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HEALTHY FOOD AND NUTRITION FOR WOMEN AND THEIR FAMILIES

Training Course for Health
Professionals

**Part 1: Trainers' instructions
including overheads and
handouts**

ABSTRACT

This Training Course provides a comprehensive tool to teach health professionals and policy-makers how food intake and nutritional status affect the health of women and their families. Women – by breastfeeding their babies, providing meals for their families and making up the majority of the workforce employed in food processing and manufacturing, public catering, health care and education – have a crucial role in implementing healthy nutrition policies. The Course provides information about international nutrient recommendations and dietary guidelines, of evaluating the nutritional quality of the diet, and of providing advice to women during pregnancy, birth and the postpartum period with a view to promoting WHO guidelines on healthy eating. Each session is divided into instructors' notes (describing the aim of the session and with notes for each overhead), overheads, handouts and group work so the trainers are equipped with a complete training manual.

Keywords

NUTRITION - in pregnancy
BREAST FEEDING
HEALTH EDUCATION
TEACHING MATERIALS
PRENATAL CARE
GUIDELINES
FEEDING BEHAVIOR

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WHO Regional Office for Europe, Copenhagen

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The Training Course on Healthy Food and Nutrition for Women and their Families is divided into the three following documents:

- Part 1: Trainers' instructions including overheads and handouts
- Part 2: Pre-course reading and assignments for participants
Two assignments are to be completed before the course, therefore participants should receive Part 2 at least 10 days before the course
- Part 3: Healthy eating during pregnancy and breastfeeding: a booklet for mothers

Part 1: Trainers' instructions including overheads and handouts

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Acknowledgements

The development of this training course was done in collaboration with UNICEF. We would like to thank Oleg Biloukha (Cornell University, Ithaca, USA) very sincerely for all the work he did in developing and compiling both the English and Russian versions of this training course.

Introduction and Course Organization

Trainers and Staff

It is recommended that the course is conducted by two trainers and two facilitators. Two interpreters for simultaneous translation are required where translation is needed. Trainers and, desirably, facilitators must have special knowledge in the topic of the course.

Participants

A maximum of 18 to 20 health professionals should be invited to join the training course and workshop. It is recommended that these should comprise:

- policy makers responsible for women and child health (2)
- gynaecologists/obstetricians (4)
- hygienists from sanitary-epidemiologic centers (4)
- paediatricians (4)
- general practitioners (4)

Other possible groups could be considered. These include nurses and midwives, nutritionists and family medicine doctors.

If a national training course all participants should be in relatively senior positions and so be able to implement new policies following the training or alternatively this course could be organized at a district level.

Breastfeeding promotion, support, the Baby-Friendly Hospital Initiative and complementary feeding

Ideally this 3-day course should be carried out along with a 2-day training course on breastfeeding and the Baby-Friendly Hospital Initiative. In addition, participants should obtain copies of the WHO publication on Feeding and Nutrition of Infants and young Children: guidelines for the WHO European Region with emphasis on the former Soviet countries (published 2000). This will help them to understand the importance of complementary feeding of infants from 6 months to 3 years of age.

Style and format

The Course will use different formats - Information Sessions and Working Groups. In Information Sessions, data and arguments will be presented by trainers. In Working Groups, participants will be divided into small groups to produce answers to set problems. All participants will be encouraged to engage in discussion and group leaders ask to report back to main group. In all formats, there will be opportunities to engage with and to question facilitators and lecturers.

Resources

The Course is designed to be conducted in one large room for Information Sessions (not auditorium style and not with fixed chairs) and 2 additional rooms large enough to hold small groupwork sessions. The main room should be equipped with movable tables and chairs (according to the number of participants); overhead projector and screen; flip charts, black (or white) boards, markers. Slide projector and video player may also be required, if necessary. Coloured paper/card and coloured pencils/felt-pens should be provided for each participant so that they can all participate in group work 3 where they are asked to design a healthy eating leaflet for mothers. Key documents will be available. Sessions will be accompanied by handouts, resource materials and activity notes. Participants will be encouraged to take notes where appropriate.

Approach

The Course will have a sharing and participative ethos. This is in keeping with the experience of the public health movement that the most appropriate way to identify health problems, to agree action on their remedy and to generate change is by working with others. Even though resources may be scarce, much can be achieved by drawing upon facilities, people and skills which are already there. Course evaluation sheets will be given out and collected on the final day.

Course materials

There are 4 types of materials intended for the course:

- overheads for information sessions
- pre-course handouts for participants
- instructor's notes
- tasks and descriptions of group work activities

Besides, there is a booklet for the participants containing course schedule, forms and questionnaires to be filled in before or during the Course, list of readings, evaluation forms etc. These have to be given to prospective participants 2 to 3 weeks before the Course.

Materials to be used as overheads for each session are marked and the order of presenting those is given. All the overheads should also be copied and distributed to participants as handouts. There are some additional materials (tables, graphs etc.) to be used as handouts only, those are marked "Handout" and the number of corresponding session is given. The handouts for corresponding session should be distributed to participants immediately before the start of the session.

Instructor's notes are intended for instructor's use only. They contain the brief overview of the material to be presented at Information Sessions and outline the points that are to be specifically emphasized. Text in the notes is clearly linked to the session overheads.

Group activity notes are to be distributed to participants before the corresponding group work session. They contain the tasks/topics for participants to discuss as well as

some guidelines as to how to lead the discussion and what points to address. In the end each group reports the results of the discussion to the whole class.

Sequence of Sessions.

