal insufficiency, and renal failure, to the point of dialysis – only 8% of the drug is excreted via the urine.

The starting dose is 0.5 mg per meal and can be titrated on a weekly interval to a maximum dose of 4 mg per meal or 16 mg per day.

- Side-effects

Repaglinide may cause hypoglycaemia.

- Interactions

The metabolism of repaglinide is increased by drugs that induce hepatic enzymes, e.g. barbiturates, and thiolidizinediones. Drugs, such as ketoconazole, miconazole, and erythromycin inhibit repaglinide metabolism.

Repaglinide has no significant interactions with commonly used drugs such as digoxin, warfarin, cimetidine or theophyllin.

Nateglinide is taken with meals at a dose of 120 mg per meal. The use of nateglinide as monotherapy is not recommended, as the efficacy for lowering blood glucose is less efficient. Nateglinides are only used early on in type 2 diabetes.

Drugs that increase insulin sensitivity

1. Biguanides

Metformin

Metformin is a biguanide that is used as adjunctive therapy in type 2 diabetes where diet and exercise alone have failed to achieve the desired glycaemic control. Metformin is particularly useful in the obese person with type 2 diabetes.

- Mechanism of action

  Metformin does not stimulate insulin release. It is not a hypoglycaemic agent but an antihyperglycaemic drug. Metformin acts by:

  - Reducing hepatic production of glucose (gluconeogenesis).
  - Increasing insulin-induced glucose uptake in muscle, i.e. increased muscle sensitivity to insulin.
  - Reduction in intestinal glucose absorption.
  - Reducing lipolysis.

  Other beneficial effects of metformin include:

  - Weight reduction by suppressing appetite.
  - Improved lipid profile, i.e. increased HDL cholesterol and decreased triglycerides and LDL cholesterol.

- Uses of metformin

Metformin is useful in obese persons with type 2 diabetes where lifestyle changes alone are inadequate for control. It is often used alone or in combination with a sulphonylurea. Use of metformin has been shown to delay the progression to type 2 diabetes in persons with impaired fasting glucose and in those with impaired glucose tolerance.

- Pharmacokinetics

Metformin has a half-life of 3 hours and is entirely excreted through the kidneys. It is given in 2-3 doses per day. The usual dose is 500 mg every 8 hours up to a maximum of 3 gm per day.

- Side-effects
  - Gastrointestinal: diarrhoea, abdominal discomfort, nausea, anorexia, metallic taste.
  - Lactic acidosis is rare (0.1 per 1000 patient years) but potentially fatal. The risk is increased in the elderly and in conditions that lead to increased lactate production such as chronic hypoxic lung disease, congestive cardiac failure, renal insufficiency, hepatic dysfunction.
  - Impaired absorption of vitamin B12 with long-term use.

- Renal function should be monitored in patients on metformin therapy.

- Contra-indications
  - Kidney impairment and kidney failure
  - Conditions that could lead to lactic acidosis
  - Tissue hypoxia
  - Past history of lactic acidosis
  - Major surgery
  - Type 1 diabetes
  - Septicaemia
  - Myocardial infarction.
  - Elderly
  - Pregnancy.

2. Thiazolidinediones: pioglitazone, rosiglitazone

The TZDs are a relatively new class of drugs used to treat type 2 diabetes.

- Mechanism of action
  - Decrease insulin resistance and increase insulin action on glucose and lipid metabolism.
  - Decrease hepatic gluconeogenesis.
  - Increase glycogen synthesis in muscle.
  - Increase lipogenesis.
- Side-effects
  - Weight gain because of an insulin-like effect.
  - Fluid retention.
  - Stimulates ovulation in peri menopausal persons with diabetes.
  - Hepatotoxicity can be fatal.
  - The first TZD, troglitazone was withdrawn from the market because of hepatic toxicity.
- Contra-indications

- Cardiac failure
- Impaired hepatic function
- Ketoacidosis
- Pregnancy/lactation.

- Drug interaction
  - Not recommended to be used in combination with oral contraceptives.

Drugs that delay glucose absorption

1. Alpha-glucosidase inhibitors: Acarbose, miglitol, voglibose

Acarbose and related drugs inhibit the enzyme alpha-glucosidase which is responsible for the breakdown of carbohydrates into monosacharides in the intestinal brush border. It delays absorption of carbohydrates and limits postprandial hyperglycaemia. Acarbose is used in type

2 diabetes where diet with or without other antidiabetic drugs have failed to adequately control blood sugar. It is given at meal times in doses of 50-100 mg per meal.

- Side-effects
  - Gastrointestinal upsets; flatulence, loose stools or diarrhoea, abdominal pain, bloating.
  - Tolerability can be improved by slowly titrating the dose over several days.

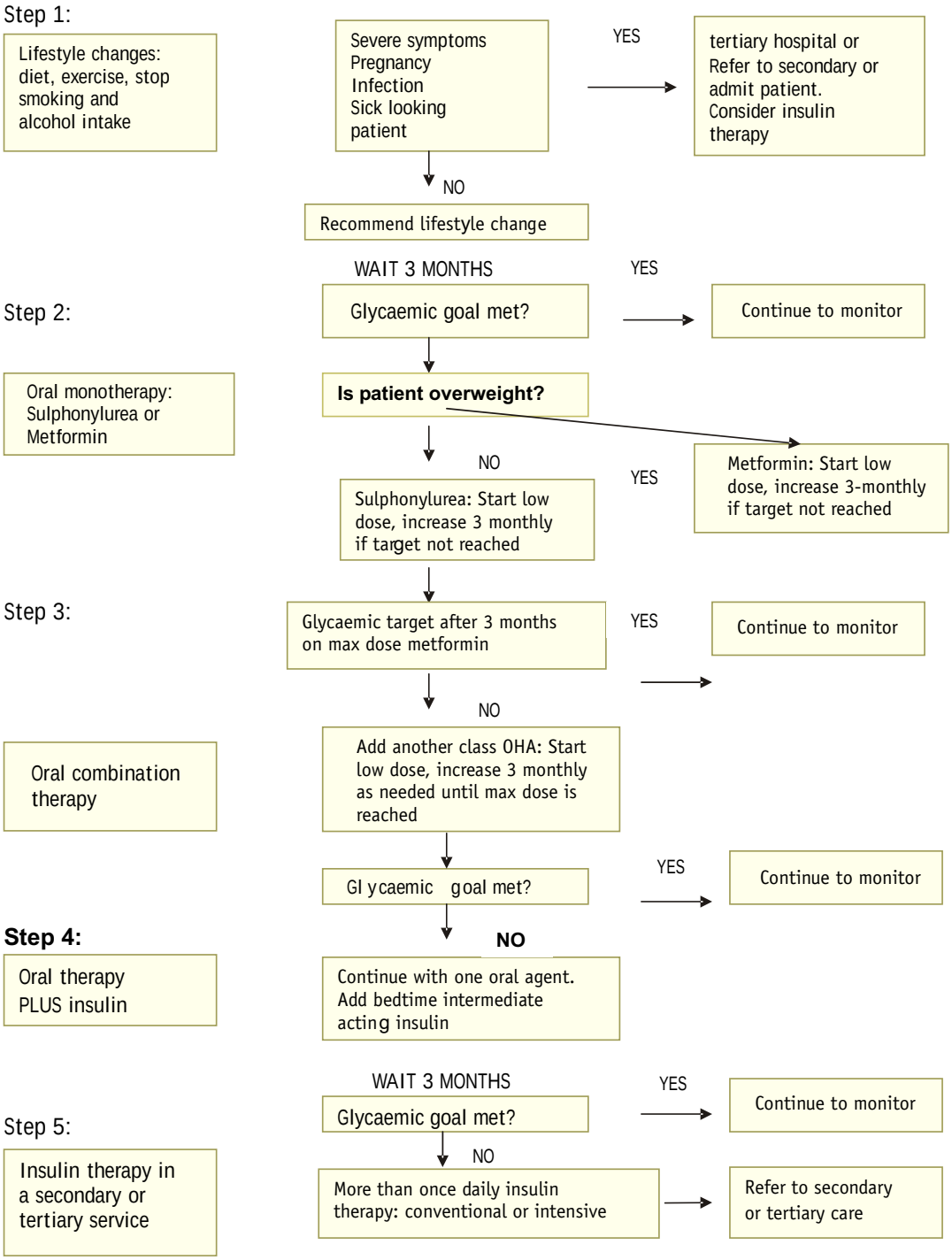

Figure 1. Algorithm on the management of type 2 diabetes

Summary Table of glucose-lowering agents

NAME OF DRUG	Starting dose	Maximum dose	MAJOR SIDE-EFFECTS	CONTRAINDICATIONS
SULPHONYLUREAS				
Glibenclamide	2.5 mg	20 mg	Hypoglycaemia, weight gain, skin rashes	Pregnancy, use with caution in liver and renal disease
Gliclazide	40 mg	320 mg	,,	,,
Glimepiride	1 mg	8 mg	,,	,,
Glipizide	5 mg	40 mg	,,	,,
Chlorpropamide	100 mg	500 mg	,,	,,
Tolbutamide	500 mg	2500 mg	,,	,,
Tolazomide	100 mg	1000 mg	,,	,,
Acetohexamide	250 mg	1500 mg	,,	,,
BIGUANIDES				
Metformin	500 mg	2550 mg	Abdominal pain, nausea, loose bowel motions, lactic acidosis	Renal, heart and liver failure; pregnancy
THIAZOLIDINE DIONES				
Rosiglitazone	4 mg	8 mg	Liver impairment, fluid retention, weight gain, dilutional anaemia	Renal, heart and liver failure; pregnancy
Pioglitazone	15 mg	45 mg	,,	,,
MEGLITINIDES				
Nateglinide	180 mg	360 mg	Hypoglycaemia, weight gain, dyspepsia	Heart and liver failure, pregnancy
Repaglinide	1.5 mg	16 mg	,,	
ALPHA-GLUCOSIDASE INHIBITORS				
Acarbose	25 mg	300 mg	Dyspepsia, loose bowel motions	None
Meglitol	25 mg	300 mg	,,	,,

Tools

Posters, case studies, videos, or CDs explaining mode of action of drugs.

Evaluation

Questionnaires, evaluation of case studies.

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MODULE 3-3: INSULIN THERAPY

Insulin is the core treatment for people with type 1 diabetes and many persons with type 2 diabetes mellitus. Persons with type 1 diabetes lack functional ß-cells and require insulin for survival. Insulin secretion:

A healthy thin person without diabetes produces from 18-40 units of insulin per day or 0.2-0.5 units/kg body weight/hour. About half of this is produced as basal insulin secretion (between meals and during the night) and another half in response to meals, known as prandial or bolus insulin secretion. This occurs in two phases:

a. The 1st-phase insulin secretion is a rapid phase lasting 5-10 minutes; this phase is often absent or deficient in persons with type 2 diabetes.

b. The 2nd-phase insulin secretion is a longer phase where insulin secretion continues as long as glucose is released into the bloodstream, e.g. during a meal. In persons with type 2 diabetes, this phase is delayed and insufficient.

GENERAL INFORMATION ON INSULIN:

Insulin is currently only available as an injection:

Since insulin is a protein, it cannot be taken orally as it will be digested by enzymes in the gastro intestinal tract (GIT).

The insulin available on the market can be classified as either insulin from animal origin or biosynthetic human genetically engineered insulin (HM). The most recent insulin molecules on the market are known as analogues, which are classified as synthetic insulin.

The insulin strengths available on the market are 40 IU/ml, 80 IU/ml, and 100 IU/ml.

Persons with diabetes can be changed from 40 IU/ml to 100 IU/ml without any problem, provided they are supplied with the correct syringes. No dosage adjustment is necessary. However, an explanation should reassure the person with diabetes that although the volume of insulin being injected is different, the number of units is the same. Insulin that is supplied as a sterile preparation contains a preservative. Multi-dose vials will remain sterile throughout their use because of the action of the preservative. Different preservatives are used in the different types of insulin and this has to do with the stability of the product.

Insulin preparations can be classified according to duration of action or according to source of origin.

There are three different types of human insulin:

- Soluble human insulin
    - ACTRAPID – NOVO NORDISK

- HUMULIN R – LILY
- Isophane insulin
  - PROTOPHANE/INSULATARD HM – NOVO NORDISK
  - HUMULIN N – LILY
- Premixed insulin
  - ACTRAPHANE (30/70) or MIXTARD 30 – NOVO NORDISK
  - HUMULIN 30/70 – LILY

ANALOGUES:

- Regular insulin molecules are attracted to each other, and exist as dimers and hexamers in solution.
- For the insulin to be absorbed from the injection site, it has to be broken down from a hexamer into six monomers.
- This process can take for as long as 30 minutes.
- An insulin analogue is created by making a small change in the structure of regular human insulin, i.e. changing the amino acid positions.
- Because of this amino acid sequence change, the ONSET OF ACTION and DURATION OF ACTION can be altered.
- Insulin analogue is a synthetic form of insulin, as there is not a natural example of such a molecule in the body.

WHY select ANALOGUES?

The limitations of soluble human insulin:

- Hexamer formation and slow dissociation into dimers and monomers extend the onset of action in subcutaneous- administered soluble human insulin.
- This means that soluble human insulin is recommended to be injected approx. 30 minutes before a meal, allowing insulin monomers to reach the circulation before glucose levels rise.
- This restriction is inconvenient for people with diabetes, and actually, many people with diabetes do not comply with the recommended 30-minute interval for insulin injection before meals, but often administer their insulin shortly before mealtimes.

As a result, this:

- exposes individuals to excessive postprandial glucose peaks, as insulin concentrations rise

slowly after subcutaneous injection;

- may also increase the risk of hypoglycaemia, as insulin levels may increase after injection before glucose levels rise, or remain high after postprandial hyperglycaemia has passed;
- does not mimic endogenous insulin profiles; diurnal (daytime) plasma insulin profiles are therefore frequently inappropriate, with a resulting failure to normalise glycaemic control.

Hence, there is a need for new advances in therapeutics and understanding of diabetes to facilitate achievement of good control in people with diabetes.

ADVANTAGES OF ANALOGUES?

a. Improved compliance – inject and eat, since no 30-minute interval is required (rapid acting).

b. Can be injected 15 minutes from starting a meal – convenient for children (rapid acting).

c. Mimics the physiological insulin profile more closely, allowing:
    - improved postprandial and 24-hour blood glucose control;
    - improved HbA1C;
    - lower risk for hypoglycaemia – major and nocturnal;
    - allows person more flexibility of lifestyle.

Which analogues are currently available on the market?

A. Short-acting analogues or bolus analogues:
    1. NovoRapid – Novo Nordisk
    2. Humalog – Lily

B. Long-acting or basal analogues:

    Lantus – Aventis

C. Premixed analogues:
    1. NovoMix 30 – Novo Nordisk
    2. Humalog Mix 25 – Lily

CHOOSING AN INSULIN REGIMEN

A regimen is chosen according to the person's lifestyle:

- If the person requires extreme flexibility in their normal day-to-day activities, the regimen of choice is basal bolus (4 injections daily). This allows the person to adapt the insulin injection

to suit their lifestyle.

- If the person leads a well-organised unvaried lifestyle, a twice-a-day injection of premixed insulin is an excellent regimen. A person on this regimen will find that when the morning injection has been given, the insulin release is dictated for the day ahead. This dose will therefore determine the size and time of breakfast, the size of the morning snack, size and time of lunch, and the size of the afternoon snack.
- A person SHOULD NEVER be given insulin to mix if they have a physical incapability or if their eyesight is poor.
- A person's need for tight control must be assessed before a regimen is chosen:
    - If the person is elderly, the need for excellent blood glucose control is absent, and therefore, a twice-a-day injection of intermediate-acting insulin may suffice.
    - If the person is not aware of hypoglycaemic symptoms, the regimen chosen should account for this (i.e. control must be relaxed).

Summary of available insulin profiles

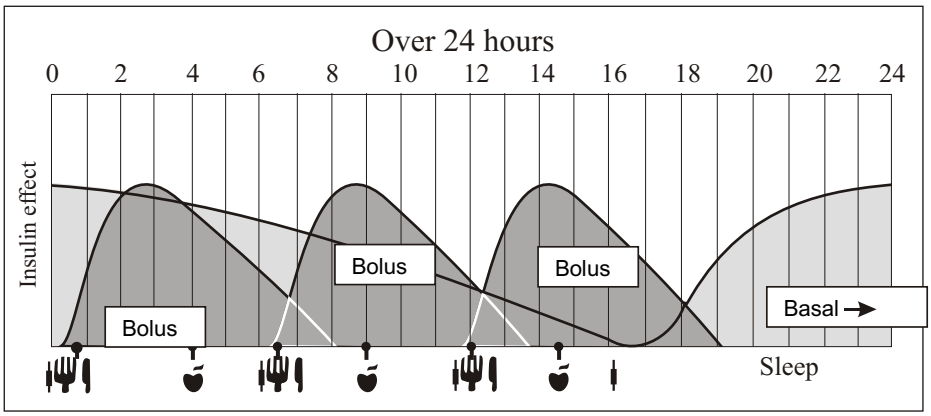
Trade name	Composition	Type of insulin	Onset of action: time after injection	Peaking action: hours after injection	End of action: hours after injection	Use in practice	When to inject
Actrapid	Soluble insulin	Short-acting	30 min	1-3	8	IV, sliding scale in DKA, as bolus component in multiple injection regimen	½ hr before meals
Humulin R	Soluble insulin	Short-acting	30 min	1-3	5-7	IV, sliding scale in DKA, as bolus component in multiple injection regimen	½ hr before meals
Protophane/ Insulatard	Isophane	Intermediate-acting	1.5 hrs	4-12	24	Basal insulin In combination with bolus insulin in multiple injection regimen Not for IV use	Once a day , e.g. 22:00
Humulin N	Isophane	Intermediate-acting	1 hr	2-8	18-20	Basal insulin In combination with bolus insulin in multiple injection regimen Not for IV use	Once a day , e.g. 22:00
Actraphane/ Mixtard 30	30% soluble insulin 70% isophane	Premixed	30 min	2-8	24	Monotherapy in twice a day regimen. Not for IV use	½ hr before breakfast ½ hr before supper
Humulin 30/70	30% soluble insulin 70% isophane	Premixed	30 min	1-8	14-16	Monotherapy in twice a day regimen. Not for IV use	½ hr before breakfast ½ hr before supper
NovoRapid	Insulin aspart	Short-acting analogue	10-20 min	1-3	3-5	Bolus insulin in combination with basal in multiple injection regimen	Directly before/after each meal
Humalog	Insulin lispro	Short-acting analogue	5-15 min	1	1-3	Bolus insulin in combination with basal in multiple injection regimen	Directly before/after each meal
NovoMix 30	30% insulin aspart 70% protamined insulin aspart	Premixed analogue	10-20 min	1-4	24	Monotherapy in twice a day regimen Not for IV use	Directly before/after breakfast and supper
Humalog Mix 25	25% insulin lispro 75% protamined insulin lispro.	Premixed analogue	5-15 min	1-8	14-16	Monotherapy in twice a day regimen Not for IV use	Directly before/after breakfast and supper
Lantus	Insulin glargine	Basal analogue	variable	4-24	≥ 24	Basal insulin	Once a day , e.g. 22:00

Some variations and problems that may influence the choice of insulin regimen in persons with diabetes	
Employment	• Shift-workers • Long working day (early breakfast, late evening meal) • Missed midday meal or frequent business lunches • International travel
Eating	• National variations (e.g. traditiona l large breakfast in UK, main meal at midday in some countries, dietary composition country to country, etc.) • Individual variations (fads, availability, affordability, preferences, eating out at restaurants).
Travel	• Long-haul air travel • Travelling to work, e.g. long walking distance
Exercise	• Sportsmen and women • Sedentary office workers • Labourers
Leisure	• Strenuous hobbies, e.g. gardening, sports, etc.
Age and disability	• Elderly • Children • Handicapped person (visual impairment, arthritis, etc.)
Diabetic complications	• Nephropathy (hypoglycaemia prone) • Retinopathy (inability to perform BGSM) • Autonomic neuropathy (hypoglycaemia prone)
Intercurrent illness and events	• Other chronic illnesses • Pregnancy
Injection preferences	• Dislike of multiple injections
Insulin absorption	• Individual variations in absorption and its predictability • "Brittle diabetes" and 'subcutaneous insulin resistance syndrome'
Stability of diabetes	• Long duration of diabetes (no endogenous insulin) • Multiple hospital admissions for ketoacidosis and/or hypoglycaemia
Psychological state of person with diabetes	• Poor compliance
Intelligence and education	• Poor education about diabetes • Reduced ability to adjust insulin dosages
Medical facilities	• Poorly trained staff • Lack of diabetes education facilities

Initiating insulin therapy

Ideally, the insulin regimen should be individualised, based on the lifestyle of each person. Insulin replacement should mimic physiological insulin secretion characterised by a slow basal secretion that suppresses hepatic glucose output, and an increased secretion in response to meals. The quicker absorbed rapid-acting insulin analogues given before meals take care of mealtime glucose excursions and prevent postprandial hyperglycaemia. Basal insulin levels can be maintained by injections of intermediate-acting insulin at bedtime with or without a smaller morning dose. Long-acting insulin given once a day can achieve the same effect. A number of regimens can be adapted to suit an individual person.

INSULIN REGIMENS:



A. Basal bolus regimen: to achieve flexibility and tight control

A. Basal bolus regimen: to achieve flexibility and tight control

Starting dose:

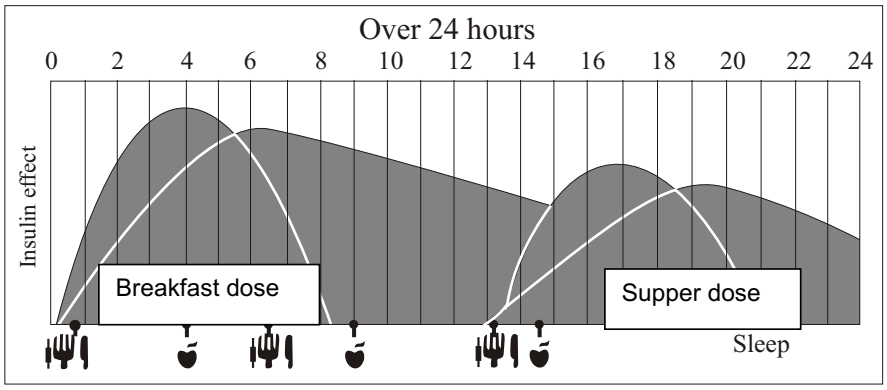
Type 1 diabetes: 0.6 IU/kg x body weight = total daily dose (TDD)

Type 2 diabetes: 0.2 IU/kg x body weight = TDD

Sixty percent of the TDD should be injected as short-acting (bolus) insulin before meals, e.g. if person has three equally sized meals per day:

Before breakfast 20%, before lunch 20%, and 20% before supper.

The remaining 40% of the TDD should be injected as basal insulin, e.g. before bedtime (22:00).



B. Twice-a-day regimen: simple regimen to suit a more well-organised lifestyle: premixed insulin.

Starting dose: Type 1 diabetes: 0.6 IU/kg x body weight = TDD
Type 2 diabetes: 0.2 IU/kg x body weight = TDD
2/3of TDD to be administered before breakfast.1/3of TDD to be administered before supper.

C. Initiating insulin in the person with type 2 diabetes:

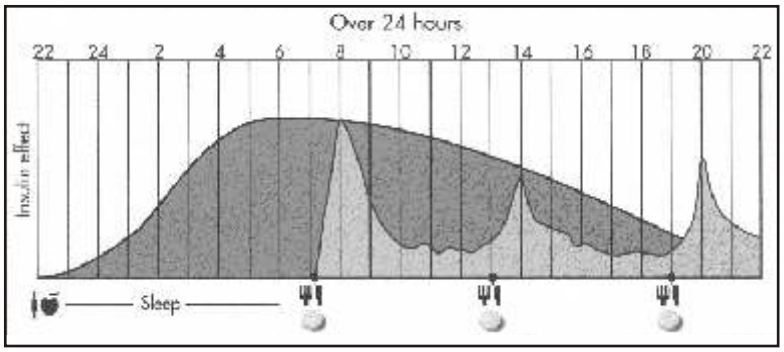
The following two regimens are suitable for the person with type 2 diabetes:

1. Supplement therapy

   Basal insulin and oral antidiabetic agent (OAA) combination:

   Continue tower dose of oral agent and start once daily insulin regimen

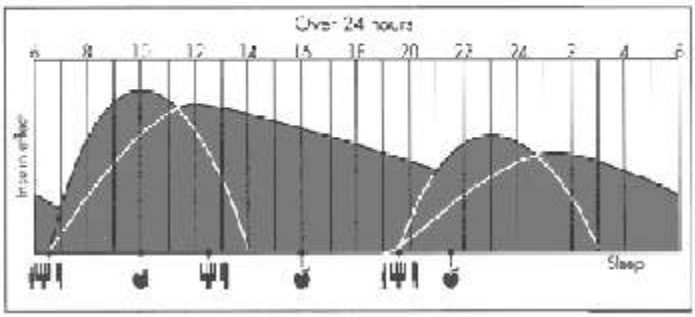
   Starting dose (Type 2): 0.2 iu / Kg / day
   To be administered at 10pm



2. Substitution therapy

Stop oral agent and start twice daily insulin regimen

Starting dose [Type 2]: 0.2 iu / kg / day
2/3 of dosage to be administered before breakfast and the balance (1/3) before supper



3. Analogues and oral combination in type 2 diabetes:

Persons with type 2 diabetes can be initiated on a premixed analogue (0.2 IU/kg/day) introduced before supper, and metformin given at breakfast and lunch. When the TDD exceeds 30 IU, the person can be initiated on NovoRapid twice a day, (? of TDD before breakfast, ? of TDD before supper) and metformin is omitted. This regimen provides the person with type 2 diabetes with much needed postprandial control, as well as basal insulin for 24 hours.

4. Adjusting insulin doses:

GREAT CAUTION SHOULD BE EXERCISED WHEN INCREASING OR DECREASING INSULIN DOSAGES:

- Obtain a pattern of pre-prandial blood glucose levels over a period of at least 3-4 days of 4 times daily profiles.
- Increase/decrease one insulin dose only at a time, not more than twice a week.
- Do not adjust insulin doses by more than 2-4 units (adults) at a time.
- In the presence of ketones adjustment can be more rapidly.

5. Other options:

Continuous subcutaneous infusion pumps

- Most pumps provide a basal infusion of insulin with an option to adjust the release rate during the day and at night. Pump therapy should be prescribed and implemented by a skilled

professional team. The person with diabetes should demonstrate a high level of understanding for using the pump, and should be highly motivated to control their blood glucose. Rapid-acting insulin analogues are recommended for use in insulin pumps.

IMPORTANT PRACTICALITIES ON INSULIN THERAPY

1. Rebound hyperglycaemia

   - A hypoglycaemic episode, whether it causes symptoms or not, stimulates secretion of insulin antagonistic hormones.
   - In a person without diabetes, increased pancreatic insulin secretion will neutralise the hyperglycaemic effect of these hormones.
   - In the insulin-deficient person with diabetes, these hormones act unopposed to cause hyperglycaemia. This is known as the Somogyi effect.
   - As a result, the person with diabetes may wake up with an early morning elevated blood glucose level.

2. Dawn phenomenon

   - In a person without diabetes, the early morning levels of insulin at about 03:00 are very low.
   - These levels gradually increase until 09:00 – this increase is essential to cope with the increase in the blood glucose that is seen in response to the increased GH and cortisol levels (overnight).
   - In the person with insulin dependent diabetes, we would like the levels of insulin to follow the same pattern – low in the early evening and peaking at about 06:00.
   - This increase in insulin requirement in the morning is called the Dawn phenomenon (note this is not the same as the Somogyi effect). For this reason, we are keen on a person with diabetes who is taking basal insulin to do this as late as possible in the evening, i.e. 22:00 instead of 06:00. The later the injection is given, the later the peak action of insulin occurs.

HOW WOULD YOU DETERMINE IF THE PATIENT IS SUFFERING FROM REBOUND HYPERGLYCAEMIA OR DAWN PHENOMENOM, AS IN BOTH CASES THE PATIENT MIGHT WAKE UP WITH EARLY MORNING HYPERGLYCAEMIA?

- ASK THE PERSON WITH DIABETES TO SET AN ALARM CLOCK FOR ABOUT 02:00-03:00 IN THE MORNING.
- MONITOR AND RECORD THE BLOOD GLUCOSE.
- REPEAT THIS ACTION FOR A COUPLE OF MORNINGS.

IF THE BLOOD GLUCOSE IS TOO LOW:
PERSON EXPERIENCES EARLY MORNING HYPO, FOLLOWED BY A REBOUND HYPERGLYCAEMIA RESPONSE

CORRECTION:
- Lower insulin dose at night time
- Add a snack at 22:00

IF THE BLOOD GLUCOSE IS NORMAL TO HIGH: PERSON MAY BE EXPERIENCING THE DAWN PHENOMENOM

CORRECTION:
- Inject basal insulin at 22:00
  OR
- Choose a basal insulin with a longer peaking action

3. Lipohypertrophy

- The repeated and prolonged injection of insulin into one particular site can cause hypertrophy of the fatty tissue.
- This reaction is characterised by the appearance of large, elevated, spongy masses of fatty fibrous tissue (lumps) at the injection site.
- Easily accessible sites, such as the thighs, are most commonly affected.
- Injections into the fatty masses are relatively painless, which may lead to multiple injections on one affected site. This gives the lesion the appearance of a pincushion.
- Of importance is that the absorption from these areas is poor.
- Simply changing to a different injection site prevents lipohypertrophy, so the effects of insulin are unpredictable.
- Skin necrosis can occur when insulin is injected into the skin intradermally, rather than subcutaneously.

4. Storing insulin

Insulin not in use:

- Keep insulin in the fridge at 4-8 °C. Human insulin is stable for 30 months from the

manufacturing date at these temperatures, compared to 24 months for analogues.

- Store the insulin in a separate container, at the bottom of the fridge and away from the freezer compartment.

- Do not store insulin in the fridge door, as this will cause exposure to fluctuating temperatures.
- Insulin must not be frozen. This may appear to be perfectly acceptable once it has defrosted, but changes in the crystalline structure cause the action profile of the insulin to be unpredictable.
- The expiry date is printed on each insulin vial, penfill or penset.

Insulin in use:

- Insulin currently in use by the person with diabetes does not need to be stored in the fridge. An injection of cold insulin will hurt.
- Human insulin is stable at 25 °C for 6 weeks and at 37 °C for 4 weeks.
- The insulin, however, must be kept out of the sun.
- Analogues will maintain stability for 4 weeks at temperatures of 30 °C and lower.
- Re-suspend insulin by rolling the vial gently between the two hands; avoid vigorous shaking, as this will destroy the insulin molecules.

5. Transporting insulin

- Persons with diabetes travelling abroad should be advised to check on the availability of the insulin at their port of arrival.
- If the insulin is not available, they should take adequate supplies of insulin with them.
- Please advise persons with diabetes to carry their insulin in their hand luggage as cargo luggage is often sent to an incorrect destination, temperatures in the hold are not guaranteed, and freezing can occur.
- All persons with diabetes should carry a valid prescription for insulin with them.
- Insulin should not be kept cool in direct contact with ice packs, as this could cause the insulin to freeze.

6. Mixing insulin

When mixing soluble and intermediate-acting insulin together in one syringe it is important that a certain technique be followed:

WHY?

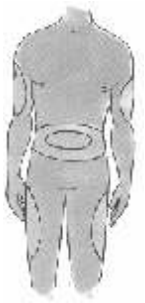
This is to ensure that no intermediate-acting insulin contaminates the soluble insulin.

HOW?

There is a need for air to be injected into the vial before withdrawing the insulin as the vial is a closed system and if this is not done, a vacuum is created.

- Air is first injected into the cloudy insulin.
- Air is then injected into the clear insulin and the insulin is drawn into the syringe.
- The needle is then re-inserted into the cloudy insulin and the cloudy insulin is then drawn up into the syringe.
- This mixed insulin must be injected within 5 minutes.
- If soluble insulin mixed with a Lente insulin is left for long periods, the following occurs: excess zinc ions combine with the soluble insulin and causes a blunting effect of the soluble insulin. This does not happen with isophane insulin but only with Lente insulin.
- When mixing short-acting analogues with basal insulin, this should be injected within 3 minutes of mixing.
- If one is not proficient with mixing, or finds it difficult to mix, it is safer to inject with two different syringes.

7. Injection sites for insulin administration

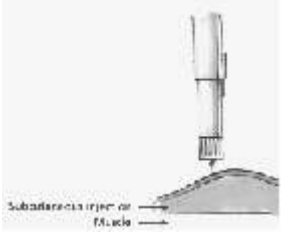


- The injection sites most commonly used are the abdomen, the thigh, and the buttock.
- The arm is an acceptable injection site, but is not popular because of difficulty to access.
- The rate of absorption is fastest on the abdomen and slowest on the unexercised thigh.
- The thigh should be avoided as an injection site when exercise is going to be done, as this will increase the rate of absorption of the insulin.
- One area should be used for an injection at a particular time of day, e.g. the abdomen is the site for the morning injection, and the thigh is the site for the evening injection.

- Within these areas, the injection site is to be rotated.
- We suggest the person uses the same area for the same time of day as absorption rates can differ and this can lead to changes in control.
- The rotation within an area is essential to avoid hypertrophy occurring to the subcutaneous fat.
- If there is hypertrophy to an area (seen as a lump), this area should be avoided for future injections, as the absorption rate from hypertrophied tissue is not predictable.
- Soluble insulin is best given into the abdomen and isophane is best given into the thigh. The reasons are that we want soluble insulin to be absorbed as quickly as possible and the isophane insulin to be absorbed more slowly.

8. Injection technique

- The skin should not be cleaned with spirits or alcohol as this hardens the skin.
- If the person feels more comfortable with cleaning the area prior to injection, then this can be done with water.
- A skin fold should be supported and the needle slid into the loose tissue.
- The injection should be done at a 90-degree angle with the skin if the needle is short, i.e. 12 mm or less.
- If the person is very thin or the needle is long, then a 45-degree angle for entry is suggested.
- The injection site may bleed slightly if there are many surface capillaries.
- Do not use any cloudy insulin intravenously.



9. Rate of absorption

Increasing the rate of absorption of an injection should be avoided, such as:

- Exercise.
- A hot bath or a sauna.

- Rubbing the area.
- Giving the injection intramuscularly instead of subcutaneously may be indicated in case of an emergency.

Decreasing the absorption rate should also be avoided, such as in the following cases:

- Inactivity,
- Extreme cold.
- Giving an injection into a hypertrophied area.

Checklist before changing insulin dosages:

- Correct storage of insulin – check compliance with storage temperature and storing conditions.
- Expiry date of insulin in use.
- Is the person injecting the required insulin as prescribed by the doctor, e.g. basal at 22:00 and bolus insulin before meals?
- Check injection timing – does this comply with the stipulated requirements, e.g. Actraphane/Actrapid ½ an hour before a meal, NovoRapid and NovoMix 30 immediately before a meal?
- Check injection techniques, e.g. proper re-suspension of a premix, priming the pen before injection, correct dosage drawn up and injected, correct mixing procedure followed.
- Check injection sites for lipodystrophy.
- Check compliance of the person with diabetes regarding eating plan, exercise, blood glucose monitoring, etc.
- Check what other conditions may be present to interfere with blood glucose control, e.g. stress, underlying infection, disease, intake of sugar-based cough mixtures, energizers, vitamin syrups, etc.

It is important to correct and or treat any compliance or other probable causes for poor control, before adjusting insulin dosages.

Should insulin dosages be adjusted, the person needs to monitor blood glucose control more frequently, until the desired effect is achieved.

How to adjust insulin dosages:

- Insulin dosages could be adjusted once a week, but not more than twice a week, as the body needs time to adjust to the change in dosage.
- Children: not more than a ½ unit per dosage adjusted.

- Adults: Human insulin adjustment should not be more than 2-4 IU according to the TDD, and analogues not more than 4-8 IU according to the TDD.
- When a single dose is adjusted, e.g. a specific dose during the day/night, titration should be done slowly to avoid hypoglycaemia – human insulin at 1-2 IU/dose, analogues at 2-4 IU/dose. This is followed by frequent blood glucose monitoring.
- Check whether food is available, and if not, be careful.

Tools

Posters on profiles of insulin action, and insulin regimens;

Examples of different types of insulin available on the market;

Examples of insulin syringes and different insulin devices;

Workshops to demonstrate correct injection techniques, injection sites, use of different devices;

Case studies.

Evaluation

Evaluation of practical demonstrations and case studies; and questionnaires.

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MODULE 3-4: DIABETES AND PHYSICAL ACTIVITIES

Introduction

IPhysical activity (exercise) is an important component of diabetes management with physiological and psychological benefits.

Regular physical activity is beneficial in the management of type 1 and 2 diabetes.

Objectives

After completing the module, the participant will be able to:

- Describe the benefits of exercising.
- Describe the different types of exercise.
- Identify the risks of exercise for people with diabetes.
- Give recommendations for exercising.
- Know how to assess the person with diabetes before the exercise session.
- Monitor the person with diabetes during the exercise session.
- Recognise that individuals have barriers to exercise.
- Give recommendations for particular cases.

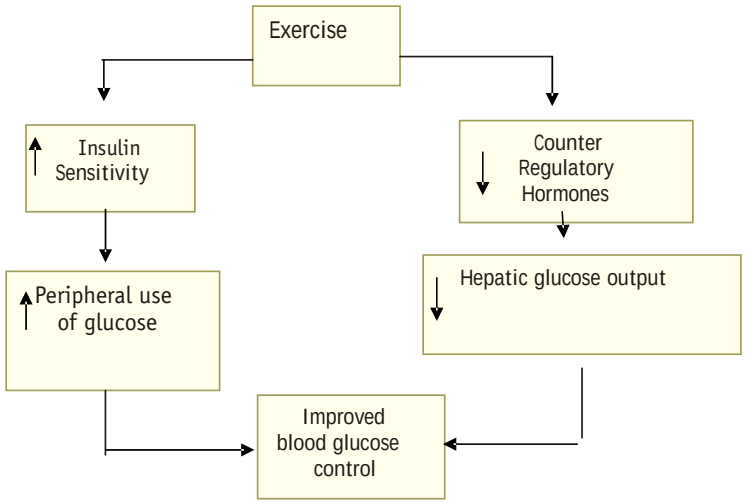

Figure 2. Metabolic effects of exercise in type 2 diabetes

The benefits of exercise

- Improves cardiovascular fitness in type 1 and 2 diabetes.
- Reduces cardiovascular risk factors, such as hypertension and hyperlipidaemia in type 1 and 2 diabetes.
- Contributes to the flexibility, endurance, and muscle strength.
- Improves glucose control in type 2 diabetes.
- Increases peripheral use of glucose.
- Decreases glucose hepatic output.
- Increases insulin sensitivity.
- Decreases counter regulatory hormones.
- Helps maintaining weight in addition to meal planning among people with type 2 diabetes whose weight is normal, and helps to reduce weight in obese people.
- Gives a sense of well being and a better quality of life in people with types 1 and 2 diabetes.

The different types of exercise:

Aerobic

Examples of aerobic exercises are walking and running. These exercises are more effective in managing weight.

Aerobic exercises are rhythmical, can be sustained over a prolonged period, and are recommended in most cases, e.g. swimming, cycling. These exercises usually engage large muscle groups, and increase the body's demand for oxygen.

Resistance training (strength or weight training) is also utilised, such as lifting of weight or resistance machines.

Anaerobic

Exercise without using oxygen, with the principal fuel as glucose (usually short bursts of energy as in the 100-m dash, shot put, or javelin).

These are less adapted to the needs of most people with diabetes.

What are the risks of exercise for people with diabetes?

- Developing hypoglycaemia during or after exercise, especially in a person on insulin.
- Increased hyperglycaemia in poorly controlled persons and under-insulinised persons with pre-exercise blood glucose levels of 250-300 mg/dl (14-17 mmol/l).

- Myocardial infarction or arrhythmia in persons with diabetes who also have atherosclerotic disease, if exercise is not properly paced.
- Possible worsening of microvascular diabetes complications especially retinopathy.
- Damage to soft tissue/joints in the presence of peripheral neuropathy.
- Damage to the feet, when not wearing the proper shoes.

Recommendations for exercising

- Adequate fluid intake during exercise.
- Use of proper footwear.
- Wearing an identification bracelet.
- Avoidance of exercise in extreme temperatures (heat or cold).
- Inspection of feet after exercise.
- If possible, exercise with a friend.

For type 1 diabetes no uniform recommendation can be made for hypoglycaemia prevention and improving metabolic control. However, self-monitoring of blood glucose needs to be integrated into the exercise programme and the information to be used to adjust the insulin dosage and food intake (see general guidelines below).

In type 2 diabetes, the following are general recommendations:

- Adapt the type of exercise to person's general physical condition, preferences, and lifestyle to enhance adherence, reduce risks.
- Frequency: at least 3 days per week.
- Duration: according to the individual.
- Intensity: 50-70% of person's maximal heat rate

  (maximum heart rate = 200-age)

People using hypoglycaemic agents or insulin should self-monitor their blood glucose to determine glycaemic response to exercise. They should adhere to the recommended different phases of exercise as follows:

Warm-up: 10 - 15 minutes

Actual exercise: 30 - 45 minutes

Cool down: 5 - 10 minutes.

Assessment of the person with diabetes before exercise

It is important that persons with diabetes be assessed to ascertain their fitness in readiness for exercise.

History and physical examination

They must detect diseases of the heart, blood vessels, eyes, kidneys, and nervous systems

Persons with diabetes especially at risk must have a more detailed medical examination. This includes people:

- aged > 35 years
- with type 2 diabetes for longer than 10 years
- with type 1 diabetes for longer than 5 years
- with any additional risk factors for coronary heart disease.
- with microvascular disease (proliferative retinopathy, nephropathy).
- with peripheral vascular disease, autonomic neuropathy.

Always examine feet and footwear.

Basic tests:

These can be done depending on the individual situation

- Cardiovascular system: ECG, exercise ECG.
- Peripheral arterial disease: toe pressure, ankle doppler
- Retina: retina screening (fundoscopy)
- Kidneys: urine microprotein
- Peripheral neuropathy: 10 g monofilament test.

MONITORING DURING EXERCISE

1. Metabolic control before physical activity
    - Avoid exercise if fasting level is > 250 mg/dl (14 mmol/l) and urine ketones present, or if > 16.6 mmol/l irrespective of whether ketosis is present.
    - Increase intake of carbohydrates if glucose levels are < 100 mg/dl (6 mmol/l).
2. Blood glucose monitoring before and after physical activity

- Identify when changes in insulin or food in take are necessary.
- Gain knowledge of the glycaemic response to different exercise/physical activity conditions.

3. Food intake

- Consume added carbohydrates as needed for avoiding hypoglycaemia.
- Carbohydrate-based food should be readily available during and after exercise, e.g. Fresh juice, commercially available high-energy drinks.

4. Insulin administration

- Avoid exercise during peak insulin action.
- Reduce insulin dose if exercise is anticipated.
- Administer insulin away from the working limbs.

It is notable that the effect of exercise especially in type 1 diabetes may last several hours later. The lag effect (as result of muscular uptake of glucose to restore glycogen) causes hypoglycaemia up to 24 hours following exercise, so it maybe advisable to eat a snack or carry a carbohydrate supply in case of hypoglycaemia.

TARGETS OF EXERCISE

Metabolic targets e.g.

- Glycosylated haemoglobin below 7% and glucose level in acceptable range adapted to the situation or
- Total cholesterol below 5 mmoll.

Cardiovascular fitness: the cardiovascular system's ability to take up, transfer and utilise oxygen for energy.

Achievement of ideal body weight.

BARRIERS TO EXERCISE

These are hindrances to exercise which need to be identified and addressed. They may even require psychological help.

Barriers may be real, e.g. lack of motivation, presence of debilitating illness, physical disability, e.g. polio, blindness, lack of available space, time, and security. Real barriers often relate to foot problems, neuropathy, or arthrosis.

There may also be perceived barriers, such as having to go to the gym, exercising being expensive and a waste of time, not liking it or being tired.

HOW TO HELP PEOPLE TO OVERCOME BARRIERS

An effective approach to barriers enhances the possibility of successful adherence to an exercise programme. Encourage group exercising.