Information Sessions must be conducted in the order specified, as each session of the course is designed to build on previous learning. Group work activities should follow the corresponding information sessions. The recommended schedule of the workshop (including approximate times necessary for each of the activities) is given in the booklet for participants (see above).

Introducing the course

- **Welcome to participants:** participants and instructors introduce themselves and briefly explain their positions and responsibilities; if local authorities participate in the opening ceremony, their speech will take place first
- **Purpose and learning objectives:** explain the purpose and learning objectives of the course (see schedule booklet)
- **Overview of activities:** explain the types of activities (Information Sessions, group work, final evaluation), their nature, timing etc.
- **Course agenda and materials:** review the course schedule, explain where the sessions will take place, introduce the types of materials that will be given out during the course
- **Administrative matters:** explain, if necessary, by whom are covered travel costs and accommodation of participants, course materials etc.

Making the presentation (Information Session)

- availability of the overhead projector is essential; try before the session projecting any visual aid on the selected screen to adjust the focus and to check whether image is large enough to be readable by the participants sitting at the back of the room
- introduce the title and learning objectives of the session first; remind the participants that all session overheads were given as handouts;
- present information according to the order specified on the overheads, keep to the facts given on the overheads and in the instructor's notes; if local data relevant to the topic of the session is available, it may be presented at the end of the session by a local health professional

Facilitating group work

- explain that in group work activities participants will use their professional expertise, knowledge of the local situation, information obtained at the information sessions and information they collected before the course (interviews of health professionals, 24-hour recall of pregnant woman), if relevant;

- explain that group work is designed to give the participants an opportunity to discuss the present situation they encounter on a day-to-day basis, to identify existing problems and to suggest the ways to rectify them; the ultimate goal is to develop a comprehensive plan of action aimed at improvement of maternal nutrition during pregnancy and lactation
- before each of the group work activities explain to participants its goal and emphasize the main points to be addressed in discussion, inform about the time allocated for the group session;
- divide participants into groups; assure that instructors/facilitators will be available to give any needed suggestions during the activity
- during the group discussion instructors/facilitators may be present as observers, answer emerging questions and help to focus the discussion

Conducting the course evaluation

- explain to participants, that the final course evaluation is aimed at providing feedback on the course to the instructors, thus enabling them to improve contents and methodologies
- assure participants that questionnaire is anonymous
- remind that complete filling of the questionnaire is essential to further improve the course

Handout

Final Course Evaluation Form

Handout

Final Evaluation

PURPOSE: The overall purpose of this evaluation is to assess that the participants':

- competencies have been further developed in reducing maternal and infant mortality and morbidity and promoting family planning; and,
- leadership competencies and skills have been further developed as a basis for strengthening maternal and infant health and promoting family planning.

DIRECTIONS: Answer all items; leave no blanks. Check (X) the chosen level for each item.

SCORING: There are no right or wrong answers.

Section I: Workshop Objectives	Achieved	Partially Achieved	Not Achieved
Upon completion of the workshop I am able to: 1. List the current dietary guidelines for healthy eating 2. Explain difference between nutrient requirements, recommendations and dietary guidelines 3. Describe causes and possible solutions to nutrition-related problems during pregnancy 4. List groups of women likely to be nutritionally compromised and why	 _____ _____ _____ _____	 _____ _____ _____ _____	 _____ _____ _____ _____

Section II: Teaching Strategies	Always	Sometimes	Never
The teaching methods were: 1. Related to the objective 2. Effective 3. Useful Specifically, the 4. Presentations were useful 5. Group work was useful 6. At home assignments were useful 7. The materials should be useful in future workshops	 _____ _____ _____ _____ _____ _____ _____	 _____ _____ _____ _____ _____ _____ _____	 _____ _____ _____ _____ _____ _____ _____

Section III: Trainers/Facilitators	Excellent	Good	Poor
<p><i>Trainer's/Facilitator's Name:</i> _____</p> <p>1. Preparation</p> <p>2. Knowledge of Subject</p> <p>3. Quality of Material</p> <p>4. Delivery of Material</p> <p>5. Use of Time</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>
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Section IV: Overall rating	Excellent	Good	Poor
Overall, I would rate this course as:			

Overall, when compared to other workshops I would rate this one as:	Better than most	Worse than most

Section V: Participant's self-evaluation	Very great	Quite small
The amount of work I did for this course was		
The quality of my work for this course was		
My contribution to the workshop as a whole was		
I learned from this workshop	Very much	Very little

Section VI: Comments

Section VII: Recommendations

Session 1

NUTRITIONAL STATUS AND FOOD INTAKE OF NON-PREGNANT, PREGNANT AND LACTATING WOMEN

INSTRUCTORS NOTES

AIMS

The trainer's aims are to:

- help participants to understand what is nutritional status and food intake, how are they measured and how they relate to each other through the life cycle
- help participants to be clear about the meaning, calculation and implications of body mass index as an indicator of nutritional status of individuals
- help participants to understand the current dietary guidelines for a healthy population and the importance of their promotion among pregnant and lactating women

Overhead 1: Objectives

By the end of this session, participants will be able to:

- explain what is nutritional status and food intake and how they are related through the life cycle
- explain what is body mass index, its estimation and implications for recommendations of weight gain during pregnancy
- list the current dietary guidelines for healthy adult population

Overhead 2

The nutritional challenges vary as we progress through the life-cycle. Adequate nutrition for pregnant women and young children is essential for their optimum health and development. In adulthood the issues are different: the challenge is to avoid premature death or disability and progress into a fit and healthy old age.