Allow the person with diabetes to choose what he/she likes and can afford to do.

Discuss with the person and agree about a specific target, such as walking 30 minutes every day, and so on. Explain that simple, regular exercise is possible in most cases, such as walking, climbing stairs, going uphill, and even the usual daily chores that can be organised. Show a few exercises that the elderly people can perform regularly every day. In young people, playing football or basketball, doing gym in a group, or jogging are suitable suggestions.

RECOMMENDATIONS IN PARTICULAR CASES

Exercises for people with retinopathy

- Not recommended: excessive jogging, high-impact aerobics, weight lifting, and boxing.
- Recommended: mild exercises, such as walking, low-impact aerobics, and endurance exercising.

Exercises for people with nephropathy

- Moderate exercise is allowed (working at 65% of heart rate).
- In overt nephropathy: exercise is self-limiting.

Exercise for people with current or previous foot disease, Charcot's arthropathy:

- No weight-bearing exercises.
- Avoid repetitive exercises, e.g. prolonged walking, jogging, step exercises.
- Recommended: swimming, bicycling, rowing, chair exercises, and arm exercises.
- Amputees can do exercise in a wheel chair, with arms and body. They need strength in their arms to keep their balance when walking with crutches and prosthesis.
- In case of arthritis or arthrosis: mild exercising, e.g. walking, relaxed gym.

Exercise in children

- Encourage them to do regular physical activity, such as sport, outdoor play, football, gym.
- Pay attention to the need of balancing glycaemic control with normal playing.
- To achieve control, parents, teachers, and caregivers have to work together.
- Hormonal changes in adolescents may complicate control.

Exercise in the elderly

- Advancing age and obesity may hinder aerobic exercising.
- Encourage mild exercise, e.g. walking regularly.

CONCLUSIONS

The response to exercise is so variable and multi-factorial that adjustments in medication and food should be based on individual responses to exercise.

The use of blood glucose monitoring is important for understanding exercise response patterns.

Tools

Leaflets, posters and workshops.

Evaluation

Questionnaires and case studies.

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MODULE 3-5 (a): NUTRITION THERAPY

Introduction Medical nutritional therapy is an integral component of diabetes management and diabetes self-management. It has benefits for both short- and long-term diabetes outcomes. Nutritional therapy should however be individualised to accommodate preferences, age, needs, religion, culture, lifestyle and readiness to change. Current nutrition recommendations include:

Goals:

- To provide appropriate energy and nutrients for optimal growth, development and health.
- To maintain or achieve ideal body weight.
- To achieve and maintain optimal glycaemic control for the individual by balancing food intake with metabolic requirements, physical activity and medication.
- To assist in the prevention and treatment of acute and chronic complications of diabetes.
- To promote physical, social and psychological well being.
- To provide the diabetes educator with the necessary information in order to enable them to advise patients about optimal nutritional well being.

Nutrition guidelines for diabetes:

- A diabetic diet is not seen as a 'diet'. It is rather a healthy eating plan.
- The basic principles of a healthy eating plan are:
  - to balance energy intake to energy expenditure
  - to provide adequate quality and quantity of macro and micronutrients to meet nutritional recommendations
  - to provide a healthy meal plan in accordance with culture, beliefs, values and socio economic status.
- It is not necessary to include foods that are different from the rest of the family – a 'diabetic

diet' is a good way of improving the diets of the whole family.

- It is important to eat a variety of all foods.
- Make starchy foods the basis of all meals.
- Limit intake of fatty foods and simple sugars.
- Include 2 to 4 fresh fruit for the day. When drinking fruit juice, choose the juice that says 'no sugar added' but dilute the juice (half glass of water and half glass of juice) before drinking it.
- Artificial sweeteners containing cyclamate, aspartame, saccharine, are available as tablets, granules, powders and in liquid form. Some of them can be used in coffee, while some others can be used for cooking. All of them can be used freely in a reasonable amount. ? Natural sweeteners, such as sorbitol and fructose, contain calories and should be avoided.

ASSESSMENT OF THE NUTRITIONAL STATUS FOR A PERSON WITH DIABETES

Nutritional assessment is a pre-requisite for giving dietary advice, which enables the diabetes educator to provide optimal nutrition therapy that is individualised to the needs of each person with diabetes.

Nutritional information required:

- Overall meal pattern, including the number and timing of all meals and snacks.
- Food choices: the types of foods eaten as meals and snacks, including the amounts and frequencies consumed, foods that are liked or disliked, as well as food allergies.
- Overall dietary balance in terms of food groups and nutrients.
- Nutritional adequacy: the likelihood of a dietary surplus or deficiency.
- Alcohol consumption: typical intake, and are safe limits exceeded?
- Beliefs or misconceptions held about diet and diabetes, e.g. that certain foods are prohibited and specific foods are required.

Personal information required:

- Age, gender, socio-economic circumstances, ethnicity, occupation, literacy, and numeracy.
- Ability and willingness to change nutritional habits and practices.
- Emotional state, especially if newly diagnosed.

Clinical information required:

- Diabetes type.
- Treatment modality – insulin, oral hypoglycaemic drugs or diet alone.

- Current physical activity levels.
- Anthropometric measures: BMI, waist circumference.
- Blood pressure.
- Biochemical indices, e.g. glycaemic control, lipid profile, liver function tests, urea and electrolytes (renal function tests).
- Alcohol consumption, tobacco use.
- Other medical conditions, e.g. visual handicap, nephropathy, and coeliac disease.

Current reference values		
Body mass index (BMI)*	Underweight	<18.5
	Normal weight	18.5 - 24.9
	Overweight	25 - 29.9
	Obese	> 30
* weight (kg) / height $(m)^2$		

Once the nutritional assessment is complete, the diabetes educator can use this information to assess readiness to change in people with diabetes. Together they can suggest changes to the current food choices and meal patterns. Always try to involve the person who prepares the food.

NUTRITIONAL/DIETARY EDUCATION

This is an ongoing interactive process between person with diabetes and the professional, and not a standard package delivered in a single session.

However, because of the scarcity of dieticians, it may well be necessary to use a standard package with some adaptations, or nurses may be involved in this part of the teaching programme.

- Initially after diagnosis: patient retention is low; at assessment explain types of dietary changes needed and explore how these may be met. Written information highlighting key messages can be given to the person to refer to later on.
- If possible, regular follow-up sessions are advisable to evaluate the effectiveness of change, continue the learning process, and correct misunderstandings.
- Various educational strategies can be used, e.g. in-group or individual setting – through verbal, written, or audiovisual information media.
- Match the type and level of information to individual needs and abilities.
- Close liaison with other diabetes team members to ensure consistent dietary messages

(via training/updates in nutritional management).

Monitoring progress

- Follow-up frequency depends on the ability and confidence, type of treatment and diabetic control of persons with diabetes. ’
- A follow-up review is mandatory each time the control is not adequate and at least twice a

  Year
- Those with special problems, e.g. renal disease, pregnancy or preparation to pregnancy, perceived poor practice or knowledge should be seen more frequently.

Dietary review to consider

- Meal pattern, composition, balance, and food choices.
- Insulin administration has to be in accordance with the time of the meals, certainly when one is using regular insulin.
- The extent to which specific dietary targets have been achieved.
- Reasons why targets have not been met and how barriers to change may be overcome.
- Person’ s ability to interpret blood glucose measurements or the clinical signs of hypoglycaemia
- Acceptability of the dietary changes made and their impact on the person’s quality of life.

Components of a healthy diet

CARBOHYDRATES

- Are necessary for all persons with diabetes and should be included in a health diet.
- It is recommended that 60% of calories should come from carbohydrates. ? One carbohydrate serving = 15 g of carbohydrates.
- Carbohydrates are found in the following food groups - cereals, grains, dairy, fruit, and vegetables.
- Fresh fruit is preferred to fruit juice, since this adds fibre to the diet. If drinking fruit juice, (dilute half juice and half water).
- Regarding the glycaemic effect of carbohydrates, the total amount of carbohydrates in meals or snack is more important than the source or type.
- As saccharose (sucrose) does not increase glycaemia to a greater extent than the isocaloric amounts of starch, it can be substituted to other sources of carbohydrates if necessary,

However, this has a faster action on the glucose level and should be used with caution or when necessary, such as during exercise or when experiencing hypoglycaemia.

- Individuals receiving bolus insulin therapy should adjust their doses based on the carbohydrate content of meals.
- Individuals receiving fixed daily insulin doses should try to be consistent with their amount of day-to-day carbohydrate intake.
- Consumption of dietary fibre should be encouraged.

PROTEIN

- Proteins are mainly found in meat and meat substitutes.
- The effect protein has on blood glucose is dependent on insulin availability: ingested protein does not increase plasma glucose in well-controlled diabetes, but is a potent stimulant of insulin secretion (in type 2).
- Protein requires insulin for metabolism.
- It is recommended that 15% to 20% calories should come from protein (approximately 0.8 g protein /kg body weight).
- A diet high in protein and low in carbohydrates is not advised because it is generally high in saturated fats.

DIETARY FAT

- Mainly found in the fat and meat groups.
- It is recommended that fat intake should not exceed 30% of total calorie intake.
- Fats provide more energy per gram than other foods, usually 9 cal/g for all fats. The “good ones” and the “bad ones” have the same calorie contents. They only differ in their action on the cholesterol metabolism.
- Fat has low satiety ability.

Types of dietary fat

Saturated fats ”BAD FATS”

- They adversely affect serum cholesterol levels.
- They are mainly found in food of animal origin, however, coconut and palm oils belong to this category.
- They are solid at room temperature with the exception of coconut and palm oils.

- Sources: butter, cream, meat, bacon, sausage.

Unsaturated fats or "GOOD FATS"

These comprise both mono- and polyunsaturated fats.

- If substituted for saturated fats in the diet, they will help to lower cholesterol levels.
- They are liquid at room temperature.
- Sources of polyunsaturated fats: Sunflower oil and fish oils. Monounsaturated fats (MUFA)
- Diets rich in MUFA are associated with lower incidence of CVD.
- May help maintain HDL levels when diets contain < 30% total fat and MUFA
- The major fatty acid is Oleic acid
- Sources are: olives, olive oil, canola oil, nuts (peanuts/almonds) and avocado pear.

Polyunsaturated fats (PUFA)

- High intake (6-9 g) of omega-3 fats can reduce triglyceride levels.
- Found in fish oils (salmon, sardines), flaxseed oil, and soybean products.
- Omega-6 fatty acids.
- Found in vegetable oils – corn, sunflower or safflower oils.

Trans fatty acids

- Formed from hydrogenation of liquid oils to solid fats.
- They are solid at room temperature.
- They raise total and LDL cholesterol levels.
- They are used in the food industry to increase shelf life and flavour of snack foods, baked products, and French fries.
- People with diabetes should be instructed to look for "trans fat" on labels – teach about label-reading/awareness.

FATS (SUMMARY)

- A high intake of saturated fats increases cardiovascular risk.
- Recommendations should be based on lipid profile results.
- Fat should make up 20% to 30% of calories.

Guidelines to reduce fat in food

Skim milk: liquid skim milk may be used or powdered skim milk can be made up according to instructions on the packet.

Fat: prepare foods without fat. Trim all the visible fat from meat before cooking. Remove skin from chicken before cooking. Grilling, boiling, steaming, and baking are the best cooking methods. Use polyunsaturated and monounsaturated cooking oils only. Avoid deep fried foods.

Meat: buy lean cuts of meat. Avoid cuts of meat where fat cannot be distributed.

Fish: grill with lemon juice and a little margarine. Bake in a hot oven with skim milk, tomato and onion, or in foil with vegetables.

Vegetables: steamed or boiled, no butter, sugar sauce or fat should be added. Use onion, garlic and other spices. Chopped parsley or cinnamon added to carrots adds a different flavour. Potatoes baked in jackets, boiled or steamed. Mashed potatoes must be made with skim milk. Lemon juice or vinegar can be used as a dressing

Dessert: milk dessert and custard made with skim milk. Use fat free yoghurt as a topping instead of cream or ice cream. Fresh fruit salad with fat free yoghurt is also allowed. Avoid commercial baked products with pastry.

Diabetic foods

- There are many commercially prepared diabetic food substances on the market.
- These foods are expensive.
- They are high in trans fatty acids.
- They contain sugars other than glucose/sucrose.
- They are as high in energy as other regular products.
- Before using these foods, one must consult with a dietician.
- These foods do not have a role in a healthy eating plan.

EDUCATIONAL METHODS FOR TEACHING DIETARY (MEAL PLANNING) METHODS

The food pyramid

- This is a food guide that shows the kinds and amounts of food one's body needs to be healthy and feel good.
- The body needs more foods from the large section at the basis, showing bread, cereal, rice, pasta, and other carbohydrates.

- The body needs less from the small top section, showing fats, i.e. margarine, butter, oil, gravy, sweets, salad dressing: (Names of food with various regions)

Explain what a serving is

Omit the processed foods not usual in Africa and all the brand names Express all the measures in metric = ml, cm, gm, 100 ml …

Food pyramid: Food guide [2]

Food group	Number of servings	What is a serving?
Starches and breads	6-11	1 Slice bread
		½ cup cooked rice, cereal
		¼ cup dry cereal,
		½ cup pasta
		3 biscuits
		(eat whole-grain, fortified or enriched starches, bread, and cereals)
Vegetables	3-5	¼ cup vegetables cooked
		1 cup vegetables raw
Fruits	2-4	1 cup fruit
		½ cup fruit juice (fresh frozen or canned without sugar
		1 medium piece fresh fruit
Milk and milk products	2-3	1 cup skim / low fat milk /
		¾ cup plain or artificially sweetened yogurt.
Meat and meat substitutes	2-3	57-85 g cooked lean meat fish or poultry
		28.5 g meat is equivalent to: -
		1 egg
		28.5 g cheese
		¼ cup tuna, salmon or cottage cheese
		1 tablespoon peanut-butter
Fat	use sparingly	1 teaspoon margarine
		1 teaspoon salad dressing
		1 teaspoon oil or mayonnaise

[3] Adopted from: Food Guide Pyramid: A guide to dairy food choices. Bulletin 259, Washington DC: US government printing

FOOD ITEM	ALLOWED	AVOID
Milk and milk products	Real dairy skim milk powder, fresh fat free milk, long life fat free milk, fat free artificially sweetened yoghurts, fat free plain yoghurts	Full cream milk, 2% low fat milk, cream, condensed milk, coffee creamers, milk blends, Orley whip
Cheese	Low fat or fat free cottage cheese, low fat Melrose cheese (processed), low fat hard yellow cheese, low fat cheese spread, ricotta and feta cheese	Hard yellow cheese, (sweet milk, cheddar, cheese spreads, cheese wedges, cream cheese)
Meat, poultry and substitutes	Lean meat, lean mince meat, chicken without skin, soya and soya products, dried peas, beans and lentils, peanut butter	Any fatty meat, duck, bacon, salami, polony, tinned meat, spare ribs, biltong, liver, kidney, offal, brain tongue, hamburger patties, meat pies, sausage rolls, samoosas
Fish	Any white fish (snoek, hake, herring, kingklip, canned fish in water or brine, salmon, sardines, pilchards	Prawns, shrimps, fish roe, caviar, fried fish, fish canned in oil perlemoen, oysters, muscles, crayfish
Eggs	Not more than 2 to 3 a week. Only one a day (poached, boiled, scrambled) includes eggs used in cooking and baking	Fried eggs
Fats	Any tub of soft margarine (Flora, Canola, NuVo, or any medium or lite spread), avocado pear, sunflower, olive or canola oil, trim mayonnaise, or any reduced fat oil dressing	Pure butter, lard, holsum, creamy salad dressing, hard brick margarine, mayonnaise
Starches	Brown or whole wheat bread/rolls; high fibre cereals (jungle oats, high fibre bran, All bran flakes, Weetbix, Pronutro hi fibre, maltabella, maize meal); Provita, Rye Vita; whole wheat/white pasta; Brown, white or basmati rice	White bread; processed cereals (rice krispies, frosted flakes); butter biscuits, biscuits with fillings (lemon creams, choc crust, romany creams) Tuc, Zap, Ritz, Bacon snaps, cheese biscuits
Fruits	Any fruit in season	Coconut (often found in muesli)
Vegetables	Any fresh or frozen vegetables in season	Creamed, buttered or stir fried vegetables
Desserts and sweets	Artificial sweeteners, artificial sweetened low fat ice cream, artificially sweetened low fat jelly and sweets	Sugar, honey, syrup jam, glucose sweets, jelly, chocolates, toffee, cake, doughnuts, pastries, instant puddings, full cream or sorbet ice cream
Soups	Vegetable soups (include beans, lentils, peas, barley); milk soups made with skim milk	Preferably without meat or bones; packet soups, creamed soups made with full cream milk and hard cheese (cream of mushroom, cream of chicken, cream of tomato)
Beverages	Diet coke, diet Sprite, Schweppes lite, Tab, Lecol lite, Brookes low cal sugar free concentrates	Cold drinks with sugar, full cream milkshakes, milo, horlicks, chocolate drinks, (Nesquik. Cocoa, hot chocolate)
Other items	Marmite, Bovril, Oxo, Fray Bentos, Fish Paste, sugar free tomato sauce (All Gold lite), Worcester sauce, Soya sauce	Pizza, samoosas, crisps, fried chips, take-aways

Guide to calorie allocation (calories/kg body weight)*

BMI	Inactive	Moderately active	Very active
Overweight	20	20 - 25	30
Normal weight	20	25	35 - 40
Underweight		40 - 50	

* Adapted from Meal Planning: American Dietetic Association 1997

One serving contains:

Carbohydrates: 15 g Fruit: 15 g carbohydrate and 60 calories

Milk: 12 g carbohydrate, 0-8 g fat, and 90-150 calories Vegetables: 5 g carbohydrates, 25 calories

Meat: 7 g protein, 1-8 g fat, and 35-100 calories

Fats: 5 g fat, 45 calories Alcohol:120ml wine, 25ml spirits, or 340ml beer.

Guide to recommending a meal plan

Profile of person with diabetes	Number of servings from each food group
Recommend about **1200 – 1600** calories a day if the person is: • A small woman who exercises • A small or medium woman who wants to lose weight • A medium woman who does not exercise much	To provide **1200 – 1600** calories • 6 starches • 3 vegetables • 2 fruit • 2 milk and dairy • 2 meat or meat substitute • Up to 3 fats
Recommend about **1600 – 2000** calories a day if the person is: • A large woman who wants to lose weight • A small man at a healthy weight • A medium man who does not exercise much • A medium to large man who wants to lose weight	To provide **1600 – 2000** calories: • 8 starches • 4 vegetables • 3 fruit • 2 milk and dairy • 2 meat or meat substitute • Up to 4 fats
Recommend about **2000 – 2400** calories a day if the person is: • A medium to large man who does a lot of exercise or has a physically active job • A large man with a healthy weight • A large woman who does a lot of exercise or has a physically active job	To provide **2000 – 2400** calories • 11 starches • 4 vegetables • 3 fruit • 2 milk and dairy • 2 meat or meat substitute • Up to 5 fats

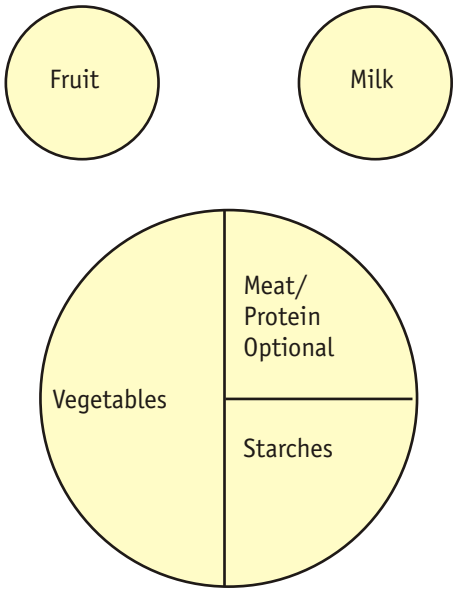
The plate method

- Is a way to plan meals without measuring (a qualitative diet approach).
- You fill your plate (20 cm diameter) to match the amount of vegetables, starches, and meat in the sample picture, and then add a piece of fruit and/or a glass of milk.
- Divide your plate in quarters.

At breakfast:

- ½ is for starches.
- ¼ is for meat.
- Amount of vegetables eaten, protein is optional.

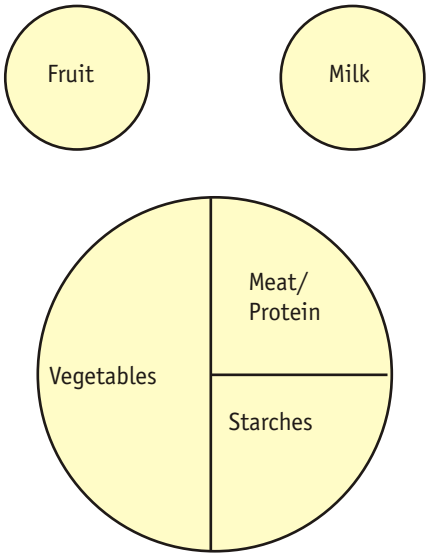
Plate method: Breakfast



The plate method

At lunch/dinner:

- ¼ for starches.
- ¼ for meat.
- ½ vegetable



- Filling a dinner plate (20 cm diameter) excluding snacks will provide 1200 – 1500 calories per day depending on serving size.
- The plate method is ideal for most non-insulin treated persons and some with type 2 diabetes on fixed insulin doses.
- Advantages: it is simple, adaptable, embodies principles of healthy eating, and promotes memory and understanding via visual messages. It can be easily implemented in residential/nursing homes.
- Disadvantages: not flexible, especially in insulin-treated persons with diabetes who need to vary carbohydrate intake/meals. This is also difficult when people cannot afford some of the items.

The glycaemic index (GI)

- The glycaemic index is a scale that ranks carbohydrate rich foods by how much they raise blood glucose levels compared to standard food.
- The standard food is glucose or white bread. Though attractive, theoretically and practically there

are many limitations:

- Different food processing methods or preparation can make large differences to the GI
- Ripeness of certain foods, e.g. bananas influences GI
- Different rice strains have different GI etc.
- GI of a specific food can be influenced by other foods in a mixed meal. However, diets based on low GI food show improved glycaemic control, and improvement in insulin resistance, lipid profiles and fibrinolysis.

- Thus, GI has a value as a broad guide to good carbohydrate food choices by stratifying foods into low, medium and high GI categories. Patients must be advised against over-reliance on GI in dietary books, as information may be misunderstood or misused.
- Moreover, excessive emphasis on the GI content of a meal may divert attention from other more important aspects such as fat or calorie content.
- However, encourage patients to make choices from foods with medium or low GI, and to mix foods of high GI with those of low GI to lower the overall GI because of the former. Patients can gain experience using different foods and looking at the results on their blood control.

Alcohol

The metabolic effects of the alcohol are complex and are influenced by many variables:

- The type and quantity of alcohol consumed.
- The rate of ingestion.
- Age and gender.
- Individual variations.
- Time of consumption in relation to meals and exercise.
- Nutritional status.
- Ill health and medication.

The major issues in relation to alcohol intake:

- Alcohol has the potential to worsen hypoglycaemic episodes.
- Alcohol has the ability to create an unawareness hypoglycaemia.
- Sustained effects of heavy drinking on glycaemic control.
- The possibility of aggravating microvascular complications.

- People with diabetes can be safely consume Alcohol, if they adhere to the following precautions:
- What is a unit? Explain with practical beverages
    - Maximum units per week: 14 units for women.
      21 units for men.
    - Units must be spread over the week not taken all at once.
    - Observe 1-2 alcohol free days per week.
- Alcohol should be avoided in the following instances:
    - During pregnancy.
    - Persons who experience gastritis, pancreatitis and severe liver disease.
    - Persons who have previously been addicted.
    - Persons who use chlorpropamide.
- Alcohol provides 7 kcal/kg, and can cause or aggravate hypertriglyceridaemia.
- In type 2 diabetes: it can also cause reactive hypoglycaemia because of enhanced early insulin response to sucrose. Hence, advise to use low carbohydrate mixers and cordials and limit consumption of sweet drinks (especially sweet wines and sherries).
- In type 1 diabetes: increased risk of severe hypoglycaemia with large alcohol quantities especially if food is omitted or if alcohol is substituted for some or all carbohydrates of the meal.
- Delayed hypoglycaemia can occur up to 16 hours post drinking, hypoglycaemia awareness is reduced at blood alcohol concentration of 20 - 25 mmol/l; recovery from hypoglycaemia is also delayed.
- It is not advisable to consume alcohol on an empty stomach.
- Heavy alcohol consumption causes severe but reversible hypoglycaemia in persons with type 2 diabetes, in persons with type 1 diabetes it causes recurrent episodes of hypoglycaemia.

Benefits of alcohol

Moderate alcohol consumption has the same cardio-protective functions in persons with and without diabetes, and may be protective in peripheral vascular disease.

Guidelines for use of alcohol drinks

Beverage	Amount	Calories	Carbohydrates
Beer			
Regular	340 ml	150	13
Light	340 ml	100	5
Near	340 ml	60	12
Cocktails			
Manhattan dry	114 ml	360	4
Martini	114 ml	250	trace
Distilled Spirits (80 proof): Gin, rum, scotch, vodka, whiskey.	43 ml	80	trace
Wines dry	114 ml	215	30

SPECIAL GROUPS

Children and adolescents

Ideally, children and adolescents should be seen by a specialist paediatric dietician periodically. However, this is not always feasible. Changes in eating habits are more easily achieved, when involving the family, school and carers in making decisions on healthy food choices. Information on appropriate snacks as well as treatment of hypoglycaemia must be made available to all carers.

Nutritional or energy requirements change throughout childhood and adolescence, e.g.:

- < 5 years – need a relatively energy-dense diet.
- 6-12 years – energy intake doubles, protein intake per kg body weight decreases.

Recommendations

- Regular dietetic review every 3-4 months during growth and puberty.
- Monitor height and weight.
- Review changes in lifestyle and physical activity.
- Provide advice on safe alcohol use (older children) (better to avoid).
- Be on the lookout for eating disorders.
- In extreme adolescent rebellion: it's more important to maintain contact with the person than risk alienation by labouring principles of healthy eating.
- Motivated adolescents benefit from a more flexible approach to diet and insulin.
- Use and intensive management approach in order to permit variability inherent in normal

teen lifestyles or eating habits. Dietary advice must be individualised.

- Make sure that the person with diabetes understands the link between the time of injecting insulin and the time of the meal
- Nutrient requirements for children and adolescents with type 1 or 2 diabetes are similar to other children/adults of similar age.
- As the incidence of type 2 diabetes in childhood rises, dietary advice must take the requirement for calorie restriction into account. However, linear growth should not be compromised. Persons should also be screened for any associated dyslipidaemia or hypertension. Physical activity must be encouraged.

Eating disorders

Eating disorders, such as anorexia and bulimia, are very common in adolescent females. This is because of their concern about body weight/shape since they (type 1 females) tend to be heavier than their non-diabetic peers. It may involve omission of insulin, reduced food consumption, or outright starvation.

Success rates for treating eating disorders are lower in persons with diabetes than in those without diabetes.

The following events should arouse suspicion regarding possible eating disorders:

- A high HbA1c.
- Recurrent or unexplained episodes of diabetic ketoacidosis.
- Recurrent severe hypoglycaemia.
- Early onset of microvascular complications.

Early intervention may enhance success rates as the condition may persist into adulthood.

The emotional distress associated with adult type 2 diabetes is often greater than in adolescents with type 1 diabetes, especially as these women become trapped in the vicious circle of low self-esteem, increased restraint eating or binge eating.

Pregnancy

Pregnancy in pre-gestational diabetes

Good control of diabetes before/during pregnancy is vital to reduce risks to the mother and the child. Optimal control preconception reduces the incidence of congenital malformation.

- A dietary review is essential to keep up with changes in insulin regimen.
- Folate supplementation (5 mg daily) should be taken to prevent neural tube defects in the baby.

- Vitamin/mineral supplements should be given if deemed necessary.
- Women whose body weight exceeds 120% of the ideal should be advised to lose weight before pregnancy.

During pregnancy

Regular dietary follow up is necessary to maintain near-normal glycaemia and provide nutritional demands for pregnancy.

- A stable meal pattern that is composed of smaller frequent meals is vital. Food choices should focus on the need for micronutrient-rich foods (fruits, vegetables, low fat dairy products, lean meat, fish or alternatives) rather than energy-dense fat rich foods.
- Greater consumption of low glycaemic index foods is advisable.
- Alcohol should be avoided.
- Tight glycaemic control increases hypoglycaemic risk and people with diabetes need to be advised on symptoms and measures to take.
- Measures to cope with nausea and vomiting should be given.
- Weight gain must be monitored. For a pre-pregnancy BMI of 20-26 kg/m2, recommended total gain is 11.5-16 kg.
- If weight is gained too rapidly, try to replace energy-dense food with nutrient-rich, lower energy alternatives. The aim is to stabilise weight/reduce the rate of weight gain. Active weight reduction is not advisable as it may compromise nutritional intake/foetal development.
- Energy consumption should be sufficient to prevent ketonaemia.

Lactation

Breast feeding should be encouraged unless the infant requires specialist care in a neonatal unit.

- The high energy costs of lactation means the mother may require an additional 40-50 g of carbohydrates/day compared with her pregnancy state.
- Extra carbohydrates may be required before going to bed while the infant is still having nocturnal feeds.

Gestational diabetes

The benefits of dietary intervention and optimal dietary prescription remain uncertain.

- Provide advice on healthy food choices.
- Emphasise low glycaemic index foods and carbohydrate distribution throughout the day.

- Modest dietary restriction 24-30 kcal/kg in obese women may be advised.

Postpartum advice on healthy eating and weight management is vital as these women are prone to type 2 diabetes.

The elderly person

General principles of dietary management of diabetes apply, but as appetite is often diminished, the use of nutrient-dense foods needs to be encouraged.

Overweight persons: weight reduction is beneficial as long as micronutrient intake is not compromised.

Zinc deficiency is more common in elderly, hence, a need for supplements or zinc-rich diet.

Calcium intake: at least 1200 mg; multivitamin supplementation is advisable especially if low appetite.

Dietary guidelines:

- Meals should be balanced to meet clinical needs of diabetes without diminishing older person's ability to enjoy meals.
- Avoid hypoglycaemia (relax targets): to reduce falls with associated fractures.

Physical activity/exercise is beneficial and should be encouraged.

Institutional care

- In Africa, this is an emerging concept, i.e. homes for the elderly. However, we have children in boarding schools, residential homes, and juveniles or adults in prison.
- Residents have no control over the time of their meals and medications, or type and amount of food provided; as well as no access to facilities for food preparation and storage.
- Undernutrition is common in elderly people in residential care.
- It is recommended that such elderly residents be given regular meals, with less restrictive diets for better nutritional status and quality of life.
- In prisons, problems include inappropriate foods and or meal times, and limited opportunities to exercise. Diabetes management must thus be provided by a multidisciplinary team, who are fully aware of the realities of prison life.

Ethnic considerations

Africa has great ethnic and religious diversity. Type 2 diabetes, obesity and hypertension are major challenges. The dietician must be familiar with customs, food habits and cooking practices of various ethnic groups, while also aware of the enormous diversity within a particular ethnic group or in a family – no assumptions can be made. Language barriers are also obstacles, but a translator or a relative may help.

The intricacies of fasting, depending on particular religions, are to be addressed in dietary plans and medication regimens.

Other aspects of dietary advice

Insulin treatment

- Tailor dietary and insulin regimen to individual's lifestyle.
- If on flexible regime (intensive), the dietician should be knowledgeable regarding the time action profiles of different insulins and insulin analogues.
- Insulin is an anabolic hormone, hence weight gain in type 2 diabetes should be anticipated. This should be explained to these persons and dietary measures should be instituted.
- Combination of insulin and metformin (type 2 diabetes) can reduce insulin resistance (less insulin used) and lessen weight gain by its anorexic effect.

Oral hypoglycaemic drugs

- In overweight type 2 diabetes: drug of choice is metformin as opposed to sulphonylureas, thiazolidinediones or insulin.
- The meglitinides (repaglinide) are probably weight neutral.
- All those treated with oral agents to be advised on causes, recognition and management of hypoglycaemia.
- Acarbose rarely causes hypoglycaemia as sole therapy, if hypoglycaemia occurs with it being used with another agent: glucose not sucrose should be used, as acarbose is an alpha glucosidase inhibitor and prevents hydrolysis of disaccharides.

Hypoglycaemia

- Glucose (10-20 g) is the treatment of choice, as this requires no digestion or metabolism.
- Toffees and snack bars are inappropriate, as they contain fat and slow down carbohydrate absorption, though gastric emptying during hypoglycaemia is as rapid for solids as it is for fluids.
- After recovering from hypoglycaemia a further 10-20 g of slower-acting carbohydrates should be given, unless the next meal or snack is due which should then be taken.

Exercise

- Regular exercise should be encouraged in all people with diabetes.
- Advice on prevention of hypoglycaemia is vital, especially during and after exercise.
- Blood glucose concentration may increase during the early phase of intense exercise and

metabolic decompensation can occur if pre-exercise blood glucose concentration is too high.

- Thus, exercise should be avoided if glucose > 15 mmol/l, or if there is ketonuria.
- If unplanned exercise: increase carbohydrate intake before and during exercise or if planned: reduce insulin or sulphonylurea dosage to prevent hypoglycaemia.
- If possible, monitor blood glucose before and after exercise to determine the magnitude of adjustments in food and insulin that are to be made.
- While exercising – ensure easy access to rapidly absorbed carbohydrates.
- Beware of the 'lag effect', as muscles replenish glycogen stores, with increased insulin sensitivity: hypoglycaemia can occur soon or long after exercises (hours later). So reduce insulin, and increase food especially after intensive exercise. A bedtime snack may also be advisable or reduce evening dosage of intermediate insulin.
- The potential for nocturnal hypoglycaemia is greater if alcohol is consumed after exercise.

Special situations

Intercurrent illness

- During acute intercurrent illness, advise on adequate hydration/nutrition especially easily assimilable foods/drinks, e.g. soup, yoghurt, jelly, fruit juice. (sick day management).
- Increase fluids especially if there is fever, vomiting, or diarrhoea.
- Commercial oral rehydration salts can be used or even tomato juice or broth.
- Continue medication when ill.

Hospital care

- As far as possible, allow persons with diabetes to make their own food choices.
- Hospital dieticians should ensure menus have appropriate or healthy food choices.
- All wards should have food and drink for oral treatment of hypoglycaemia.

Catabolic illness

- The energy needs of most hospitalised persons can be met by providing 25-35 kcal/kg body weight.
- In catabolic illness, at least 1.0 g/kg body weight up to 1.5 g/kg body weight in more stressed persons.
- Avoid overfeeding to prevent hyperglycaemia, hypertriglyceridaemia and hypertonic dehydration.

- Correct mineral/vitamin deficiencies before enteral or parenteral feeding is begun when indicated.

Palliative/terminal care

- The aim of nutritional advice in this case is no longer that of risk reduction for micro/macrovascular disease, but avoidance of symptoms because of hyper- or hypoglycaemia.
- Avoid non-intrusive dietary/management regimens, especially in cases of long-term palliative care.
- Appetite changes, use of glucocorticoids may require substantial alterations to insulin dose/regimen or to oral hypoglycaemias.
- Persons with poor appetites on sulphonylureas may revert to megitinides as and when they feel able to eat.

Nephropathy

The role of dietary protein restriction in the management of diabetic nephropathy is still uncertain. Many people in Africa are still following a diet poor in proteins, against their wishes, out of poverty.

A pragmatic approach:

- Reduce protein to 0.8-1 g/kg/day in individuals with microalbunimuria.
- Reduce protein to 0.8 g/kg/day in individuals with overt nephropathy as this may slow the progression of nephropathy.

Hypertension

- Advise overweight persons to lose weight. There is approximately 1 mm Hg decrease in mean arterial pressure for each 1 kg body weight lost.
- Reduce salt consumption to less than 6 g daily.
- Replace processed foods, which are mostly high in salt, with fruits and vegetables, which are rich in potassium and aid in reducing blood pressure.
- Avoid sustained excessive alcohol consumption, as it has a deleterious effect on blood pressure.
- Regular exercise (30-45 minutes) on 4-5 days/week is beneficial.

Dyslipidaemia

- This is often present at diagnosis or in those with poor control.
- Re-assess regularly and after control of hyperglycaemia.

- In many persons with type 2, and overweight persons with type 1 diabetes, dyslipidaemia is associated with insulin resistance. This is characterised by raised triglycerides and small dense LDL cholesterol.
- Plant sterols and stanols have been shown to lower LDL cholesterol:
    - An intake of 2 g/day – LDL reduction of 10-15%.
- Sterols and stanols are being incorporated into spreads and other fat-derived products, e.g. yoghurt, semi-skimmed milk, cereal bars, soft cheese, and marketed as adjuncts to other dietary methods for reducing LDL cholesterol. They are very expensive and out-of-limit for many people.
- Hypertriglyceridaemia is also associated with alcohol consumption.
- The use of pharmacological doses of fish oils > 3 g daily to treat hypertriglyceridaemia is not recommended because of its potential deleterious effects on LDL cholesterol and glycaemic control.

Coeliac disease

- Is especially prevalent in type 1 diabetes.
- Poses a dietary burden on the person and expert advice is required.
- If not treated: high risk of hypoglycaemia.
- Use of gluten free foods – raises insulin requirement.
- Beans and legumes can be used to increase fibre content of the diet
- Calcium supplements to be given to reduce risk of osteoporosis if dietary intake is < 1500 mg/day.
- Gluten-free foods from wheat or maize starch have similar glycaemic indices as those of gluten-containing products, and these are indicated.

Cystic fibrosis

- Patients with Cystic fibrosis and diabetes may be underweight.
- Hence, high-energy diet with extra calories from fat and no restriction on carbohydrate is required.
- Adjust insulin regimens when supplementary overnight enteral tube feeding is used and during periods of acute infection.
- Good metabolic control is a challenge but can be reached with a basal bolus regimen and is associated with weight gain.

Conclusion

Evidence exists that a healthy diet and lifestyle change (avoiding sedentary lifestyle, moderate alcohol consumption, avoiding cigarette consumption) prevents diabetes apart from controlling it. Prevention is the way forward to curb this condition. These principles must therefore be emphasized to all populations not just to people with diabetes.

Tools

Food models.

Food pictures/chart.

Meal planning chart.

Leaflets with nutritional materials.

Real food samples.

Locally made food representation.

Evaluation

Assessing the level at which metabolic targets achieved.

Ability to compose own meal plans.

Assessing BMI (regularly), waist to hip ratio (anthropometric measures).

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MODULE 3-5 (b): DIABETES AND OBESITY

Introduction Increasing numbers of the people with type 2 diabetes are either overweight or obese. Being overweight or obese significantly increases the risk of morbidity and mortality from type 2 diabetes and its co-morbidities. Successful reduction has a positive impact on these outcomes. Obesity is a major component of the metabolic syndrome.

Goals: For the educator to understand the importance of obesity as a modifiable risk factor for diabetes.

Objectives

1. To be able to define, classify and assess for the presence of obesity.
2. Describe the risks of obesity.
3. Describe life style interventions for prevention and management of obesity.

1. Definition and classification of obesity

Various anthropometric measures are used to describe people with diabetes mellitus and may be related to risk of developing the disease. The most common measures in adults are weight, height, body mass index, waist circumference, waist-hip ratio, and sagittal diameter. These are defined and measured as follows.

Weight in kg is recorded to the nearest 0.1 kg wearing light indoor clothing without shoes. Use a levelled platform scale with beam and movable weights. Alternative methods may be necessary in the elderly and infants (see WHO report).

Height in cm is recorded to the nearest 0.1 cm without shoes. A vertical board with attached metric scale and vertical rule and horizontal headboard should be used or a stadiometer. The person being measured should stand with heels together and with the buttocks, back and head in contact with the vertical board. The head is positioned so that the external auditory meatus and the lower orbit are level. The movable headboard is brought onto the top of the head with the subject inhaling deeply.

Body mass index is a derived index and the main measure used to assess relative weight in adults. It is calculated as weight (kg) / height (m2) following the measurement guidelines above. The WHO guidelines to express relative weight are given in the table below.

BMI	Description
18.5-24.9	Normal
< 16	Grade 3 thinness
16.0-16.9	Grade 2 thinness
17.0-18.4	Grade 1 thinness
25.0-29.9	Grade 1 overweight
30.0-39.9	Grade 2 overweight
> 40.0	Grade 3 overweight

Waist circumference is measured in the standing position with the feet 25 cm to 30 cm apart. This measurement is taken with a flexible but inelastic tape measure. The waist measurement is measured midway between the inferior margin of the lower rib and the iliac crest in the horizontal plane with the subject exhaling gently. The circumference is measured to the nearest 0.1 cm.

Hip circumference is measured in the standing position in underwear. The tape measure is placed around the maximum extension of the buttocks in the horizontal plane and the circumference measured to the nearest 0.1 cm.

Waist/hip ratio is calculated to two decimal places. No internationally agreed criteria are available. The Suggested working definitions for a normal ratio is less than 0.9 for men and 0.95 for women.

2. Describe the risks of obesity

   - Type 2 diabetes.
   - Impaired glucose tolerance (IGT).
   - Hypertension and other cardiovascular diseases.
   - Kidney disease.
   - Some forms of cancers (breast, colon, uterus, kidneys, etc.).
   - Arthrosis.
   - Others, including sleep apnoea…

3. Describe life style interventions for prevention and management of obesity.

   GENERAL PRINCIPLES FOR THE MANAGEMENT OF OBESITY:

   1. Assess dietary intake, level of physical activity, BMI, and waist circumference (on presentation and monitor regularly.
   2. Dietary changes and increased level of physical activity are the most economical means to lose weight.

3. The socio-economic situation will affect ability to comply with dietary advice [refer to Module 3-4 on exercise and Module 3-5(a) on diet].
4. Integrate weight control measures into the overall management of diabetes mellitus and co morbidities if BMI > 25 kg/m2 and/or waist circumference > 102 cm and 88 cm in men and women, respectively.
5. Weight loss is difficult to achieve and maintain.
6. Educate people with diabetes, as well as their families.
7. Set realistic goals.
8. Use a multi-disciplinary approach to weight control.
9. Psychosocial factors need to be addressed.
10. Attention should be given to the development of community facilities and a safe environment to facilitate physical activity.

Tools

Posters and leaflets.

Evaluation

Group discussion.

MODULE 3-5 (c): FASTING AND DIABETES

Introduction

Most commonly fasting occurs because of religious or cultural reasons. However, in Africa, people with diabetes may be forced to fast because of poverty or because crop failures cause various natural disasters. Religion and culture are an important aspect of life. Culture defines the norms for values, beliefs, and judgments about what is good, what is desirable, and how individuals should behave. An appreciation of one's cultural or religious context is critical in understanding the behaviours and environments that govern an individual's daily life. Many people with diabetes wish to follow their religious convictions and may end up fasting without their doctor's advice and knowledge. Caregivers must be aware of this and should be able give appropriate advice on diet and treatment adjustments to persons who are fasting.

FASTING FOR RELIGIOUS PURPOSES

- All the major religions recommend or command one form or other for fasting. In Africa, most of religious fasting is associated with Christianity, Islam and traditional religions.
- Fasting for religious purposes is possible in certain circumstances in people with diabetes.

General principles

- The health provider should be consulted to seek advice whether fasting can be embarked upon on medical grounds.
- Advice from the religious leader should also be sought as to whether (s)he can be exempted.
- Check the level of glycaemic control using HbA1c or fasting blood glucose. Those who are very poorly controlled should be discouraged from embarking upon fasting. Drug dosage adjustment is required for patients with fasting blood glucose ? 80 mg/dl (< 4 mmol/l).
- If the person is on insulin or insulin secretagogues, drugs, dosages and timing will require adjustment during the period of food denial to meet calorie intake.
- A total fast is not recommended for anyone with diabetes. Adequate hydration is important even during the period of fasting.
- Self-monitoring of blood glucose is mandatory for people with diabetes who elect to fast. Once-a-day monitoring is adequate for persons on diet only, or on a diet along with metformin. In persons on insulin secretagogues, blood glucose should be done at least three times a day. The doctor and persons with diabetes should agree on how to handle abnormal results before starting to fast. If hyperglycaemia is marked, retesting should be done more frequent and the urine tested for ketones.
- Vigorous activity should be avoided during the fasting period.