Good nutrition during the first few years pays dividends throughout life and so investing in early child development is one of the best investments a country can make. This starts with maternal nutrition because of its importance to the foetus and evidence that nutritionally related low-birth-weight raises the risk of chronic non-communicable disease in later life. Failure of mothers to get a safe, healthy variety of food during pregnancy and lactation therefore has long-term social and economic consequences. Policies targeted towards women, especially those of childbearing age, can therefore lead to significant health gain. WHO Regional Office for Europe has developed these materials to address this through these workshops.

Overhead 3

At the beginning of the session instructor should explain the meaning of the terms "nutritional status" and "food intake" and the difference between the two. The adequacy of food intake is dependent on how well it meets the nutrient requirements of individual. Both insufficient and excessive food intake are undesirable and may have negative effect on health. The concept of insufficient intake is usually well understood. A good example is vitamin C deficiency and scurvy. Undesirability of excessive intake may require further explanations and examples. Dramatic increase of some chronic diseases (cardiovascular, cancer, diabetes etc.) and their relationship to excessive intake of certain nutrients (saturated fat, sodium etc.) should be cited as one of the examples. The other examples may be toxicity of vitamins A and D.

Overhead 4

Instructor should clearly explain how recommendations for excessive protein intake can adversely increase fat consumption. In addition there are many other undesirable consequences of excess protein intake (e.g. contribution to age-related renal failure, cysteine - homocysteine issue as it relates to the increased risk of cardiovascular disease, increased demineralization of the bone, increased risk of cancer). See also instructor's notes for session 2 where undesirable consequences of excess protein intake will be explained in more detail.

Overhead 5

It should be emphasized that nutrient requirements are highly variable across individuals and in the same individual over time as they depend on the variety of genetically predetermined and environmental factors. Nutrient requirements in pregnancy and lactation tend to increase because of the changes in metabolic rate, and the necessity to synthesize new tissue (in pregnancy) and breast milk (in lactation), but these will be explained in more detail later.

Overhead 6

Nutritional status is usually well correlated with present food intake, however there may be situations when insufficient intake can be compensated by body stores, or, vice versa. "Sufficient" food intake may be insufficient if stores were previously depleted. Energy is stored in the form of fat and glycogen; some other nutrients that can be stored in the human body include fat-soluble vitamins (e.g. vitamin A is stored in the liver, vitamins D and E in adipose tissue) and some microelements (e.g. iron in the liver, calcium in bone tissue). On the other hand, protein, water-soluble vitamins (vitamin C and B-vitamins) and electrolytes (e.g. sodium, potassium, chloride) cannot be stored and, thus, have to be regularly supplied with food.

Overheads 7 and 8

In presentation of the food intake assessment it should be emphasized that all these methods except direct observation heavily rely on patient's memory (for retrospective methods), accuracy and compliance. The most widely used methods are 24-hour recall, food frequency questionnaires and food diary. Food frequency cannot be used for quantitative assessment of food intake, but provides an idea about general eating patterns and allows for qualitative assessment of intake of target nutrients (e.g. if interested in calcium intake - ask how often dairy products which are the main source of calcium are consumed). Direct observation is the most accurate, but also most expensive and difficult to implement. Its use is usually limited to clinical settings where patient's intake is controlled. After the data on food intake is collected, the nutrient content of the diet is estimated using food composition tables or computer databases and then compared to standards or estimated nutrient requirements. A list of some commonly used sources of food composition data is given below:

- USDA, Composition of Foods, Agricultural Handbook No. 8, Washington, DC
- Bowes and Church's Food Values of Portions Commonly Used, Harper and Row, New York
- Skurihin tables, Moscow
- McCance and Widdowson Composition of Foods; Ministry of Agriculture, Fisheries and Food, London, UK
- "Infoods" (New Zealand), e-mail: <infoods@crop.cri.nz>
- COST 99 - "European Nutrient Data Base"

- COST 99 is an initiative to promote research on food composition data in Europe - one topic addressed by this group is a “European Nutrient Data Base”. The Web site is <<http://food.ethz.ch/cost99>>, and it provides information on data bases available. In addition a 3 week training course is organized annually by professor Clive West, Department of Epidemiology and Human Nutrition, Wageningen Agricultural University, Netherlands.
- Instructor could ask depending on the training and qualifications of the participants which problems they think are likely to be encountered when trying to estimate exact composition of foods and nutrient intake. Limitations that influence the accuracy of food intake assessment can be pointed out if appropriate. Participants have to be aware that some nutrients, especially vitamins are destroyed or lost during storage and cooking. Instructor can briefly mention that multiple thawing and freezing cycles as well as cooking in excessive amount of water can result in significant leakage of nutrients. The other problem is that not 100% of nutrients digested is absorbed (good example is iron), and different pathological conditions of gastrointestinal tract can substantially impair absorptive ability (good example is vitamin B₁₂ absorption).

Overhead 9

Before showing this overhead on diet history the instructor should ask which factors are likely to affect a person's eating pattern and food choices. As the participants call them out the instructor should write the responses on a flip chart and only then show the overhead.

Overhead 10

In presentation of nutrient status assessment the importance of simple and cheap methods of assessment (medical history, physical examination, anthropometry, commonly used laboratory analyses) should be emphasized. Physical examination, if accurate and thorough, can also provide plenty of information on an individual's nutritional status. Special attention should be paid to body size and proportions, amount of adipose tissue and pattern of it's distribution, appearance of skin and mucous membranes and dental status. Manifestations of most of the vitamin deficiencies involve skin and mucous membranes. One of the most important indicators of nutritional status is the proportion of fat in human body. Detailed description of nutritional status assessment methods can be found in textbooks on human nutrition and metabolism (see suggested readings for the instructor).