- People who fast should have ready access to their health-care providers during the period of fast.
- Clear guidelines should be set as to when to terminate the fast, e.g. frequent hypoglycaemia, intercurrent infection.
- Compensatory eating should be avoided when one opens their fasts. Diets should remain the same during fasting periods.
- In persons with underlying complications, such as cardiac failure, nephropathy and hypoglycaemic unawareness, fasting should be discouraged.

RAMADAN

People treated with oral hypoglycaemic agents and dietary modification:

- In this situation fasting is possible.
- Usual dietary advice should be followed at this time. Compensatory eating should be avoided when breaking fasts.
- Patients on metformin, alpha-glucosidase inhibitors and thiazolidinediones can continue taking the usual doses at the usual times.

Persons on sulphonylureas:

- If on chlorpropamide, this should be stopped and substituted with a shorter-acting agent.
- If on a second or third generation sulphonylurea (glibenclamide, gliclazide, glipizide, glimepiride), this should be taken before breaking the fast and not before dawn.
- If on tolbutamide, both morning and evening doses can be taken, but the smaller dose should be taken before dawn.

Persons with type 2 diabetes on insulin:

- If on once-daily insulin before bedtime:
  - This can be given as usual.
- If on twice-daily short- and intermediate-acting insulin:
  - Before the dawn meal, give the usual evening dose of short-acting insulin without any intermediate-acting insulin.
  - Before the evening meal, give the usual morning dose of short-acting and intermediate acting insulin.
- If on basal bolus regimen:

- Usual doses of the short-acting insulin can be given before the dawn and evening meals, and usual doses of the intermediate-acting insulin can still be given at 22:00.
- Regular SBGM is essential to ensure prevention of hypoglycaemia, and titration of doses should occur according to SBGM results.
- Neither the insulin injection nor the breaking of the skin for SBGM will break the fast.

FASTING IN OTHER RELIGIOUS TRADITIONS

The following three basic types encompass most forms of fast: viz., absolute fast, partial fast and normal fast.

Absolute fast, or what Christians call "Esther fast", imposes total abstinence from both food (solid or liquid) and water. This should not go beyond a maximum of three days and is not recommended for those people taking insulin secretagogues or insulin.

In partial fasting, the so-called "Daniel fast", the person abstains from selected foods and drinks. The foods consumed usually consist of fruits, vegetables and water. Choosing to fast or to omit a certain meal, each of the fasting days is also taken as partial fast.

Normal fast or the common fast is when the fasting person abstains from all foods (solid or liquid) but can take water for a limited time.

The purpose of fasting can also be met by denying oneself other pleasures and entertainment. The pleasure fast involves setting aside one's favourite form of entertainment, such as watching TV, listening to the radio, newspapers, etc. for the fasting period.

If a person with diabetes intends to fast, consider the following:

1. If the type of diabetes or treatment precludes any of the traditional types of fasting, then another form of fasting, e.g. pleasure fast, can be chosen.
2. If medically eligible to fast, the fast that best suits the person's type of diabetes should be selected in consultation with the health-care provider.
3. If the person is on insulin, a partial fast is preferred to absolute or normal forms of fasting.

Summary of advice to those fasting for religious purposes in people with type 2 diabetes

The Table below summarises broad suggestions to Christians and others, who elect to embark on fasting during lent or similar occasions.

Treatment regimen	Fasting regimen	When to take antidiabetic agents
Diet only	Total normal of partial fast	Not applicable
Metformin/thiazolidinediones	Normal or partial fast	With meals
Insulin secretagogues sulphonylureas	Partial fast	Before meals
Daily intermediate- or long-acting insulin	Partial fast	Before first meal
Glinides	Normal or partial fast	With meals
Multiple doses using short- and intermediate-a cting insulin	Avoid fasting or partake in pleasure fasting	Not applicable
Long-acting plus bolus fast acting	Avoid fast or partial fast	Lantus a.m. and analogue with meals
Complex medications	Pleasure fasting	No change indicated

Fasting because of poverty

Sadly, because of various reasons such as poverty, famine or wars, people with diabetes may find themselves in situations where food is scanty and they are forced to fast. The body turns to itself to provide energy. First to go are fat deposits and large quantities of water. Thereafter, the body begins to break down protein in other organs, such as the liver, spleen, and muscle tissue. The heart and brain proportionately show little loss. Intake of less than 150-200 g carbohydrates daily may result in starvation ketosis. Starvation may also increase the risk of hypoglycaemia, especially in people with type 1 diabetes.

Adjustments in treatment regimens will have to be undertaken to avoid the above:

- Reduction in the insulin dosage to provide only basal insulin requirements. Basal insulin will also be required to decrease ketone body formation associated with severe starvation (starvation ketosis).
- Dietary restriction to be removed and persons are advised to eat foods that are available. When meals are available small boluses of short-acting insulin should be used.
- Adequate hydration is important during these periods.

Fasting prior to specialised investigations

Various diagnostic and radiological investigations may require fasting which lasts up to 12 hours. Where possible these investigations should be carried out early in the morning and may require to be managed with intravenous infusion of glucose, insulin and potassium, as would be in a surgical case (refer to Module 4-5).

Tools

Brochures.

Charts/Slides.

Evaluation

Group discussions and short quizzes.

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MODULE4

MODULE 4-1: DIABETES IN CHILDREN AND ADOLESCENTS

Introduction

Particular people have particular needs "(IDF Bulletin 1998) children and adolescents with diabetes have special, changing needs as they develop and grow. These needs must be recognised and addressed: they arise from the stages of growth through which they pass.

All young people have a right to diabetes education and management: children cannot fight for their rights so it is important that society accord them all the necessary support.

Goals: Educators must recognise the special and changing needs of young people with diabetes and their parents, families.

Objectives

To help the young person with diabetes in:

- Managing diabetes with self-control.
- Attaining normal growth and development.
- Avoiding acute complications, e.g. ketoacidosis, hypoglycaemia.
- Preventing long-range complications.
- Closer monitoring, especially in adolescence.
- Enjoying a smooth transition to adult life.

Practically, this includes teaching the young person in skills such as:

- blood glucose monitoring;
- urine ketone monitoring;
- nutrition advice;
- exercise;
- regular use of medication.

Introduction

Individualised assessment of the child's maturity level, developmental stage, family and social support, eating habits, and school and sports schedule is critical. This must take into consideration cultural, socio-economic, and environmental determinants in developing a realistic comprehensive individualised management plan that is offered in stages as the child develops.

Use a simple approach and a language they can understand. Be very practical in your teaching.

Administration of insulin

It takes time and patience to teach someone how to inject insulin. Make sure that everything is understood and that the practical aspects are followed. Experience proves that errors are very common, and supervision is needed for a long time. Demonstrate as you explain, and then ask the individual to do it. Later on at a follow-up visit, ask for a control demonstration. Measuring small amounts of insulin in children is sometimes difficult. You have to use small syringes (if possible 0.3 or 0.5 ml) of very good quality. Check the prescribed amount of insulin and explain in details to the child and parents. Most people who require insulin therapy (bar cases of type 2 diabetes, i.e. mature onset diabetes in the young (MODY), who will require oral agents). There is no established formula determining a child's insulin requirements. Body weight, age, and pubertal status usually determine the dosage.

Children with newly diagnosed diabetes may need from 0.5 IU to 1 IU/kg/day.

Usually, after a few weeks or days of sustained treatment, the needs for insulin diminish, and sometimes stop. This is called the "honeymoon period". The educator must be watchful for the signs of hypoglycaemia and adapt the insulin to the real needs of the young person with diabetes.

As a general reminder:

Pre-puberty dosage: 0.5-0.8 IU/kg/day

Puberty dosage: 0.8 IU/kg/day

Adult dosage: 0.6 IU/kg/day

Insulin may be administered as follows:

Conventional therapy (2 times daily).

Intensive therapy (3 or more times daily) enhancing flexibility with meals/activity.

The latter is recommended for older children, with special precaution to avoid severe hypoglycaemia. Insulin is adjusted depending on the results of blood glucose monitoring and in relation to various activities or lifestyle of the child.

Insulin refusal or omission poses a great challenge to care. Consider the use of micro-fine gauge 29 or 30 siliconised insulin needles, which cause less pain, and the hope that repeated injections will enhance acceptance. Most persons with diabetes do not complain about the pain. Monitoring

Clinical signs are important. Teaching to recognise the signs of hypoglycaemia and ketoacidosis must be done early. Parents, teachers, and caregivers should suspect hypoglycaemia if the child is irritable, displays abnormal behaviour, complains of hunger, etc. Children need to be trained too, and with time, to carry some form of glucose at all times in case of need.

Urine testing is easy to perform and must still be used in young patients as often as possible. Ketones in urine are a sign of emergency. This can be checked at home.

Blood glucose measurement should be performed at home if affordable and as often as possible.

Skills to adapt behaviour to the results of the test are essential, certainly for hypoglycaemia. Education should also include control parameters for blood glucose. In an ideal situation these should be:

Fasting blood glucose – 5-6 mmol/l

Postprandial blood glucose – below 8 mmol/l

Glycosylated haemoglobin (HbA1C): for children younger than 5 years old, 7-9% is acceptable and older children 7-8%.

One has to accept that this is not always possible, and it can even be dangerous if close monitoring is impossible or if food is not always available.

Growth (weight) and height monitoring is essential in all children/adolescents, and if any abnormalities are detected, early intervention is recommended.

Education

Talking to children and teenagers is a special task. You must use simple words, short sentences and make sure at each step that the individual understands. Ask them to repeat what you have told them.

The first step is to listen to the family and the person with diabetes. They have a lot to explain and many questions to ask.

Integration of the family and school is vital in the education process. Try to understand their problems and find a way to adapt the treatment to the possibilities of the young person with diabetes and his/her family. The level of education of the person with diabetes and the family may differ vastly. Make the necessary adaptations. Using a stepwise approach, first teach the “survival kit”, and add knowledge at each visit. Teach them very simple things at first.

You may encounter a problem with language barriers, as they may speak a language not understood by you or your team.

Diabetes education is a vital component of care, providing knowledge of diabetes, which has short- or long-term effects, and ways to curb these. Education empowers them to take control of their disease and play an active role in the management of diabetes.

There is no generalised teaching programme, and the content will depend on individual targets.

Compile a record sheet in the file, to record what has been mentioned each time.

Education is an ongoing process, and survival skills need to be provided at diagnosis. Family and children need ongoing education and support as the child grows and takes on more elements of self-care.

Frequent contact between the caregiver and the person with diabetes decreases the number of admissions and increase the quality of control. When available, a contact per telephone is very useful. Knowledge and skills should be evaluated regularly.

Exercise

Keep the young person with diabetes active, playing, and following sport sessions. Regular exercise is an important component of management and needs to be encouraged. These children and adolescents should be involved in all school activities and sports. Especially since these activities not only enhance discipline, but also reduce discrimination and feelings of inadequacy. Physical activity is also a crucial component of their management.

The children must be well educated to understand the impact of extracurricular activities on blood sugar, thereby knowing when to reduce insulin, to eat snacks before exercise, and to carry some forms of hypoglycaemia treatment. Importantly, insulin should not be given in an exercising limb, and preferably one hour before exercise. Before and sometimes during exercise food intake might be necessary.

Nutrition

For young people with diabetes food should not be very different from the healthy diet of a normal teenager without diabetes. They need the same amount of energy.

A balanced diet provides the necessary amount of energy with proteins, starches, fats, water, salt, and vitamins. With the use of drawings or representations of foods, explain those who contain fat, proteins, sugar, carbohydrates, salt, and vitamins. Repeat until well understood.

Encourage food intake, which is high in fibre, as well as vegetables and fruits.

Water is essential, especially in a hot climate and during exercise. Find out if the person with diabetes knows how to take enough to drink during a school day or working day.

Explain how to organise meals according to the insulin schedule and to food availability. Inform why food and insulin must be adapted to each child's lifestyle; special precaution being paid to regular meal distribution (4-6 meals/day), to avoid hypoglycaemia.

Use a stepped approach, beginning with survival information and progressing to more advanced topics, e.g. using food exchanges, carbohydrate counting. Try to know the child's food preference and the possibilities of the family.

Food plays an important role in family dynamics; it brings a family together, especially if everyone is eating a similar meal. If a family adopts healthy eating habits, it is not necessary to prepare separate meals.

Children differ from each other according to age, parameters, problems, likes, and dislikes, therefore, management goals will differ from one child to another, as will nutritional advice vary.

Explain that the body needs more energy during exercise, and therefore some food intake is necessary before or during the session.

Make sure that the individual knows how to avoid hypoglycaemia, and what kind of food should be taken.

Some special concerns

In toddlers: food refusal, irregular eating.

In teenagers: the influence of peer pressure, such as eating/drinking fast foods, soft drinks, sweets, etc.

The influence or restrictions of culture and religion must be considered and if detrimental, appropriate suggestions offered.

Eating during a school day is not always easy or possible; find ways to organise a few snacks from time to time.

In young female teens, self-image is a big issue, therefore, omitting insulin to keep slim poses a challenge to adequate nutrition, and help must be offered.

General support, psychosocial aspects

Young children require a lot of supervision and emotional support in diabetes care, yet the freedom to be a child is of paramount importance.

As they grow up, and depending on their individual cognitive maturity, they will be able to take up self-care skills with waning supervision. However, through these stages continuous education, care and support from the diabetes care team and their family is vital for a successful transition to adult life.

Networking with other children with diabetes can help to deal with the challenges of diabetes care, e.g. participating in diabetic camps, hikes, etc.

Recommend small changes and implement them at a rate the child can tolerate. Reward achievement by positive remarks, such as praise, gestures, or small gifts as appropriate.

The diagnosis of diabetes in a child presents the family with challenges they must face. It is important to recognise the emotional trauma this poses. Allow the family and child to go through the various psychological stages of shock, denial, bargaining etc, until they accept their condition, and are ready to take control, then pace education as the family wishes.

The care team should identify problems in family functioning, health beliefs and quality of life. Thereafter they should address issues or offer appropriate referrals and support for the solution. To enhance adherence to life-long changes in behaviour involving daily repeated tests and activities,

the health care teams must discuss these behaviours with parents and families. Educators with experience should be aware that many young people have either no parents, or parents who are absent or unable to help their children. These children with diabetes are in need of a very special support. Always record a family history and try to find out how best the person with diabetes can enjoy support and by whom.

Address the child's goals and win his/her trust by being willing to compromise.

Encourage parents to play an active role even in adolescents' care (without being over bearing). Share the 'burden of care' with the family, especially when goals are not being achieved. Determine the degree of parental involvement through the success of self-management achieved by the child or adolescent.

In the overall management of diabetes, the fear of hypoglycaemia must be addressed, and parents, caregivers, and children be taught to take appropriate action.

Adolescents

Adolescents with diabetes are in a transitory period and are exposed to many other challenges, which must not be ignored.

Eating disorders: these are especially common in young females, who have an obsession to be slim and may vary from anorexia nervosa to bulimia. Some are life-threatening disorders, which should be identified early and managed. Sudden weight loss, deterioration, or instability in control can be pointers to an eating disorder, or binge eating (especially of restricted foods), and these may be appropriately constituted into meal plans as a solution. Peer pressure pushes children towards eating fast foods or soft drinks.

The use of alcohol, drugs, and cigarettes poses danger to control and may enhance diabetic complications.

Sexual abstinence: needs to be encouraged in adolescents with diabetes, if not able to abstain contraceptive advice needs to be given. Unprotected sex poses danger of unplanned pregnancy and more important, the HIV/AIDS risk is great.

These challenges must be addressed long before adolescence: 'forewarned is fore armed'! The integration of family, teachers, religious and community leaders, and sports heroes helps bring out the message louder and appeals to a wider audience.

Persistent denial or other severe emotional disorders: depression or anxiety may require psychological help.

It is imperative for parents, caregivers, and peers to be in support of adolescents with diabetes: at a certain point, they will need someone to turn to and this had better be the right person. Parent support groups should be encouraged.

Transition to adult life

For many young people it is a difficult situation, more so for those affected by a chronic condition,

such as diabetes. The most difficult topics are related to the emotional life, sexual desires, desire to marry, and fond a family. Educators cannot do everything, but can listen to the adolescents and their problems, and find a solution along with them. Often one has to talk to a future husband or wife about their diabetes condition.

Some counselling in the choice of a career is essential.

Complications

The educator should approach the person with diabetes cautiously to avoid instilling undue fear.

Emphasis should be on weight control of the child being a family issue, which should be approached in a way to avoid alienation.

Education in a positive way should highlight the risks of developing complications; but emphasize the role of overall good diabetes care today as a means of preventing complications.

Conclusions

Diabetes management in children, and especially adolescents, is an arduous task. It is a challenge from which one should not shrink, since any sustained reduction in blood glucose level means fewer incidences of complications, particularly because this special group has a longer way to go.

Above all, children have rights they cannot advocate for, so adults must fight for these children's rights.

Tools

A handbook for young people with diabetes with pictures [see Attachment].

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ATTACHMENT

Booklet to be used for education of children with diabetes

This is written in simple words for children and young persons with diabetes.

The text can be used as such, but illustrations are an essential part of the teaching and will be added where possible.

This should be kept in a different folder under the title of "tools" for education.

The following are chapters in the book:

What is diabetes?

How can we treat diabetes?

The signs and symptoms of diabetes

The signs of hyperglycaemia

How my body uses insulin during the day Daily monitoring

What brings changes in your blood glucose?

- Insulin
- Food
- Exercise
- Stress

Briefly: hyperglycaemia; hypoglycaemia; how to avoid these situations.

Treatment with insulin

- Where does insulin come from?
- Different kinds of insulin
- Action of insulin
- How to use insulin?
- Where to inject insulin
- How to keep insulin
- Injections: how to prepare, and how to mix the injection

- How to adapt your dosage of insulin.

How to monitor your diabetes

- The optimal situation
- Other situations
- Tools for measuring: blood glucose, urine test
- Your logbook.

Hypoglycaemia

- What is hypoglycaemia
- What happens
- What to do: do not wait
  - Mild signs of illness
  - If you frequently feel the same signs
  - If the signs and symptoms are serious
  - What to do the next day
  - Hypoglycaemia during the night
- What kind of food or drink to take during hypoglycaemic incident
- What is glucagon?

Hyperglycaemia

- How do you know that you have hyperglycaemia?
- What are the signs?
- What to do
  - Take your insulin as usual
  - If the situation is not improving
- What are the reasons for hyperglycaemia?
- How can you avoid such a situation?
- Can one have ketones in urine with normal or slightly abnormal glycaemia?

Food for young people with diabetes

Why do we talk about food?

What kind of food should you eat?

- Carbohydrates
- Lipids or fat
- Proteins

A healthy diet for everyone

- A few simple guidelines
- A few mistakes that shoud be avoided

Time schedule for your meals:

- How to organize your day
- Breakfast
- Noon and evening

How much food?

Sugar for persons with diabetes.

Living with diabetes

- Now that I have diabetes
- What to do?
- Find help
- Consultation at regular intervals
- Personal care
- If something goes wrong
- Family
- School
- Travelling
- Job, career

Sport and physical activity

Medical treatment.

First booklet

WHAT IS DIABETES?

Diabetes mellitus is the full name for the disease commonly known as diabetes. Diabetes means having too much sugar in your blood.

Keep this in mind: You will not have diabetes just because you eat too much sugar. Many people think so, but this is not true.

In children and young people, diabetes is caused by a lack of insulin because of destruction of B-cells in the islets of Langerhans of the pancreas.

How can we treat diabetes?

To lower your blood sugar, we must give you the insulin that your body lacks. But you have to remember three things:

1. Insulin cannot be given by mouth because it is destroyed in your stomach.

   This medication must be injected with a needle.

   Fortunately, we have very fine needles and

   the injection is almost painless.

2. Treatment is necessary for the rest of your life.

   We hope that new treatments will be available in the future, but for the moment you have no other choice if you want to be healthy and lead a normal life at school and at home.

3. You can inject insulin yourself or ask one of your parents or relatives.

   A doctor or a nurse will teach you, and after a few days of training, you take responsibility for your own injections. This will be taught either at the hospital or at a health centre.

The signs and symptoms of diabetes

A car needs gasoline for a journey. Likewise, a normal person needs energy to be active. This energy mostly comes from glucose or starches. When you digest starches, they change into glucose in the blood stream. Glucose is a sugar circulating in your blood. It is distributed throughout the whole body.

Everybody has a blood sugar level, which is easy to measure with a small instrument called a glucometer. The amount of sugar in the blood is called “glycaemia”.

The level of glucose in the blood is controlled by the insulin produced in the pancreas. When insulin is distributed in your blood, it regulates the amount of glucose.

A person has diabetes

When the pancreas is unable to produce enough insulin, such lack leads to an abnormally high level of glucose in the blood. A certain amount of sugar in the form of glucose leaves your body through urine. It is easy to measure the glucose in your urine by using strips (dipstix) or Benedict's reagent (the Clinitest®) or other such products.

Some people have a strange experience when urinating; their urine seems to attract ants. These ants are in fact a sign of sugar in the urine. The presence of glucose in the urine is called “glycosuria”.

Along with sugar in your urine, you also pass a lot of water. This explains why you have to go to the toilet so often to urinate. This is indeed a sign of diabetes. It is therefore not surprising that you will find yourself drinking a lot, losing weight, and feeling very tired.

You will experience other signs too that can be dangerous because of a lack of insulin. One of these is “ketonuria”, and happens when a certain amount of ketones appear in your urine.

The signs of hyperglycaemia

Sugar in the urine

Urinating a lot

Thirst Fatigue

Weight loss.

The only way to lower your blood sugar is to inject insulin. But you must learn how to do this and how to determine the amount of insulin your body needs.

How my body uses insulin during the day

Glucose or carbohydrates are present in many foodstuffs. When you eat and digest this food glucose reaches the small intestine, crosses the barrier, and passes into the blood.

After each meal, you experience a rise in blood glucose.

- In a person without diabetes:

  Between meals, blood glucose remains between 80 mg and 100 mg per 100 ml (3.3 - 6.7 mmol/l)

  After food intake, blood glucose usually increases, but not more than 150 mg per 100 ml (8.4 mmol/l)

  After two or three hours, blood glucose returns to its normal level.

  The presence of insulin prevents a rise in glucose.

Between meals, the pancreas produces small amounts of insulin. However, during a meal blood glucose increases, and the pancreas has to work harder to produce enough insulin to keep blood glucose within the normal range.

After food intake, the same small amount of insulin is sufficient to keep blood glucose at a normal level.

- During the day, this is what happens to a person without diabetes:

  Early mornings at breakfast, there is an increase in insulin from your pancreas.

  Between meals: you do not eat any food and less insulin is present in your body.

  At noon, you eat, and more insulin circulates.

  In the evening, you eat again and more insulin circulates.

  During the night, there is very little insulin in circulation.

- If you have diabetes:

  Early mornings before your breakfast when you have an injection, insulin usually acts fast.

  Between meals: you do not take any food and you only need a small amount of insulin.

  At noon: before food intake, you take an injection of fast-working insulin.

  Between meals: no injection.

  In the evening with your food, take your insulin.

  During the night, when you do not eat any food very little insulin is needed.

  However, to know exactly how much insulin you need, you must measure your blood sugar and check your urine for sugar.

Daily monitoring

In a person without diabetes, the pancreas adjusts the production of insulin according to the needs of the body. It has its own way of assessing the exact blood glucose level.

When the pancreas loses its capacity to produce insulin, other measures have to be taken to provide the correct amount of insulin. Fortunately, we have ways of doing this for people with diabetes. Therefore, it is possible for them to inject the exact amount of insulin at the right time of day.

Blood glucose is measured in the hospital or at the health centre, by a nurse or doctor with a glucometer. If you can afford to buy one, you can test your blood glucose at home as often as you wish.

You can also measure sugar in your urine. If the glucose in your blood is too high, sugar passes into

your urine, and very often, you urinate a lot. This is a kind of overflow.

If you have diabetes, you may from time to time find glucose in your urine, either in greater or smaller quantities. The amount of sugar in urine depends on the level of glucose in the blood.

Urine is usually free of glucose. It only passes into urine when the blood glucose exceeds 180 mg per 100 ml (10 mmol/l).

Persons with diabetes experience variations in their blood glucose level and the amount of glucose in urine.

The kidneys regularly produce urine, which accumulates in the bladder. When you pass urine, you empty your bladder. When you test your urine for glucose, the presence of sugar means that at some moment since you last passed urine, your blood glucose was higher than 180 mg per 100 ml.

When you check your blood sugar, it reflects the situation at that exact moment.

However, when you measure the glucose in your urine, it gives you an indication of the situation prevailing a few hours before the test.

So, both tests give different indications and both are necessary.

When your blood glucose is high, or if you do not feel well, also check for ketones in the urine. This is important. If present, you are probably in need of more insulin and your health may be affected.

Be careful and pay attention to the following signs relating to the level of your blood glucose. These signs can be present when your blood glucose is low, “hypoglycaemia”:

Hunger

Pallor

Shivering

Sweating

Blurred vision

Fatigue

Trouble or uncertainty with your speech

Strange behaviour, possibly violent.

If your blood glucose is high (hyperglycaemia), you may:

Urinate a lot and often, even during the night Feel thirsty

Lose weight

Be tired

Have dry skin, or a dry mouth.

Signs of hyperglycaemia are experienced when the blood glucose is very high. It is important to avoid such situations. You do not always experience these symptoms immediately. So keep watching your blood glucose level carefully.

Hypoglycaemia is different:

A mild hypo can hardly be avoided at all times. If this is what you are experiencing, you should take the measures explained above: take a soft drink or eat something sweet and that will solve your problem.

A severe hypo is a stressful experience. Check with your doctor or nurse what you should do to avoid this.

Keep a record of incidents of hypos or high glucose in your logbook. It will be easier to plan the treatment and obtain a better control of your diabetes.

What brings changes in your blood glucose?

Insulin

The insulin test is the most important way of controlling blood glucose.

Your injection must keep your blood sugar within a normal range, neither too high nor too low.

We explained previously that you must check your blood glucose and your urine as often as possible. Your doctor or nurse will tell you how often. Food Your blood glucose increases after a meal. With the help of insulin, this increase remains within safe limits. This is the reason why you should eat at regular intervals. Your meals should be linked with the injection of insulin (rapid-acting insulin must be injected 20 minutes before food intake).

This is explained in your booklet about eating habits.

Food must not be the cause of big variations in your blood glucose. You must eat at regular intervals, sometimes three meals, with two snacks a day. Try to carry some food with you to be able to nibble something when necessary.

Exercise

When you play, walk, or do gym, your muscles use a fair amount of glucose to function. You should realise that your blood glucose is lowered after exercise.

If you start playing, running, or doing gym, you may either increase your food intake or decrease your insulin dosage.

Do eat something during exercise.

Stress

When you feel excited or very unhappy, when you fear something or are angry, when you are ill, your blood glucose may increase.

Check your blood glucose or urine glucose in such cases.

Briefly:

Hyperglycaemia means:

1. Not enough insulin.
2. Too much food.
3. Not enough exercise.

Hypoglycaemia means:

1. Too much insulin.
2. Not enough food.
3. Excessive exercise.

How to avoid such situations:

Try to adapt your insulin injection to your needs with the help of your parents, nurses, or doctors. This is not easy and changes have to be made often, but in an orderly way.

Be careful to eat at the correct times and take in an appropriate amount of starches.

Organise your injections and food when you change your schedule of exercise.

TREATMENT WITH INSULIN

Where does insulin come from?

Your insulin is prepared in a big laboratory. It is not easy to make.

Injected insulin closely resembles, or is similar to the human insulin that our pancreas produces.

Units?

The amount of insulin you inject is expressed in “units”.

Some kinds of insulin contain 40 units per millilitre, while others contain 100 units per millilitre Be very careful when injecting insulin. You must always use the proper syringe. Indications are clear: “use with 100 IU or 40 IU”. It can be very dangerous to use the wrong syringe

Different kinds of insulin

Rapid-acting insulin

If you are using the insulin with rapid action, it looks like water.

It starts-acting after 20 to 30 minutes and can last more or less 6 hours.

Some analogues of rapid insulin have a much faster action and last only 3 hours. As brands may differ in your country, ask for advice. Your doctor or nurse will tell you about brands which are not familiar to you.

Long-acting insulin

In the vial, you see a cloudy liquid. Before using it, you must roll it very gently.

Some brands become active after 1 to 3 hours with duration of 12 hours or more.

The action of Lente insulin starts after 4 hours and lasts up to 24 hours.

Ask your doctor for information as in some countries you may find different names and brands.

Mixed insulin (mixtard 30 Hm or 70/30 Humulin)

This insulin contains 30% of rapid-acting insulin and 70% of long-acting insulin. This type is easy to handle, and the duration of action lies between that of rapid- and long-acting insulin.

Action of insulin

May vary, according to the place of injection: arm, leg, or abdomen.

If you exercise, the action is accelerated.

Fever may influence the action.

Having a cold may be the reason for slower action.

If you have swelling or unevenness in the injection area, the action is often slower.

How to use insulin?

There are many ways of using insulin. It differs according to your meal plan, and your activities. Here are a few examples of frequently used regimens:

- Two injections daily of a mixture of short- and intermediate-acting insulins (before breakfast and the main evening meal)
- Three injections daily using a mixture of short- and intermediate-acting insulins before breakfast; short-acting insulin alone before an afternoon snack or main evening meal; intermediate-acting insulin before bed; or variations of this
- Basal-bolus regimen of short-acting insulin 20-30 min before main meals (e.g. Breakfast, lunch and the main evening meal); intermediate- or long-acting insulin at bedtime
- Basal-bolus regimen of rapid-acting insulin before main meals (e.g. breakfast, lunch and

main evening meal); intermediate- or long-acting insulins at bedtime, probably before breakfast and occasionally at lunchtime

Other ways of using insulin

Your doctor or nurse may prescribe other ways for injecting yourself. It depends on your activities and the brand of insulin. Some are very long acting, some shorter.

It is impossible to explain everything in a booklet.

Insulin is sold in vials of 10 ml.

You may also find insulin in 3 ml cartridges used as "pens".

Your nurse will show you how to use the insulin with which you are supplied.

Where to inject insulin?

There are many places: arms, legs, abdomen, and buttocks. Ask your nurse and check with her about these.

Your arm: external surface of the upper arm; 2 cm below the shoulder to 2 cm above the elbow.

Your leg: on the anterior part of the thigh; 2 cm below the groin to 2 cm above the knee.

Your buttocks: on the upper and external part.

Your abdomen: but avoid the space around your umbilicus.

In each site, make sure that you change places every day.

If you always inject in the same spot you will see swelling and depressed areas. Doctors call these "lipodystrophy".

Keep in mind that the action of insulin varies during your various activities: if the muscles of the injection spot are actively involved, insulin will act much faster.

If you always inject in the same place, the action of insulin will probably be delayed or diminished. This is certainly true if you inject in a place where there is swelling.

How to keep insulin?

- Your reserves should be kept in a refrigerator between 4 °C and 8 °C.
- Never, ever put insulin in a freezer. Frozen insulin must be destroyed.
- Your vial in use must be kept in a dark, clean, and safe place, avoiding sunlight.
- Handle it gently, and do not shake too vigorously.

Injections

- Keep your insulin with the syringes in a clean place that is cool and safe.
- Check the syringe: they are made for use with 40 units/ml or 100 units/ml insulin.
- Make sure to use the correct syringe.
- Some syringes for 100 IU contain 1 ml, some 0.5 ml, or 0.3 ml. The volume is different but the concentration of units per ml is the same for the three different syringes.
- Most of the time, you are injecting yourself. It should also be useful for a parent to help you with the injection, for example if you were ill.
- For younger children, the injection is always given by a parent.

How do you prepare for your injection?

- Wash your hands with soap and water.
- Prepare insulin and syringe on a clean towel.
- Disinfect the top of the vial with an alcohol swab.
- Fill the syringe with a volume of air equivalent to the quantity of insulin to be injected.
- Put the needle straight into the vial and push the air into the vial.
- Turn the vial and syringe upside down, then pull the plunger to draw a quantity of insulin a little bit superior to the prescribed amount.
- Release the needle from the vial.
- Tap gently on the syringe, to make sure that air is lodged at the upper end.
- Keep the syringe vertical and push the plunger until all air is expelled from the syringe. ? Check the exact quantity of insulin.
- Never touch the needle with your fingers, or with anything else.
- If your doctor prescribes two different types of insulin, the safest procedure is to inject each one separately.

However, if you choose to mix the two types of insulin in the same syringe take the following steps:

- Wash your hands with soap and water.
- Check the exact quantity of the two different types of insulin.
- Gently roll the vial with long-acting insulin.
- Disinfect the cap of the vials with an alcohol swab.

- Fill the syringe with a quantity of air equivalent to the long-acting insulin.
- Push the air into the vial of slow-acting insulin. Remove the needle without drawing up insulin.
- Fill the syringe with an amount of air equivalent to the rapid-acting insulin.
- Inject the air in the bottle of rapid-acting insulin.
- Turn the vial and the needle with syringe attached upside down.
- Draw a quantity of rapid-acting insulin, a little more than the desired amount.
- Release the needle from the vial, keeping the syringe in the same position.
- Tap the barrel of the syringe gently to expel air to the upper part.
- Expel the air from of the syringe.
- Verify the exact amount of insulin.
- Turn the vial of long-acting insulin and insert the needle while holding back the plunger. Draw gently the exact amount of long-acting insulin from the bottle, taking care not to let insulin flow back from syringe into vial.
- At this point, never re-inject insulin into the vial.
- Release the needle from the vial.
- Your injection is ready for use.

The injection

When the syringe is ready, inject immediately. Wash the place with soap and water. Disinfect with alcohol (if the site is very clean, alcohol is not necessary).

Sit down in a comfortable position, in a quiet place.

You can inject directly at an angle of 90° with the skin.

Or you may make a fold with the two fingers of your left hand and inject at the base of the fold at an angle of 45° with the skin.

Always insert the needle completely. Most of the needles are very small and this is not dangerous.

Wait for a few seconds before withdrawing the needle, for a few seconds apply a swab to the point of injection.

Discard the syringe. Or if reusing, recap and put it in a clean box.

Never use alcohol to disinfect the syringe. Keep your materials in a safe place in a box or cupboard.

How to adapt your dosage of insulin

From time to time, the usual dosage of insulin has to be changed:

- You may feel signs of hypoglycaemia.
- You may feel signs of hypoglycaemia.
- You may find your blood glucose level normal or low.
- Sugar in urine is almost or totally absent all the time.
- You are in a situation when not enough food is available.

On the other hand:

- You may feel thirsty, dehydrated, tired, or be losing weight.
- Your blood glucose results are high.
- Your urine contains a lot of sugar.
- You find ketones in your urine.

You must try to avoid such situations, but from time to time, it will be necessary to adapt your insulin.

But be careful. It is impossible to make corrections if you are not recording your blood sugar and/or urine tests as frequently as possible.

You have to keep a good logbook of your results and other findings.

If you are not sure, or if you are unable to check your blood glucose and/or urine, ask the nurse or the doctor at the health centre or the clinic to help you.

You have to proceed carefully. Diabetes is a particular disease: Blood glucose may vary enormously during the day. Previously we have told you about more exercise, less food, stress, malaria, etc.

Firstly, we will describe how you should make adaptations with frequent checking of your blood glucose, and then how you should monitor sugar in urine, and clinical signs.

There are two ways of adaptation:

According to the results of the previous day or days before

According to the results of the day concerned.

Look at the results in your logbook

Here are a few examples:

Your morning results could be:

Too low	less than 60 mg/100 ml (3.4 mmol/l)	urine: no sugar
Normal	from 60 to 120 mg/100 ml (3.4-6.7 mmol/l)	urine: no sugar
Some elevation	from 120 to 200 mg/100 ml (6.7-11.2 mmol/l)	urine: sugar less than 1%
Really elevated	from = 200 mg/100 ml (= 11.2 mmol/l)	urine: > 1% of sugar.

You know that levels are higher after food intake and when going to bed;

ask yourself a few questions and consider the following: Low blood sugar:

- I forgot to eat.
- Not enough food taken.
- I ate too late.
- Unusual exercise: walking too far a distance to get to school, playing a football match, or doing gym.

High blood sugar:

- I ate too much, or took something during the day, such as a soft drink.
- Not enough insulin: you insulin vial is empty and you have no money to buy a new one.
- No physical activity: watching TV, sleeping too long.

As a general rule:

- If your results are too low, decrease your insulin dosage.
- If your results are normal or slightly increased, keep to the same dosage.
- If your results are very high one day, keep to the same dosage.
- If your results are high two days in succession, increase your insulin dosage.

As you can see:

This is only possible if you can afford a blood glucose test every day.

If not, try the following rules and check your urine for glucose:

- If you feel dizzy and hungry, are sweating or tired, and have no sugar in your urine, decrease your insulin.

- If you feel well and there is no sugar or very little, keep to the same dosage.
- If you see a large amount of sugar in your urine (2% or more) for two days, increase your insulin, only if you have food available (if not, be careful).
- If you find ketones in your urine, increase your insulin and report to your health centre or doctor.

How much insulin?

- If you are taking between 5 and 15 IU, change this by about 1 unit.
- If you are taking 15 IU or more, change this by about 2 units.
- If you find ketones, increase your usual dosage with 3 units every hour until you can consult your doctor or nurse.
  (See next Module)

If your results are not good and too high early in the morning for at least two days or more, consult your doctor. He will find out if increasing your insulin in the evening is indicated. It may be possible to take your insulin at a later hour.

Practice
If you take two injections a day:

Adapt your morning short-acting insulin with ..... IU according to the results in the morning and before lunch	Adapt your evening short-acting insulin with ..... IU according to the results at bed-time and early in the evening
Adapt your morning slow insulin with ..... IU according to the afternoon and evening results	Adapt your long-acting insulin according to the results of the night and next morning

It is better not to change the dosage of the two different kinds of insulin at once, but to do it step-by-step:

Adapt your morning short-acting insulin with ..... IU according to the results in the morning and before lunch	Adapt your short-acting insulin according to the results of blood glucose in the afternoon	Adapt your evening short-acting insulin with ..... IU according to the results at bed time and early in the evening
Adapt your morning slow insulin with ..... IU according to the results of the evening		Adapt your long-acting insulin according to the results of the evening and next morning

It is safer to take the decision with the help of your nurse or doctor, particularly in the beginning of the diagnosis of your diabetes.

Keep on the safe side if you are not sure.

Too much insulin is dangerous, since you may develop serious hypoglycaemia very quickly.

Too little insulin is also dangerous, but you have more time to take a decision. Complications take longer to appear.

HOW TO MONITOR YOUR DIABETES

Insulin injections must be adapted to your needs, which may vary from day to day. If you really want to control your disease properly, supervision and control are essential.

We have already explained the signs that you may experience. When you do not feel well, or dizzy, explain this to your doctor or nurse, who will tell you what the reason is and what to do.

Next, we will discuss the analysis of blood glucose, urine glucose, and ketones.

With modern appliances, it is possible to do all the tests at home or at the health centre.

For young people in need of insulin these tests are obligatory. However, we know that very different situations may exist. Firstly, we will explain the optimal pattern, and then we will explain how to proceed if you cannot afford to do the tests more often during the day.

You should always check your blood and urine for sugar, and occasionally for ketones.

The optimal situation

You check blood sugar and urine

- Early morning
- Later during the morning
- After food intake in the afternoon
- In the evening.

Sometimes it will be necessary to check your blood sugar at different times, such as when you are ill, urinate a lot, or feel dizzy.

If your blood sugar is high and if you pass a lot of urine, or if you are dehydrated, also check for ketones in the urine. If present, this is an emergency, and you need insulin immediately.

If you feel signs of hypoglycaemia: perspiration, hunger, weakness, or a dizzy spell, check your blood sugar if possible.

Other situations

Strips for blood glucose are expensive and in some places not always available, but you can check your urine for glucose, which is cheap and always possible.

Keep to a good habit and check your urine for glucose as often as possible:

Twice a day: early morning, and in the afternoon.

Check for ketones in urine when you pass too much urine, and when you feel thirsty or dehydrated.

Blood glucose should be measured as often as possible. This can be done, either at your health centre, in the hospital or at home. You may compare the results of the two tests, as this helps to know how much insulin you need.

Tools for measuring

Blood glucose

We use a glucometer to measure blood glucose. You may find different types of instruments.

Each one must be used with its appropriate strips. Never use strips for one instrument on another one. Each meter must be used according to the special instructions. Read them carefully or ask your nurse to help you.

Take care of the following:

Keep you meter in a dry place: humidity is dangerous. Do not keep it in the fridge. Keep it clean. Check the batteries; if not in use for a long time remove these. Calibration of the meter is necessary. Proceed according to the instructions.

Once you have opened a bottle of strips, you must use them within a relatively short period. Humidity is dangerous for the strips in an open vial. Close your bottle immediately after taking a strip for your measurement.

When you take two measurements directly after each other, they may differ by 10%. This is regarded as acceptable accuracy.

Wash your hands before the test. If your hands are very clean, you do not need to use alcohol. Use a clean lancet to prick your finger.

Urine test

There are various methods for testing sugar in the urine.

In different countries, you may find different materials.

Some chemicals, such as copper sulphate change colour in the presence of glucose, when heated. From blue, it changes to green, yellow, and red; the solution is called either Benedict or Fehling.

You could use this reaction. Your nurse will show you how to do the test. You will have to heat the solution. This method is inexpensive.

You may also use strips to check for glucose in the urine, though many react to very small amounts of sugar. Therefore, you will not know whether your urine contains too little or too much sugar.

The Diabur test 5000 is the only one that is accurate and gives reliable results. The results are easy to read, and you can see a difference between too little or too much glucose (from 0.5% to 5%).

Dip the strip into a sample of your urine. Shake off the excess urine and read the result at the exact time of testing (usually between 30 to 60 seconds after dipping).

Your logbook

The logbook is the place where you record your results, your injections, other treatments, illnesses, food, unusual exercise, hypo, and so forth.

This helps you to adapt your treatment, but is also a link between you and your doctor or nurse.

There are different types of logbooks. But anything can be used, such as a simple exercise book.

The most important thing is to record faithfully what you do and what you experience.

There are various models: try to find one that works for you.

Model 1. If you check your urine and blood glucose frequently during the day, and take insulin two or more times a day:

Month	Morning insulin	Noon		Noon insulin	Afternoon		Evening		Evening insulin	Bedtime		During the night	Next day		Observations
		ur	bg		ur	bg	ur	bg					ur	bg	
Monday															
Tuesday															
Wednesday															
Thursday															
Friday															
Saturday															
Sunday															
ur: sugar in urine; bg: blood glucose															

Model 2. If you check your blood glucose occasionally and take insulin twice a day or less:

Month	Morning insulin		Morning		Afternoon insulin		Afternoon		Observations
			bg	ur			bg	ur	
Monday									
Tuesday									
Wednesday									
Thursday									
Friday									
Saturday									
Sunday									
ur: sugar in urine; bg: blood glucose									

Your record:

- Injections: time and dosage
- Blood glucose: time and results
- Urine glucose: time and results
- Ketones
- Unusual experiences
- Unusual exercise
- Food
- Illnesses
- Results during your medical check-up: blood pressure (BP), pulse, feet, height, weight etc.

It is not easy to keep this record for weeks, months, and years on end, although it is necessary.

This will give you an overview of your diabetes, and how well you are coping with the main problems.

You will be able to make decisions more easily concerning the amount of insulin you need.

HYPOGLYCAEMIA

What is hypoglycaemia?

It means one's blood sugar is low, usually less than 60 mg/100 ml or 3.3 mmol/l.

What happens?

You do not feel well and experience signs, such as Sweating

- Shivering
- Hunger
- Stomach pain
- Fatigue
- Dizziness.

Your parents or friends will observe that your are

- Pale
- Sleepy

Unable to speak properly

Behaving oddly

Agitated at night, have bad dreams, and a headache on waking up in the morning.

You do not experience all these symptoms at once, usually only one or two; you must learn how to recognize them. You may possibly feel some other symptoms that should be recorded here.

What to do?

You should do something at once:

Otherwise, within a few moments you may not be able to drink or to swallow water or a soft drink.

You can lose consciousness (hypoglycaemic coma).

Hypoglycaemia is not dangerous if you or your parents take immediate action.