Overhead 11-12

Most anthropometric measures, as well as more advanced and expensive techniques, such as isotope and imaging techniques, are designed to estimate proportion of fat relative to lean body mass. One of the easiest to obtain and most widely used estimates of body fatness is body mass index. The instructor should clearly explain it's meaning, method of calculation and implications for categorization of individuals into underweight, normal weight and overweight groups. Instructor should now hand out BMI charts, show participants how the chart works and help each of them to estimate their own BMI. A practical example is given regarding how ideal body weight can be calculated from BMI (e.g. 24) and height.

Overhead 13

Body Mass Index.

Overhead 14

In the first half of pregnancy women tend to accumulate energy in the form of fat, probably in order to meet increased energy requirements of lactation and late pregnancy. Women that have excessive stores of adipose tissue prior to pregnancy may not need to accumulate as much additional fat as women with normal or low fat stores. Thus weight gain recommendations for pregnant women should be differentiated according to their pre-pregnant BMI (Nutrition during pregnancy - USA Subcommittee on Nutritional Status and Weight Gain During Pregnancy (1992), National Academy Press). However, recently these recommendations have been criticized (Feig and Naylor, Lancet 1998, 351:1054-55), and it has been suggested that for women with a normal pre-pregnant BMI, weight gain of more than 6,8 kg should be encouraged but that above 11,4 kg should be discouraged. In this discussion instructor should mention the importance of breastfeeding as a way to utilize accumulated fat and prevent obesity in post-pregnancy.

Overhead 15

As shown on the overhead, the prevalence of obesity and overweight among women in Russia was found to be extremely high. Obesity is associated with increased risk of diabetes, hypertension, cardiovascular disease as well as some other undesirable health and social outcomes. In pregnancy obesity increases risk of preeclampsia. Therefore, it is important to control weight gain in pregnancy to decrease the risk of obesity later in life.

Overheads 16-19

These overheads include examples of different food models and portion sizes used to convey information on healthy eating to general public.

Overhead 20

In conclusion instructor should emphasize the role of health professionals in promotion of a healthy lifestyle (especially healthy eating habits) among pregnant and lactating women. Women who adopt this advice are likely to continue healthy lifestyle in the life and to promote it within their family. Participants should be clear about the fact that dietary guidelines for general population are relevant in pregnancy and lactation and only slight modifications that will be discussed later may be needed. These dietary guidelines (CINDI Dietary Guide and the CINDI poster "Enjoy a healthy diet") recommend to consume less than 30% of energy as fat, 50-60% as carbohydrate, 10-20% as protein. These different formats should be introduced and explained to participants. Finally, instructor may emphasize the fact, that health messages should be positive (e.g. telling people what to eat rather than what "not" to eat), and easy to understand and implement. Healthy choices should be easy choices.

Handouts for participants:

- Body Mass Index table
- CINDI Food Pyramid poster and CINDI Dietary Guide (optional)

OVERHEADS

NUTRITIONAL STATUS AND FOOD INTAKE OF NON-PREGNANT, PREGNANT AND LACTATING WOMEN

OBJECTIVES

By the end of this session, you will be able to:

- explain what is nutritional status and food intake and how are they related through the life cycle
- explain what is body mass index, its estimation and implications for recommendations of weight gain during pregnancy
- list the current dietary guidelines for healthy population

Session 1, Overhead 1

EXAMPLE

After the second world war recommendations for protein consumption were set around 100 g/day

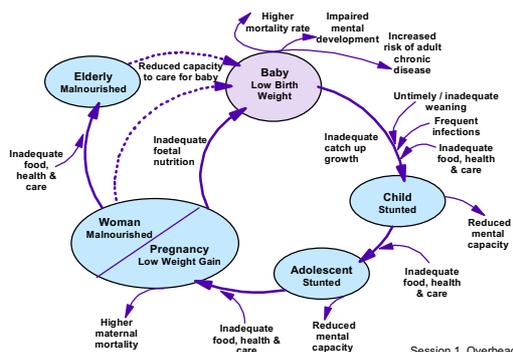
In the former USSR recommendations for protein consumption in women of childbearing age were around 80 g/day

However:

- unlike energy, humans cannot store protein and any surplus is converted and stored as fat
- much smaller amount of protein (45-47 g/day for non-pregnant, 48-60 g/day for pregnant women) is sufficient to maintain nitrogen balance in healthy individuals
- increased consumption of protein is frequently accompanied by increased consumption of fat (especially saturated fat)
- increased consumption of meat is correlated with increase of diet-related chronic diseases (cardiovascular disease, cancer, cerebrovascular pathology)

Session 1, Overhead 4

Lifecycle: the proposed causal links



Session 1, Overhead 2

NUTRIENT REQUIREMENTS

Nutrient and energy requirements can vary substantially both across individuals and in the same individuals over time

Some factors that may influence nutrient requirements:

- age
- sex
- body size (height, weight)
- body composition
- physical activity
- psychological stress
- individual differences in metabolism
- infection, disease
- growth, development
- pregnancy, lactation
- exposure to sunlight (e.g. vit. D)
- energy consumption (e.g. vit. B1)

Session 1, Overhead 5

NUTRITIONAL STATUS

Nutritional status - routinely measured by anthropometry and blood analyses

Food intake - amount of energy and nutrients in the food consumed

Nutritional status reflects how well **food intake** and **nutrient requirements** of individual are balanced

Both insufficient and excessive nutrient intake as related to nutrient requirements are undesirable and may be harmful