Do not wait

Stop what you are doing.

Sit down, and be calm.

Perform a blood test if possible, but do not waste time if it cannot be done immediately.

Drink a soft drink, such as Coke or Fanta, or take some sugar dissolved in water.

You should feel better after a few minutes.

Then eat a normal meal with bread or other carbohydrates (starches).

Is a blood glucose test necessary?

You can certainly act without this test, but it could help.

You can make sure that your dizziness is because of hypoglycaemia.

You will be able to follow your improvement during the next few hours.

1. Mild signs of illness

   Take some sugar.

   Wait and see if you feel better.

   Eat a normal meal.

   If it is your normal time for insulin, first take some sugar

   Then rest and wait until your feel better.

Take your insulin with your meal.

2. If you frequently feel the same signs

   If you do not feel better after eating sugar or a meal

   Rest and take some more food or sugar

   If you vomit, try to drink small amounts of a soft drink or sugar dissolved in water, sip by sip.

   Get help to check your blood sugar level

   If there is no improvement after 10 minutes or if you are still vomiting, get immediate help from the clinic or health centre or a doctor or nurse

   Try to remember whether you took your insulin without eating a normal meal.

3. If the signs and symptoms are serious

   If a child or young person is unable to eat or is in a coma, the parents, teachers, or someone must take the responsibility and act immediately.

   If available: a parent or other adult must inject Glucagon: one vial intramuscularly.

   If not available, ask a nurse or doctor slowly to inject 30% or 50% glucose intravenously (the medication and syringes should be available).

   In both cases improvement must be instantaneous.

4. What to do the next day

   Write down in your diary or log book the time and date of your hypoglycaemic incident. Write what you did, and how you recovered.

   Think about the reason.

   Did I eat after my injection? Did I take some unusual exercise, such as gymnastics, football, or extra walking?

   If the response is obvious, it is not necessary to change your dosage of insulin.

   If you find no reason, or if food is scarce, then you must slightly decrease your insulin.

   Ask your nurse or doctor how to do this.

5. Hypoglycaemia during the night

   You experience bad dreams, or sweating during the night, or a headache on getting up.

   If possible, check your blood glucose before going to bed.

Eat some food before going to sleep.

If your physical activity is unusual, take less insulin (1 or 2 units less).

What kind of food or drink to take during your hypoglycaemic incident

Sugar diluted in water: 1 teaspoon for small children, 2 for teenagers; 3 for adults weighing more than 50 kg.

Honey: diluted in water: 1 to 3 teaspoons.

A soft drink, coke or something similar: 100 ml to 300 ml.

As a second choice: fruit juice, fruit, cake, biscuits, or chocolate.

Never use diet coke

Explain to people around you, your friends or teachers that sugar and soft drinks are normally not permitted, but that during hypoglycaemia these should be taken. It happens quite often that less knowledgeable people do not make the right decision.

What is glucagon?

This medication raises the blood glucose for a few hours.

If available in your country, you should keep a vial in your refrigerator (not freezer).

The medicine must be diluted with water in a syringe, and injected in the same way as you would inject insulin, or deeper. Anybody can inject glucagon, it is not dangerous, but you must ask a nurse to show you how it is done and practice injecting.

In many African countries glucagon is not available (it is difficult to store).

Keep one bottle of glucose solution 30% or 50%. One bottle must be kept on hand with syringes.

In case of emergency a nurse or doctor can inject the content intravenously.

Usually the person will wake up immediately.

HYPERGLYCAEMIA WITH KETONURIA

This means that you have too much sugar in your blood (and your urine) sometimes with ketones in you urine. This could be dangerous.

How do you know that you have hyperglycaemia?

Sugar in urine: more than 2%.

Blood sugar 250 mg/100 ml or more, up to 400 mg/100 ml or more.

Ketones in urine.

What are the signs?

Thirst

Dry mouth

Frequent passing of urine

Tiredness

Loss of weight,

and later:

Nausea, vomiting; stomach ache

Rapid breathing

Loss of consciousness.

Act immediately; you have time but it is dangerous to ignore these signs.

What to do if

your blood glucose is more than 250 mg/100 ml;

urine sugar is more than 2%;

ketones are present in urine, and the first signs such as thirst, or a lot of urinating appear

then: take your usual insulin, but add some regular rapid-acting insulin 1/10th of your total daily dose;

after two hours, repeat insulin injection and test for blood glucose, and glucose and ketones in urine;

drink a lot of water and eat normally;

get help, if not possible repeat again every 2 hours;

rest until ketones disappear from you urine.

If you feel better after a few hours, blood glucose and glucose in urine will decrease.

Usually ketones are present for a longer time, this is not dangerous;

you have time to go for a consultation and discuss your treatment.

Write everything down in your logbook. This will help in making a decision later on.

If the situation is not improving

You still feel thirsty, and often pass urine in quantity.

Continue to supplement your insulin.

If you vomit or are unable to drink, hospital admission is vital. You probably need intravenous fluids under close supervision.

What are the reasons for hyperglycaemia?

You forgot your insulin.

Your dosage is incorrect, either the prescription is insufficient or there has been some error when injecting.

Your insulin is not stored properly (in a hot climate).

You did not eat and took no insulin.

Your insulin bottle is empty and you could not afford to buy a new one.

If you use a pen, you injected air instead of insulin.

May be you need more insulin.

You are ill with malaria, diarrhoea, fever or some other medical emergency.

You have reached puberty and are growing fast.

How can you avoid such a situation?

Never stop your insulin injections.
If you cannot eat, try at least to take a drink (a soft drink is allowed in such a case).
Monitor your diabetes regularly by checking your blood sugar, glucose in urine;
thus, you are warned that a dangerous situation is possible, and you can act in time.
Ask for advice from your nurse or doctor if some unusual problem arises.

Can one have ketones in urine with normal or slightly abnormal glycaemia?

Yes.
If blood glucose is normal or slightly abnormal, and there is no sugar or ketones present in urine, this is not dangerous.
Take your usual dosage of insulin, and eat normally. Ketones are often present if you do not eat enough; this is certainly true for very young children.

FOOD FOR YOUNG PEOPLE WITH DIABETES

Why do we talk about food?

Food is an important part of you life.
Food has an influence on your blood glucose.

You get energy from your food and you need it to grow and to lead a normal life.

What kinds of food should you eat?

Carbohydrates, starches, and sugars, which are a source of energy for the functioning of your muscles and intellectual activities.
Fats or lipids are also a source of energy.
Proteins are necessary for building your body.
Vitamins and minerals are necessary in very small quantities for certain bodily activities, for example iron for your red blood cells, calcium for your bones.
Fibres help you to digest your food.
Water helps your circulation, and the functioning of your kidneys and other organs.

Drawings of the compositions of some foodstuff

Foodstuffs are divided into different categories:

Carbohydrates
They can be divided into
Starches or carbohydrates with a slow digestive rate.
Sugars with a rapid digestive rate.

The difference is very important and you should keep this in mind.

Carbohydrates for slow digestion are the principal parts of food. More than 50% of your energy comes from them. People with diabetes need energy and must eat starches or slow-digesting carbohydrates.

A few examples are bread, manioc, rice, plantain bananas, cassava, sweet potatoes, potatoes, lentils, beans, pasta, maize, millet, soy, or couscous. Most of these also contain vitamins, fibres, and minerals. They are as essential to you as they are to people not having diabetes.

Each meal must contain a certain amount of carbohydrates.

Fruits contain carbohydrates in variable quantities, as well as fibre. Such fruits as papaya, oranges, apples, pears, grapefruit, mangos, pineapples, and grapes are excellent. Eat fruit every day in a quantity dictated by the carbohydrate contents.

Vegetables contain very few carbohydrates, but have more vitamins and fibre. Here are a few examples: green manioc leaves, cabbage, spinach, carrots, tomatoes, cucumbers, green beans, green salads, and many others, which differ from country to country.

Most foods with rapidly digested carbohydrates are very high in sugar and not well adapted to your regular meals. Their digestion can cause a rapid increase in your blood glucose thereby complicating your diabetes control.

Here are a few examples: cane sugar, fruit juice, soft drinks, honey, jam, sweets, chocolate bars, and

ice cream. These are not part of your usual meals. Take them only for hypoglycaemia or during vigorous exercise.

Some of these foods contain sugar, as well as a variable amount of proteins and lipids, such as biscuits, cakes, pastry, corn flakes, and sandwiches. These are not advisable as your regular meals, or should just be taken in small quantities.

Lipids or fats

These are a source of energy, and contain vitamins A and D.

You eat them in moderation. An excess of fats makes you obese. Consume them according to your level of activity: if you are physically very active, you may use more.

Here are a few examples: maize oil, palm oil, sunflower oil, peanuts, coconut oil, olive oil, butter, and margarine.

You will also find lipids in mayonnaise, cheese, milk, pastry, some meats, some fishes, cakes, peanuts, and other nuts.

Proteins

These are of animal or vegetable origin. They are an essential component for building a strong body, and for helping you with your daily life.

Here are a few examples:

Meat, such as beef, pork, chicken and others
Fish,
Eggs
Milk, cheese, yoghourt
Peanuts, lentils, peas, cereals, bread

You need a good portion of these every day.

A healthy diet for everyone

Provides the required amount of energy, but not too much, and should be divided in three or more meals a day.

The energy you need will be according to your age and your physical activity.

Energy provided by food is measured in calories.

Here are a few simple guidelines

1. Carbohydrates and starches form the basis of your meals.
2. Vegetables: eat plenty, as many as you like.

3. Fruits: one fruit per meal.
4. Milk and dairy products; if possible a cup or more daily.
5. Meat, fish, eggs: normal quantities every day, which should include beans, peanuts, and lentils.
6. Fats: be careful not to take too much. Avoid cooking with too much oil.
7. Drink plenty of water.
8. Avoid soft drinks.
9. Avoid sweets almost all the time.
10. Divide your meals into three or more per day.

Here are a few mistakes that should be avoided

1. Too many calories.
2. Too many fats.
3. Not enough carbohydrates.
4. Too many sweets.
5. Not enough fruit.
6. Not enough vegetables.
7. Too much salt.
8. Not enough water.
9. Irregular meals.
10. Skipping meals, or having only one big meal in the evening.

Your diabetes is not a sufficient reason for eating special foods.

Eat the ordinary food with the family, but keep in mind the various "do's" and "don'ts" as listed above.

Time schedule for your meals

This is your most difficult problem, particularly in Africa.

As you already know, the pancreas usually produces insulin during the day in the exact amount required by the ingested food, and exercise.

In a person with diabetes, insulin is injected according to a pre-established pattern. Once injected,

insulin starts to lower your blood sugar. At this moment food is absolutely essential for increasing your blood sugar, but the best food is complex carbohydrates, because they increase the blood sugar gradually.

How to organise your day

Inject your morning insulin.

After 10 to 20 minutes (depending on the kind of insulin; ask your doctor) have your breakfast.

Do not forget this meal!

Take a snack in the morning around 10:00, such as bread, peanuts, sweet potatoes, some porridge or ugali. If going to school, take a snack along, and never forget to drink water.

If possible, plan for three meals a day. Try to keep some food for the next meal if you are not sure that the person who prepares the food will be ready on time. This can be challenging.

Some days you may eat more. Other days you may not be hungry, or food may not be available.

You may have a sports or gym programme, or you may have to walk far.

Try to adapt the amount of your insulin injection.

Breakfast

This is an important meal. Do not skip it!

Eat starches and choose among bread, rice, cereals, porridge, ugali, or fufu, according to your habits.

Add one portion of fruit or peanuts, and some butter or peanut butter.

Drink tea or coffee, and if possible milk.

At noon and in the evening

Select food from the different categories.

Use your five fingers to remember:

1. Vegetables as well as soup.
2. Meat; fish, eggs or other proteins.
3. Bread or carbohydrates, such as maize; fufu, potatoes, sweet potatoes, cassava.
4. Milk or cheese.
5. Fruit.

Always drink enough water.

Your ten o'clock morning snack is essential. Your insulin is still active in your body, and you must eat something to avoid low blood sugar around midday. For example, eat some bread, peanuts, porridge, a fruit, or biscuits. You may keep part of your breakfast to take with you to school.

Other snacks. This depends on the time of your evening meal. If it is usually late, take a very light snack around 16:00. If your evening meal is early, take a very light snack before going to bed. Here are examples: some bread, some leftovers from your main meal, half a banana, a fruit, or a small biscuit.

How much food?

You know that food is necessary for building a strong body and for your development. Check your height and weight regularly. Ask your doctor or nurse if you are growing normally. If so, you are eating enough. If your weight is insufficient, you should try eating more. If you are a bit overweight, try eating less, especially fats.

Sugar for persons with diabetes

I like my tea sweet. Could this be possible? Yes, if you wish you may use special "sugar" for people with diabetes. This you will find in small tablets or in a powder. Most of these contain no calories, since they are made of non-caloric sweeteners such as aspartame, cyclamates, and saccharine. They have a sweet taste but are not "sugars" and have no influence on your diabetes. Ask you nurse which products you may use.

Other special foods for diabetes are not necessary and you should avoid them. They are very expensive and often contain a lot of fat. You can organise your meals without using them.

A very important rule to remember is that carbohydrates or starches should be taken at each meal in equal quantities.

LIVING WITH DIABETES

Now that I have diabetes!

Along with my parents, a brother, or a sister, I have learned to:

- inject myself
- control my urine glucose, and blood glucose
- write-up my logbook
- eat healthy meals
- take exercise
- cope with hypoglycaemia.

At home, my family and I are responsible for my treatment. We also know how to get help from the medical team or the health centre. Together we have to practice the various procedures every day. It takes time to gain experience in this new responsibility I must meet with the medical team regularly, and check on my condition.

What to do? Injections every day (2 or 3 or 4) write here how many .....

Blood glucose every.....

Urine glucose .....

Ketones in urine .....

Consultation every .....

Medical visit every .....

(Write down how often according to the recommendation of the doctor).

Find help

Telephone number .....Name .....

My health centre .....

My special consultant .....

In case of emergency.....

My hospital .....

Teaching sessions for young people with diabetes: where and when.....

My books about diabetes.....

My supplies of insulin, syringes, strips .....

Consultation at regular intervals

With the team: doctor, nurses, and dietician. If possible, I should attend in company with one of my parents or a relative. Together we check on the previous treatment and results, and look at my logbook:

How much insulin.

Blood glucose results.

Hypoglycaemia.

Food and meals.

Physical activity.

Diseases; such as malaria, diarrhoea, or a cough.

Special problems at home, school, or elsewhere.

I attend the consultation and take along:

My logbook.

My equipment for measuring blood glucose and urine (glucometer, strips, or other).

I ask questions if I see that control is not good enough or if I have other concerns.

I make sure that my supply of insulin, syringes, etc. is adequate.

In some places, the doctor is able to perform a special test to see if the control was effective during the past three months. This test is called glycated haemoglobin. The results are expressed as a percentage of my haemoglobin.

A normal test is 5%. A good test is 6% and sometimes 7%. However, over 7% is not very good. This means that I have to change either insulin, or my meal plan. I discuss this with my doctor or nurse and my parents.

Regular check-ups

At least once a year you need a real good medical check-up.

A few questions should be considered:

Food: is my meal plan correct for my age and activities. Do I really understand what is good for me?

Hypoglycaemia: do I know exactly what to do in such a case?

Other special problems:

Psychological difficulties.

Questions about puberty, e.g. for girls: menses.

Is insulin injected properly with clean equipment, in the right place, with the right needles, and no fatty lumps or hollows in the injection area?

Do I know exactly how to check urine, or blood sugar?

Do I know what to do if my blood sugar is high or low?

How is my foot care, dental care and my personal hygiene?

Personal care

Take care and examine your feet daily. Keep them clean and dry. Avoid soiling, and wash them when soiled by rain or mud.

You may not have problems with your feet if you are young, but possibly later on. Ensure good habits and look after your feet daily. Wear comfortable shoes or sandals – no high heels or narrow shoes.

Ask the doctor to check if your sensations are normal. You could experience numbness, tingling, prickling, or no feeling at all.

Ask for help even when you have a minor scratch.

Dental care is very important. Avoid caries and infection of your gums. Brush your teeth twice a day. Visit the dentist once a year, and more often if you have a cavity or infection. Losing control of your diabetes can be a consequence of a tooth or gum infection.

If something goes wrong

We have discussed hypoglycaemia. Check the signs, if you act promptly there should be no danger.

If you experience hypoglycaemia very often, ask for advice and adapt your treatment and meal plan.

If your blood glucose is high most of the time, and if you have sugar in your urine, the treatment has to be adapted. Together with your doctor or nurse, and with the help of your parents if possible, find a new schedule for insulin, meals, and activities. It is not always easy, but with perseverance and patience, you will succeed.

After a few years of diabetes, your small arteries can suffer if your blood glucose is not normal. Therefore, the arteries in your kidneys, eyes, and nerves must be examined.

A good control of your blood glucose protects you from this damage.

If you check your eyes, albumin, and your nerves regularly, it is possible to stay healthy and enjoy life.

What kind of check-ups is necessary?

Each year go for an eye examination (the fundoscopy, with a special light).

Have your blood pressure checked.

Have your urine tested for albumin.

The doctor will test your nerves and see whether you have normal sensations in your feet?

How often these tests are necessary will depend on your age and your health status. However, it is better to prevent complications or problems, and therefore attend at least every three months.

In many cases, it is possible to prevent complications of diabetes. But it is very difficult to treat eye problems, or renal complications. Be very careful, since wounds heal slowly especially those on your feet.

Family

Your family will help you to cope with your disease, but you yourself must try to perform all the tasks as soon as possible.

Diabetes does not mean that you have to lead an exceptional life. You may eat ordinary food, with a few limitations (for example, no soft drinks, no sweets, no cake).

The real problem that families have is that you need food at regular intervals, and we know that is not always possible. Ask your mother or another relative to help you. They may keep a small amount of food from a previous meal for you.

Supposing that your parents either are absent, dead or separated, try finding support from another relative: sister, aunt, or uncle.

Your family may find your treatment expenses a problem.

In some countries, there may be support for young people with diabetes. Check with your doctor, or nurse or an association for people with diabetes whether this is the case.

School

Diabetes is no excuse for dropping out of school, but there are some problems. Before you resume school after being diagnosed with diabetes, you must learn how to treat yourself. In many countries, we have a "school for diabetes" where you learn how to monitor your diabetes. This is the first step. It takes a few days, but later on when going back to school it enables you to follow classes without much trouble. This instruction is available at the hospital or health centre, or with an association.

Your schoolteacher must know that you have diabetes. You may have to go to the toilet more often, or drink between meals. A snack at mid morning is usually necessary. Take water with you, particularly in a hot climate.

In some places, you may attend special teaching days or camps.

Your teacher must know what to do (who to call or where to go to for help) if you experience a hypoglycaemic incident.

Travelling

In many places in Africa, travelling is not easy, therefore be very careful and go prepared. Try to have insulin, syringes, needles, and strips for blood glucose with a meter in good working condition. Make use of a checklist to ensure you carry all necessary supplies. Learn how to monitor your diabetes and how to take your insulin.

In many places, refrigerators are not available, and it is difficult to keep insulin for a long time.

Walking long distances is exhausting and depletes your energy reserves. In such cases decrease your insulin, or take more food if possible. Watch your feet for blisters and erosions, and wear good comfortable shoes.

Travelling by car or lorry can be long and exhausting. Make sure that you have enough water to drink and extra food with you, as well as your insulin.

Travelling by plane in Africa may be linked to long waiting times and difficulty with connecting flights. Take all your medicine, needles, and your meter with you in your hand luggage. Take some food and a bottle of water. Long delays or cancelled flights are a possibility.

A travelling problem common to young people is experienced when they attend school in a remote city and board with family members. One has to be sure that the family is willing to help in case of problems during diabetes treatment.

Can a patient with diabetes choose any job or career?

Some jobs involving safety are not advisable, such as bus or truck driving, aircraft pilot, or working at elevated heights (construction work), etc. Neither should you choose a job with very irregular schedules, involving travelling to remote areas, the military, etc. Some companies have difficulty in hiring persons with diabetes.

Sport and physical activity

1. This is excellent for a young person with diabetes.
2. Diabetes is no reason for sitting still. Try to play outdoors, play football, go to the gym, walk, and do some gardening. But be careful: before unusual exercise: take a bit more food or decrease your insulin.
3. I hope that you enjoy playing outdoors, jogging, walking, being part of a football team, or doing gymnastics.
4. Be careful: during exercise, you will need either more food or less insulin. Eat something during your sporting activities and drink sufficient water.
5. Discuss with your doctor or nurse how to adapt your treatment.
6. Be careful about your feet.

Some activities involving risk are not permitted, such as boxing, catch, violent sport, and other dangerous games.

Medical treatment

Vaccinations

Your national vaccination schedule should be followed.

This is usually provided until age 5 or 6 years.

After that: renew your vaccine against tetanus every 10 years.

Consider: rubella for young women.

Hepatitis if possible.

Medication

You are treated for many other diseases in the usual way.

Malaria tablets or tablets for fever should be used when necessary.

Malaria and quinine can lower your blood glucose. Your doctor should measure your blood sugar more often when you are ill.

Other diseases may increase your blood glucose.

If possible, avoid multiple intramuscular injections, which are very popular in many countries. Most ailments can be treated with oral medicine.

Always tell the doctor in charge, for example in the emergency room, that you have diabetes.

If you have diarrhoea try drinking enough water. You may use rehydration salts. If not possible, you will need fluids intravenously.

Some medications increase your blood sugar, for example cortisone. If you must take it, the doctor will adjust the treatment and the insulin dosage.

MODULE 4-2: GESTATIONAL DIABETES AND DIABETES IN PREGNANCY

DETF: DIABETES IN PREGNANCY

Through the entire peri-natal period, women with pre-existing diabetes and gestational diabetes have special needs and concerns. These are best attended to by using the multidisciplinary team approach. Members of the team include an obstetrician, a diabetologist, a nurse educator, a clinical officer, a nutritionist, a midwife, a social worker/psychologist, a lay diabetes educator, and the client.

The team's goal is to co-ordinate care and education for the pre-pregnant and pregnant women with pre-existing and gestational diabetes. Throughout the peri-natal period, the woman with diabetes meets with various team members for medical care and/or diabetes self-management education. Each team member reinforces and evaluates the woman's application of the self-management skills she has received from the entire team. The multidisciplinary team works together to provide integrated care within these areas:

- Pre-conception counselling.
- Medical management/nursing intervention.
- Nutrition.
- Psychosocial.
- Exercise.
- Newborn care.
- Postpartum.
- Breastfeeding.
- Contraception.

Goals: To improve pregnancy outcomes for both mother and baby.

Objectives

1. Define diabetes in pregnancy; pre-existing and gestational diabetes mellitus (GDM).
2. Asses the status of pregnant women with diabetes.
3. Screen women for GDM.
4. Identify the risks for the mother and the baby.
5. Describe pre- and post-conceptual care for women with diabetes.

Pre-existing diabetes, type 1 or 2

Women with pre-existing diabetes can become pregnant. Just like non-diabetic women, they have special needs because of the effect of diabetes on pregnancy and vice versa. They need counselling on the importance of planned pregnancy. The diabetes educator should discuss the following topics:

Contraception.

Optimal timing of conception.

GDM is a condition of abnormal increase in blood sugar that occurs during pregnancy and returns to normal after delivery.

Assessment of mothers with diabetes

1. General medical history, history of diabetes management, history of previous pregnancies, approximation of previous control since diagnosis.
2. Blood pressure, goal 130/80. This goal should be medically managed. ACE Inhibitors should not be used.
3. Fundoscopy should be done by an ophthalmologist early in pregnancy or prior to planned conception. A complete fundal examination should be repeated several weeks prior to delivery. If retinopathy is present, a caesarean section is indicated as vaginal delivery may rupture the retinal vessels.
4. Neurological evaluation. Is there impaired autonomic response to hypoglycaemia? Peripheral neuropathy, gastrointestinal functional impairment?
5. Current diabetes management. What is the nutritional plan, drug therapy? If a woman with type 2 diabetes has been on oral agents, revert to pre-conception insulin treatment as soon as she presents for care. If the woman is using insulin, advise her that the first trimester may make her more susceptible to hypoglycaemia. During the second and third trimester, the insulin dosage will increase because of the hormones, which cause insulin resistance during pregnancy. This calls for a rise in the dosage on a frequent basis.
6. General health pre-pregnancy screening, Laboratory assessments.

7. Diabetes-related assessments: HbA1C, creatinine clearance (if elevated, do a 24-hour urine protein test), thyroid panel, lipid profile, ECG if history of cardiovascular disease or elevated lipid profile.
8. What is the mother's knowledge/skill for self-management? What is her attitude to self-care, value of this pregnancy, and motivation for self-care?

Screening for GDM

Screening for GDM should be performed for women at high risk.

High risk

- Age above 35 years.
- History of large (above 4 kg) babies.
- Family history of diabetes.
- Previous GDM.
- History of problematic pregnancies.

The standard 75 g OGGT should be used with the same cut-off values, although a 2-hour blood glucose level > 7.8 mmol/l (140.4 mg/dl) (IGT) should result in the same intervention as for diabetes.

Fasting or any other elevated level is positive for GDM.

Risks to the mother with diabetes

If blood glucose levels are not maintained throughout the pregnancy, the mother is at risk for:

- Spontaneous premature delivery.
- Polyhydramnios.
- Hypertension, toxaemia.
- Foetal death.
- Stillbirth.
- Rapidly advancing renal, retinal damage.
- Vaginal lacerations.
- Infections: vaginal, urinary tract.

Risks for infants of women with diabetes

- Macrosomia.

- Hypoglycaemia first 72 hours/life.
- Hyperbilirubenemia.
- Polycythemia.
- Hypocalcaemia/hypomagnesemia.
- Respiratory distress syndrome.
- Birth trauma.
- Intra-uterine foetal death caused by maternal diabetic ketoacidosis (DKA).
- Low birth weight.
- Small-for-gestational age.
- Congenital anomalies.
- Prematurity.

Discussion

It is presently believed that the hormones produced by the placenta cause an exacerbation of microvascular growth in the eyes and kidneys of the mother with long-standing, poorly controlled diabetes.

The increased risk of intra-utero death of the foetus close to the due date is believed to be caused by hyperglycemias causing the placenta to become post-mature. If blood sugar is not controlled, phagocytosis is impaired, leaving the woman vulnerable to opportunistic infections.

If the baby is macrosomic, the chances of vaginal tears are increased.

Implications of hyperglycaemia in relation to pregnancy

In the absence of diabetes, metabolism of pregnancy is as follows: the foetus depends on the mother for fuel via the placenta; the mother is the regulator of the fuel provision. The glucose and ketones passively diffuse across the placenta. Insulin DOES NOT cross the placental barrier.

In the fasting state, the free fatty acids (FFA) and ketones are expected to be higher than in the non-pregnant state. Glucose and amino acid levels drop more quickly; gastric contents empty more rapidly during pregnancy, thus, there is an earlier peak of glucose in the blood, as well as faster entry of amino and fatty acids into the blood stream from the small intestine.

In the non-fasting state, the postprandial blood glucose goes higher and stays elevated longer during pregnancy. As pregnancy progresses, the aforementioned changes are more pronounced.

In the pregnant state (without diabetes) there are dramatic increases in basal and postprandial insulin levels (3x). The insulin needs are usually lower in the first trimester but as the pregnancy

progresses and the hormones of pregnancy cause significant insulin resistance, the demand rises appreciatively.

In the poorly controlled women with diabetes, the foetus receives excess glucose, probably less amino acids and more fatty acids. With this altered metabolic state, the different systems (cardiac, neurological, etc.) are at risk of developing abnormally, thus the increased risk of congenital abnormalities if poor control exists during the first 10 weeks of pregnancy. Poor control during the second trimester puts the baby at risk of central nervous system abnormalities and behavioural problems in childhood. Poor control during the last trimester puts the baby at risk of intra-uterine death, lung immaturity, and hypoglycaemia at birth.

The macrosomia is a result of the maternal hyperglycaemia. The mother's glucose crosses the placenta but her insulin does not. At ten weeks' gestation the foetal pancreas starts working, producing insulin when the blood glucose stimulates the glucose receptor of the foetal pancreas. If the mother is hyperglycaemic, excess sugar reaches the foetus and provides excess stimulus to the glucose receptor, developing fat and not muscle, on the foetus causing the macrosomia. The babies of poorly controlled diabetic mothers actually have a higher fat to muscle ratio compared to the babies of other mothers. This has implications for a tendency of obesity in the child, putting them at lifelong risk of easy weight gain. Being in an environment of altered protein, fat, and carbohydrate metabolism in utero predisposes the child to type 2 diabetes, often occurring in adolescence or young adulthood.

Hypoglycaemia soon after birth occurs if the diabetes was not well controlled for several days prior to delivery. Maintenance of good control (3.5 to 7.8 mmol/l) is to prevent over stimulation of the foetal beta cells. Once they are hyper-stimulated, they remain hyper-productive for several days thereafter, even if the glucose stimulus has been reduced. The foetus has received glucose via the placenta for the duration of the pregnancy; once the umbilicus is cut the baby loses this source and if the beta cells were hyper-stimulated they will continue to make insulin, lowering the baby's blood glucose severely if not fed with glucose water or put to the breast soon after delivery.

Respiratory distress syndrome happens because surfactant, the enzyme that matures the lungs in utero, is suppressed when there is excess insulin in the foetal circulation. This can be minimized by getting good control for two weeks prior to an induction or planned caesarean section at 38 weeks gestation. Prednisone can be given to the mother several days prior to delivery to speed lung maturation.

Birth trauma, i.e. fractured clavicle, can be caused by shoulder distocia. The mother should be evaluated prior to delivery to estimate the risk; if the baby is too large, plan a caesarean section.

Regarding blood idiosyncrasies, do a haemogramme and test for electrolytes soon after delivery. Blood glucose monitoring should be done hourly for the first several hours, then two-hourly for the next 24 hours.

Regarding birth anomalies, a neonatologist should evaluate the baby after birth.

Management

Goals for management

Fasting BS	3.3 to 5.0 mmol/l (59.4 - 90.0 mg/dl)
Before meals	3.3 to 5.8 mmol/l (59.4 - 104.0 mg/dl)
1-hour postprandial	6.1 to 7.8 mmol/l (109.8 - 140.4 mg/dl)
2-hour postprandial	5.0 to 6.7 mmol/l (90.0 - 120.6 mg/dl)
Bedtime	5.0 to 6.7 mmol/l (90.0 - 120.6 mg/dl)
2:00 - 6:00 am	3.3 to 6.7 mmol/l (59.4 - 120.6 mg/dl)

Blood sugars above 7.8MM (140.4 mg/dl) carry an increasing risk for maternal and foetal problems.

First urine sample testing for ketones is necessary as insufficient caloric intake or wrong distribution of meals may drive the woman into fat metabolism: presence of ketones has been known to have adverse effects on the foetal brain development. If ketones are present, a thorough reassessment of the woman's nutritional intake is needed. A bedtime snack of protein and carbohydrates will prevent hypoglycaemia and ketosis. No more than 10 hours without food should pass.

Hypoglycaemia

Women with pre-existing diabetes usually experience hypoglycaemic symptoms at a lower level 3.3 mmol/l (59.4 mg/dl) than in the non-pregnant state 3.9 mmol/l (70.5 mg/dl). The longer the duration of diabetes, the greater the possibility of hypoglycaemia unawareness is. Test blood sugar before driving or operating dangerous equipment. Carry treatment for low blood sugar at all times. See previous Module on hypoglycaemia.

It is important to note that the stomach may be in spasm when the sugar is low so the woman should not trust ingested food to get into the small intestine rapidly. Trust glucose, sugar, and sweets in the mouth to raise the blood sugar quickly and reliably. If there is sudden, unexplained hypoglycaemia, there may be sudden foetal demise. If the foetus dies in utero there will be a sudden drop in blood glucose 24 hours before spontaneous labour starts.

Hyperglycaemia

Antepartum: Blood glucose is persistently above 7.8 mmol/l (140.4 mg/dl).

Target should be 3.3 to 7.8 mmol/l (59.4 to 140.4 mg/dl).

Identify the cause of the hyperglycaemia:

Is there an infection?

Review the dietary intake.

Is insulin dosage adequate?

Is insulin dosage correctly drawn-up and administered? Abdominal site is the best throughout pregnancy.

Exercise regularly.

Medication

The woman with type 2 diabetes should be put onto insulin if the diet is not effective in achieving good control. Do not use animal insulin during pregnancy. For a woman with type 2 diabetes using insulin for the first time, the dose should be calculated around 0.5 IU/kg/24 hours, with ? of the total dose in the morning before breakfast, ? in the evening before supper. The easiest regime is to use mixed insulin, like Mixtard or 70/30, or if this is not available then use the total morning dose of 30% short-acting and 70% intermediate-acting insulin in separate syringes. The same applies for the evening dose: 30% short-acting and 70% intermediate-acting insulin. Secure the syringe to the bottle with a rubber band so that the insulins are not mixed and the short-acting insulin "contaminated". The most appropriate injection site is the abdomen as a absorption is fastest there. As the pregnancy advances, avoid leg sites since circulation in legs is affected by uterine pressure.

INSULIN DOSAGING

5TH MONTH GESTATION	0.5 IU/kg/24 hr
6TH MONTH GESTATION	0.6 IU/kg/24 hr
7TH MONTH	0.7 IU/kg/24 hr
8TH MONTH	0.8 IU/kg/24 hr
9TH MONTH	0.9 IU/kg/24 hr]

If the woman has type 1 diabetes and is monitoring her blood glucose, the dosage should be adjusted to meet the blood glucose targets.

For most women without long-range complications, walking is the best and least expensive exercise. They should take their exercise 5 out of 7 days per week to get the ongoing effects (reduction in insulin resistance) of the exercise.

See Module 3-5(a) on nutrition.

Preparation for delivery

If the baby is a reasonable size, an induction should be planned at 38 weeks' gestation. The woman should bring her own glucometer and monitor her blood glucose hourly during induction.

For the mother with type 1 diabetes, there should be an insulin/glucose intravenous drip regulating her blood glucose level.

For women with type 2 diabetes, the insulin dose should be discontinued once induction is started. An intravenous glucose drip should be initiated and regulated according to the blood glucose levels.

After delivery, there is a sharp drop in the need for insulin in both diabetes types. Discontinue insulin for type 2 and be guided by the blood sugar levels. For type 1, cut dosage to pre-pregnant dose and observe blood sugar. Lactation may further reduce insulin requirements.

Gestational diabetes

Most women with GDM can be managed with diet and exercise. If blood sugar does not reach the target levels, start with insulin treatment. The Dawn phenomenon is common in GDM so fasting blood sugar will indicate when insulin should be initiated. Often an evening dose before supper, starting at 10 IU to 12 IU insulin, can control the fasting blood sugar for a while and adhering to the diet with a well-controlled fasting blood sugar level may see her through for a while before pre-breakfast insulin needs to be added.

There is no risk of a genuine GDM having congenital abnormalities in the baby, as the blood glucose had not been elevated during the formative period.

The woman needs to be counselled about the risks to the foetus if diabetes is not controlled. She also needs to know of her chances of a high-risk delivery and possible neonatal distress after delivery.

EDUCATIONAL PROCESS

MONITORING

Mothers should be taught to monitor blood glucose if they can afford to do so. Most important times for testing are during fasting and 1-hour postprandial.

Blood glucose monitoring is definitely an advantage if economically possible. It can give excellent feedback on food intake and appropriate amounts. It will indicate when and if insulin is necessary.

As the woman is newly diagnosed with diabetes, she should complete her diabetes self-management education and be given psychological assistance to handle the additional stress of this pregnancy.

SEE DIABETES TEACHING GUIDE/CHECKLIST for what needs to be taught.

MATERNAL ASSESSMENT

When was she diagnosed?

GTT results.

Education already received.

Treatment plan.

THE EDUCATIONAL PROCESS

Client assessment: personal data.

Learning needs – do not take anything for granted.

Pregnancy-related learning barriers:

Low blood sugar Fatigue

- Hunger
- Discomfort when sitting
- Other children present
- Health beliefs
- Nausea
- Urinary frequency
- Time constraints

Predicting success

This depends on the degree to which the client believes she can perform diabetes self-care behaviour.

Performing this behaviour will positively influence blood glucose control. Good blood glucose control will positively affect the outcome of pregnancy.

Documentation of what was taught, and what was learned, is very important. As legal documentation is part of the care process. This communication of progress is applicable to all health professionals involved with the client. Frequent communication with all health care providers reduces any problems that might arise.

Frequent follow-up (every 2 weeks) is necessary to assess the diabetes control for adjustments to be made in the treatment regimen. If the client has a blood glucose meter and telephone, she can report results by phone. Psychological support should be given to maintain motivation for continued self-management.

LABOUR AND DELIVERY

Gestational diabetes:

Blood glucose may drop with onset of labour.

Stop cutaneous insulin.

Monitor blood glucose hourly.

Intravenous fluids (5 g to 10 g dextrose/hour.

Ringers lactate for fluid backup.

Prevent hypoglycaemia.

POSTPARTUM FOLLOW-UP

Pregnancy outcomes: birth weight, complications, maternal blood glucose follow-up.

GTT at 6 weeks follow-up visit.

Annual recheck.

Advise early evaluation regarding next pregnancy.

50%-change of overt type 2 diabetes within 15 years.

Postponement: weight reduction and maintenance, exercise.

Choice of contraception.

LACTATION

Pre-gestational diabetes:

Lower incidence of type 1 in breastfed infants of mothers with diabetes.

Lower maternal blood glucose postpartum.

If type 2, do not use oral agents as these may be absorbed by the milk, causing hypoglycaemia in baby.

Gestational diabetes

Promotes weight loss.

Appears to prevent hypoglycaemia in neonate if started early.

No contra-indications.

No oral agents if diabetes persists.

POSTPARTUM CONSIDERATIONS

Pre-gestational diabetes:

May need little insulin for the first 24-72 hours after delivery.

Return mother to pre-pregnancy insulin dosage.

Need for frequent blood glucose monitoring after delivery.

Insulin needs and blood glucose may be unpredictable.

LET DOWN often produces hypoglycaemia.

Reduce caloric intake if not breast-feeding.

Gestational diabetes:

There is rarely a need for insulin after placental delivery.

There is a 95%-chance that the diabetes will disappear.

With each successive pregnancy, the risk of developing type 2 diabetes increases.

With each successive pregnancy, the diabetes often occurs earlier.

Contraception:

Many women with pre-existing diabetes are unaware that diabetes increases the risk of both maternal and foetal complications in pregnancy. Often there is inaccurate information or no counselling regarding the importance of the use of contraception.

At present, there are no restrictions on any method of contraception and there is no evidence as to which contraception method is the best for women with diabetes. Available contraception methods include:

- Barrier methods.
- Hormones.

Use of the intra-uterine contraceptive device in a female with poor control, increases the risk of vaginal infections.

Hormones are associated with hypertension and weight gain especially the pill high in oestrogen.

Because of the relationship between poor metabolic control and congenital anomalies during early pregnancy, it is crucial that women with pre-existing diabetes postpone conception until good control (4.0 mmol/l; 72.0 mg/dl) fasting, and less than 6.0 mmol/l (108.0 mg/dl) postprandial) has been achieved and maintained for three months.

Attaining and maintaining good control reduces the incidence of congenital anomalies and the risk of spontaneous abortion in these women. The women should be educated concerning the risks of hyperglycaemia to the foetus at the time of conception, which should be done prior to conception.

Tools

Blood pressure apparatus, glucose meters, checklists for risk assessment.

Evaluation

Demonstrations.

MODULE 4-3: DIABETES AND THE OLDER PATIENT

Introduction

As people age, their ability to cope with living, learn new information and remain independent, vary greatly. Older people are not a homogeneous group and, therefore, it is important to treat them as individuals and address their individual needs.

Some older persons with diabetes are in good health and teaching may be done as for younger ones. We are concerned with those who present with a problem limiting their access to educational programmes. Before starting the education of a person with diabetes, try to recognize and evaluate their disabilities and to adapt the teaching programme accordingly.

Objectives

1. Define factors that may affect diabetes care in this group.
2. Describe how to address these limiting factors to diabetes care.
3. Identify what community resources are available to enable planning for safe and appropriate diabetes care.

Content

Define factors that may affect diabetes care in this group

Older people with diabetes may have one or more of the following problems:

1. Hearing defect.
2. Impaired vision.
3. Impaired mobility.
4. Impaired memory.
5. Other illnesses such as high blood pressure, heart or renal impairment.
6. Multiple medication.
7. Lack of social or family support.
8. Depression.
9. Dental problems.

10. Poor nutrition.

How to cope with these factors that limit diabetes care ?

- Hearing impairment: a hearing aid is helpful if available, if not, talk loudly and clearly, or use sign language.
- Impaired vision: annual check-ups and appropriate prescriptions are needed and a caregiver may have to help administer medication.
- Impaired mobility: use appropriate footwear and supporting aids including crutches, walking frames, and artificial limbs.
- Impaired memory: Additional caregiver support will be critical.
- Other conditions, such as high blood pressure, heart, or renal impairment: Medical follow-up and co-ordination of all therapies should be strictly followed.
- Multiple medications: pill charts and pill containers may be useful.
- Dental problems: Meals need to be adapted to the person's ability to chew.
- Lack of social and family support: Physical and emotional support affect the well-being of the person with diabetes. Work with social services where available to address any deficiencies in support.
- Depression: Identify and refer for appropriate management.

Identify what community resources are available to enable planning for safe and appropriate diabetes care.

- Local Diabetes Associations.
- Department of Social Services.
- Local community health services.
- Associations/Non-governmental organisations/various clubs for the elderly.
- Diabetes clinics: both private and non-governmental.

Tools

Specially targeted posters, audiotapes for the visually impaired.

Note this module must be read in conjunction with relevant sections in Nutrition, Exercise. Glucose lowering medications and insulin therapy modules.

Evaluation

Case studies.

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MODULE 4-4: DIABETES AND PERI-OPERATIVE MANAGEMENT

PERI-OPERATIVE MANAGEMENT

Introduction People with diabetes may have to undergo surgical or medical procedures that can disrupt their usual management. The diabetes educator must be able to assist people with diabetes in making appropriate adjustments to alter their meals and medication, glucose-lowering agents or insulin, and to allow them to maintain target blood glucose levels. Successful management for surgery in people with diabetes also requires simple, safe protocols that are understood by all staff.

Goals: To be able to understand and anticipate the hanging metabolic needs of the person with diabetes undergoing a surgical a medical procedure.

Objectives

1. Describe the metabolic changes that may take place peri-operatively.
2. Describe specific diabetes complications and hazards that may occur.
3. Understand the different approaches to diabetes management for major and minor procedures and for type 1 and type 2 diabetes.

Metabolic changes during surgery:

Surgical stress stimulates counter-regulatory hormone secretion. This results in reduced insulin sensitivity and inhibits insulin release. These changes favour catabolism that can rapidly cause hyperglycaemia and even ketosis.

- In general: major operations cause greater metabolic disruption and insulin resistance.

Describe specific diabetes complications and hazards that may occur

People with diabetes may encounter problems over and above those usually associated with surgery.

- Hypoglycaemia: Peri-operative fasting is likely to cause hypoglycaemia in the presence of usual oral sulphonylurea and or insulin therapy. Hypoglycaemia needs to be avoided particularly as anaesthetized or sedated patients either may be unaware of hypoglycaemia, or may be unable to communicate.

- Iatrogenic problems of diabetic control caused by lack of appropriate management protocol, inadequate glucose monitoring, and failure to correct obvious abnormalities.
- Increased risk of post-operative complications, including wound infections and myocardial infarction.
- Deterioration of the renal function, particularly if diabetic nephropathy is already present.
- Autonomic neuropathy can cause severe hypotension during the induction of anaesthesia.

Understand the different approaches to diabetes management for major and minor procedures and for type 1 and type 2 diabetes.

Table 2: Algorithm for major surgery in type 1 and 2 persons with diabetes

Marg McGill: Peri-operative care need to say something about the importance of hydration in patients with raised creatinine who require a procedure with radio-contrast dye

we stop metformin 24 hours before major surgery the most common problem is non-diabetes doctors/health professionals treat type 1 and type 2 the same and the type 1's often get into trouble (insulin often under used or ceased)

Am I correct that there is nothing on complications?

Tools

Evaluation

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