Research of the last decades has shown that the old approach "the more nutrients - the better" is not necessarily good, especially during pregnancy

Session 1, Overhead 3

FOOD INTAKE AND NUTRITIONAL STATUS

Nutritional status depends both on present and previous nutrient intake

Nutrient stores of the body are determined by previous food intake and utilization

If previous food intake was insufficient, requirements for present intake may be higher than normal in order to replete nutrient stores

If body stores of the nutrient are sufficient, the short-term insufficient intake of the nutrient may not adversely affect nutritional status until the stores are depleted

Some nutrients that can be stored in the body:

- energy (as glycogen and fat)
- fat-soluble vitamins (except vit. K)
- some minerals (e.g. Fe in the liver, Ca in the bone)

Some nutrients that cannot be stored:

- protein
- water-soluble vitamins (except vit. B₁₂)
- some minerals (e.g. Na, Cl, K)

Session 1, Overhead 6

DIETARY ASSESSMENT

Methods of assessment

Retrospective:

- 24-hour recall

Advantages: quick, cheap, good for group evaluation

Limitations: not representative, relies on memory and ability to estimate quantity

- Usual intake recall

Advantages: more representative, quick, cheap

Limitations: less precise, subjective

- Food frequency

Advantages: quick, better reflects usual intake

Limitations: not quantitative, relies on memory

- Dietary history

Prospective:

- **Food records (diary)**, usually 3 to 7 days
Advantages: does not rely on memory, can represent usual intake

Limitations: need highly compliant, accurate patient

- Observation

Advantages: most accurate and objective

Limitations: most expensive and time consuming

- Double portions with chemical analysis

Advantages: most accurate and objective

Limitations: most expensive and time consuming

Session 1, Overhead 7

NUTRITIONAL STATUS ASSESSMENT

Methods of nutritional status assessment

Medical history

Physical examination

- general appearance
- presence of protein-calorie under- or overnutrition
- clinical signs of specific nutrient deficiencies or excesses
- presence of conditions that may affect food consumption and/or utilization

Anthropometry

- weight, height, body mass index
- skinfold measures (biceps, subscapular etc.)
- circumference measures (waist and hip)
- weight gain or loss

Nitrogen balance assessment

Laboratory analyses

- blood analysis, urinalysis, biochemical analyses etc.

Session 1, Overhead 10

24 hour recall

- Not applicable in children < 7 years
- Necessary to use native language of interviewee
- In quiet place
- Handouts – photo album with serving sizes

Questions

1. What?
2. Where?
3. How much?
4. Didn't you forget? (additional probing)

Session 1, Overhead 8

BODY MASS INDEX

- One of the easiest to obtain and most widely used indicators of nutritional status
- The measure of overweight according to the relationship of weight to height

$$\text{BMI} = \text{weight (kg)} / \text{height (m)}^2$$

- BMI is a better indicator of maternal nutritional status than weight alone because it takes height into account
- Recommended weight gain during pregnancy depends on women's pre-pregnant BMI (e.g. on the pre-pregnant fat stores)
- Calculation of ideal body weight - see example in next slide

Session 1, Overhead 11

DIET HISTORY

- socio-economic factors
- physical activity
- ethnicity/culture
- home meal patterns, food access
- appetite
- allergies, intolerances, avoidances, special diets
- dental and oral health
- gastrointestinal function
- chronic diseases
- medications/ supplements
- substance abuse
- recent weight change
- chronic fatigue
- diarrhoea, constipation

Session 1, Overhead 9

Calculation of ideal body weight

$$\text{BMI} = \text{weight (kg)} / \text{height (m)}^2$$

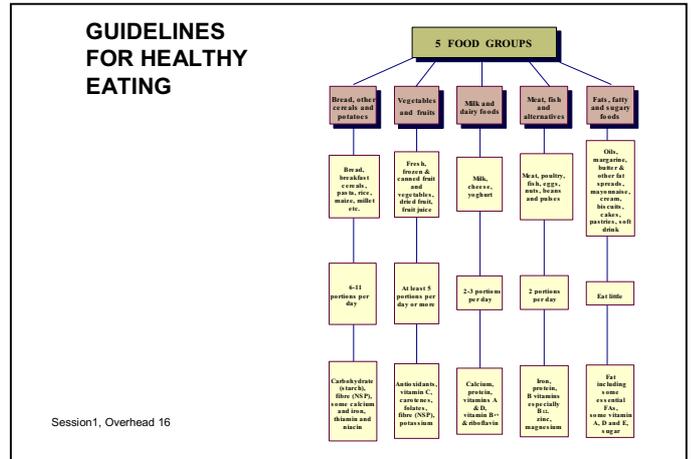
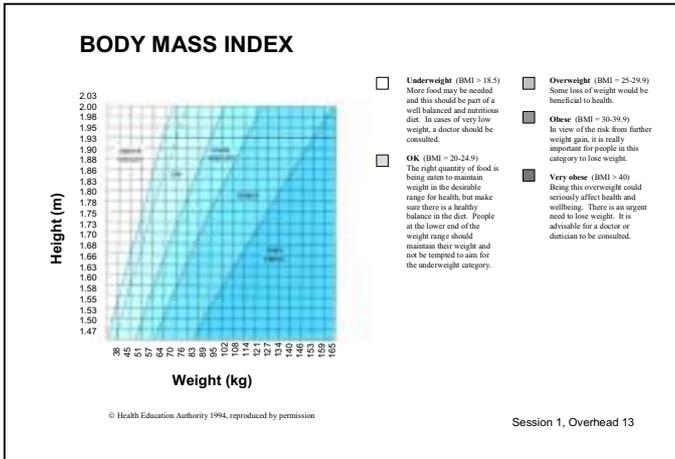
To set desirable BMI (e.g. 24 kg)

$$24 = \text{ideal weight} / (\text{height } 1.6\text{m})^2$$

$$\text{Ideal weight} = 24 \times (\text{height } 1.6\text{m})^2$$

$$\text{Therefore ideal weight} = 24 \times (1.6 \times 1.6) = 60.5 \text{ kg}$$

Session 1, Overhead 12



WEIGHT GAIN DURING PREGNANCY

The average weight gain during pregnancy is **10-12 kg** and made up as follows:

Foetus, placenta, amniotic fluid	5 kg
Maternal blood	1-1.5 kg
Maternal tissue fluid	1-1.5 kg
Uterus, breasts	1-1.5 kg
Maternal adipose tissue	4 kg
or:	
water	7 kg
protein	1 kg
maternal fat	4 kg (deposited mainly in the first two trimesters of pregnancy)

U.S. recommendations for weight gain in pregnancy*

Preconceptual body weight	Recommended	Weight gain (kg)
LOW	BMI < 19.8	12.5-18.0
NORMAL	BMI 19.9-26.0	11.5-16.0
HIGH	BMI 26.1-29.0	7.0-11.5
OBESSE	BMI > 29.1	≥ 7

*In the UK it has been suggested that for women with normal pre-pregnant BMI weight gain of more than 6.8 kg should be encouraged but that above 11.4 kg should be discouraged (Feig & Naylor, Lancet 1998; 351: 1054-55)

Session 1, Overhead 14

Portion sizes

Group 1: Breads, cereals and potatoes
1 large slice of bread (about 30-40g)
½ cup cooked pasta (macaroni, spaghetti)

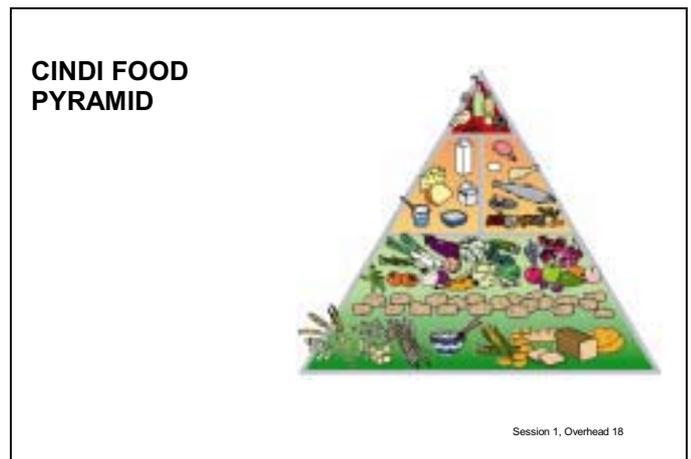
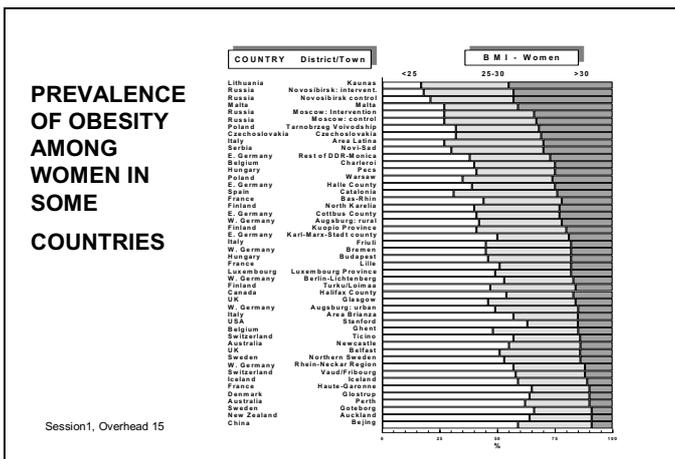
Group 2: Vegetables and fruits
160 ml fruit or vegetable juice (pure 100% juice)
½ cup (about 100g) of cooked or chopped raw vegetables

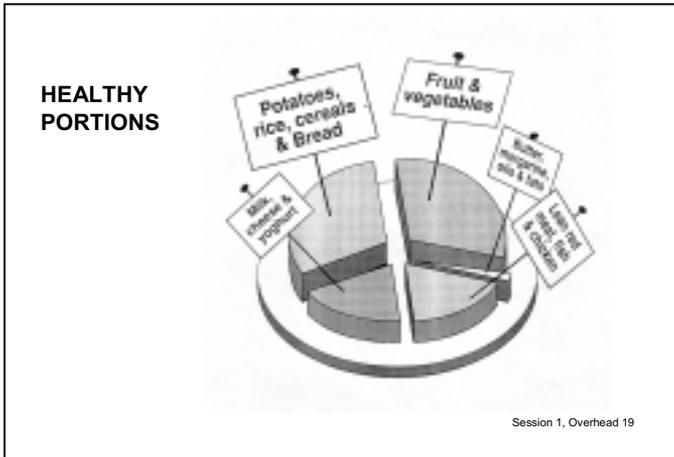
Group 3: Milk and dairy foods
1 glass (300 ml) of milk (skim, lowfat or whole)
55g of hard cheese (the size of matchbox)

Group 4: Meat fish and alternatives
70-80g cooked meat or fish
1 cup (about 150-200g) of cooked beans

Group 5: Fats, fatty and sugary foods
2 tsp butter, margerine or lard (10g)
4 tsp oil (10g)

Session 1, Overhead 17





CONCLUSIONS - A LIFE CYCLE APPROACH

- Dietary recommendations in pregnancy and lactation are based on dietary recommendations for general adult population and adjusted for increased requirements in pregnancy and lactation
- During pregnancy and lactation women are most receptive to health advice and are more willing to adopt a healthy lifestyle that benefits the baby
- Women who adopt the healthy habits during pregnancy and lactation may keep them after pregnancy and, moreover, promote health within the whole family
- Thus, the prevalence of the major chronic diseases could be reduced at the same time as improving maternal and infant morbidity and mortality

Session 1, Overhead 20

GROUP WORK

Group Work 1

HOW IMPORTANT IS NUTRITIONAL STATUS AND FOOD INTAKE?

Groups of 3-6

Participants are asked to discuss results of their survey of health professionals concerning nutritional advice to pregnant and lactating women (Pre-Course Reading and Assignments for Participants Annex A: Homework I).

The following issues should be addressed in the discussion:

- health professionals' beliefs about importance of food intake and nutritional status in pregnancy and lactation
- what advice and how often is dietary advice given to women
- whether women are interested in obtaining dietary advice
- positive and negative experience in nutritional counselling

Basing on these data participants provide feedback to the main group.

This feedback should include personal and/or group evaluation of:

- how adequate and relevant is current nutrition education of pregnant and lactating women
- how well health professionals understand the importance of this issue
- are health professionals prepared to provide dietary advice
- what pre-existing knowledge/beliefs of health professionals do not correspond to present recommendations
- what steps can be taken to improve situation and to make health professionals more interested in obtaining up-to-date nutritional knowledge and promoting it among their patients.

Each group should appoint rapporteur to present the results of group discussion. Participants discuss the problem in groups; present results and get feedback from colleagues.

Session 2

RECOMMENDATIONS ON NUTRIENT INTAKE FOR NON-PREGNANT, PREGNANT AND LACTATING WOMEN

INSTRUCTORS NOTES

AIMS

The trainer's aims are to:

- help participants to understand the differences between individual nutrition requirements, recommended intake values and dietary guidelines
- help participants to be clear about international recommendations for energy and nutrient intake during pregnancy and lactation and rationale for these recommendations

Overhead 1: Objectives

By the end of this session, participants will be able to:

- explain the differences between nutrient requirements, recommended (reference) intake values and dietary guidelines
- list and describe international recommendations for energy, protein, Fe, I, Ca, Vit. D, Zn, Vit. C and folate intake before pregnancy and during pregnancy and lactation

Overhead 2

In presentation of recommended intake values for populations instructor should emphasize that individual nutrient requirements are highly variable and there cannot possibly be one single standard for nutrient intake in different individuals. However there exists a need for some standard values to which nutrient intakes of large groups of people can be compared.

Overhead 3

Here instructor should introduce the concept of "normal distribution" of individual requirements for nutrients. The range of individual requirements for energy and nutrients tend to follow what is known as a "normal distribution". This means that the vast majority of individuals in particular population will tend to have requirements that are very close to the average requirement of that population, with progressively fewer people having requirements above or below the average level.

The recommended values are derived from studies of nutrient requirements in large populations and can be set at different levels - e.g. requirements of individuals with lowest, medium or highest nutrition needs. Reference values should be applied cautiously for individual patients since they are devised for populations and not for individuals.

Overhead 4

Instructor should explain that recommended values that are presented further in the session (WHO RNI, European PRI, American RDA) are set at the levels sufficient for almost all healthy adult individuals. These values, however, tend to be too high for many people (possible excessive energy and protein intake should be of primary concern). See Dietary Reference Values in: Garrow JS, James WP (eds), Human Nutrition and Dietetics, 9th ed., Churchill and Livingstone, 1993, pp 787-796

Based on recommended nutrient intake values and present scientific knowledge dietary guidelines are created to provide understandable and easy-to-implement messages for general public (e.g. "Guidelines for Healthy Eating", "Food guide pyramid", plate model etc.).

Overhead 5

There is still some controversy as to estimated average energy requirement in pregnancy. Instructor should stress the difference between average energy requirement values and recommendations for macro and micro nutrients. While recommendations for nutrient intake can be set at slightly higher levels, this is not the case when we speak about energy. Since obesity is one of the major public health problems in modern world, it should be stressed that advocating excess energy intake is not beneficial. Thus, there are only estimates of current average energy intakes in women which may provide a general view of what individual requirements might be during pregnancy. For this reason EAR (estimated average requirement, set to be sufficient for about 50% of the population) for energy intake is used as a reference whereas for the rest of the nutrients RNI (reference nutrient intake set at the safe 95% level) is used.

Generally, well-nourished women may need a relatively small increase in energy intake (about 200 kcal/day) in the last trimester of pregnancy (see Durnin et al.; Feig and Naylor, Lancet 1998 in Recommended Readings). This can be achieved, for example, by consuming 3 extra small slices of bread, 2 medium potatoes or 1.5 cups of milk (see the table of foods containing 100 kcal). Individual energy intake should be adjusted according to pre-pregnancy nutritional status, physical activity and other variables (see overhead). It should be emphasized that even undernourished women with low energy intake are able to produce enough breast milk. The extra energy requirements of lactation (around 400-500 kcal/day) can be met in part by fat stores accumulated during pregnancy. But again the good source of energy is bread (6-8 slices/day extra) or potatoes (4-5/day extra).

Overhead 6

Recommendations for an increase in energy intake during lactation are derived as follows. Average energy content of human milk is 70 kcal/100 ml. Maternal energy is converted to milk energy with average efficiency of about 80% (range 76%-94%). Thus, 85 kcal of maternal energy are required for production of 100 ml of breast milk. Average milk secretion is 750 ml/day during the first 6 months after delivery and 600 ml/day during the following 6 months (which corresponds to 640 kcal/day and 510 kcal/day of maternal energy, respectively). However, energy reserves in the form of stored fat (2-3 kg) can provide 100-150 kcal/day during the first 6 months of lactation. Thus, additional energy to be provided from dietary sources is about 500 kcal/day.

Overhead 7

Increases in protein requirements during pregnancy and lactation are relatively small and can be met by eating extra bread in order to meet extra energy requirement. Former USSR recommendations for protein intake tend to be too high (as discussed in session 1). Many women are routinely consuming more protein than currently recommended, so no further increase in pregnancy and lactation is necessary. To assure protein sparing enough energy should be consumed from foods like bread, cereals and pasta which at the same time to contribute more protein to the diet. If there is real concern about lack of protein in the diet, then the additional 6 g of protein could be provided by consuming of 1 egg or 25 g of cheese or 175 g of milk/kefir.

Overhead 8

Recent work has suggested that excessive intake of protein, especially animal protein, may be associated with a number of health risks. These include: osteoporosis, decline in renal function, heart disease, cataracts, certain cancers and other tissue damage. People who eat excess animal protein have higher rates of heart disease and cancers, but their diets also tend to be high in fat and low in antioxidants and fibre. In addition, those who eat lots of animal protein may also be less health-conscious in general and less physically active than others. It may be such factors therefore, rather than protein intake itself, that accounts for most of the increased risks.

In pregnancy increased meat consumption is associated with an increased risk of cerebral palsy in newborns, whereas consumption of cereals (mostly bread) and fish is inversely associated with cerebral palsy (Petridou E. et al., (1998) Diet during pregnancy and the risk of cerebral palsy. *British J Nutrition* 79:407-412).

Overheads 9-10

Increased iron requirements in pregnancy are believed to be largely compensated by cessation of menses, increased absorption and mobilization of body stores. Routine prescription of iron supplementation in women with sufficient dietary sources of iron is not advised and may cause problems with zinc absorption and copper metabolism. Peculiarities of iron absorption (haem vs non-haem iron, facilitators and inhibitors of absorption) should be pointed out. Iron requirements in lactation are the same or lower than in non-pregnant women (no menstrual losses in lactation and increased absorption from the diet).

Overheads 11-12

Iodine is essential for normal development of the foetus and newborn. Sufficient maternal intake of iodine is required to prevent neonatal hypothyroidism which can result in cretinism, goitre, growth stunting and neurological impairments of varying severity. Iodine deficiency is still prevalent in the CIS countries. This happens in part because state monitoring and control measures were relaxed with the progressing of substantial economic problems in the past several years. As a result, the prevalence of goitre in most CIS countries increased after the collapse of the USSR. At present it is crucial to develop and implement the national programs on prevention and monitoring of iodine deficiency and on salt iodization. The easiest way of iodine deficiency prophylaxis is consumption of iodized salt. Thus, pregnant and lactating women should be advised to use exclusively iodized salt on the table and for cooking. This advice is particularly important for women living in endemic regions where iodine content in soil and water is poor.

The iodine content of plants and animals is determined by the environment in which they grow. As most soils contain little iodide most foodstuffs are poor sources. Fruits, vegetables, cereals, meat and meat products usually contain between 20 and 50 mcg/kg. The only rich source of iodide is sea food and so if sea food is eaten at one or two meals per week this may provide a minimum intake of around 150 mcg/day. In the UK and most Nordic countries milk and milk products are the main source of iodine because cattle fodder is iodinated by law. Seasonal variations are seen and around 45% and 70% of total iodine intake in summer and winter respectively originates from milk. In addition all Nordic countries including Denmark, which plans to start in 1998, fortify their salt to varying degrees.

Current WHO recommendations suggest that salt at the point of production should contain within 20-40 mg of iodine (or 34-66 mg potassium iodate) per kg of salt in order to provide 150 mcg/day iodine. However to make this calculation various assumptions are made such as it is assumed that the average intake of salt per person is 10 grams. In some countries the average salt

consumption may be considerably more or less than 10 g/day. Indeed the WHO recommends an upper limit of only 6 g salt/day. Hence some countries, in an attempt to control hypertension, recommend that individuals should not consume more than 5 grams of salt/day. In CCEE and NIS, because of the tradition of preserving vegetables and meat, perhaps the intake of salt is much higher and so the level of salt consumption should be estimated. High blood pressure is the most important risk factor for stroke and modest blood pressure reduction in hypertensive people could reduce stroke incidents by half. Some studies suggest that there could be a 23% reduction of mortality from stroke by the age of 55 by taking less salt every day. In CCEE and NIS cardiovascular diseases are responsible for 68% of all premature deaths while in the rest of Europe it is 43% and moreover proportionally cerebrovascular diseases are markedly higher in CCEE and NIS. Therefore before deciding the appropriate level of iodine concentration in salt, governments should establish the average salt consumption for different groups. If daily consumption of salt is higher than 10 grams/capita governments will have to decide on the optimum level of fortification for the population. In addition it may be necessary to consider fortifying some other food (such as bread) or to consider fortifying animal fodder and launch a campaign to advise the population, and pregnant women, to decrease their intake of salt.

Overheads 13-14

Calcium and vitamin D play important role in prevention of rickets in newborn and infant. Calcium is stored in large amounts in bone, vitamin D can also be stored in the body. Moreover, vitamin D can be formed endogenously (in skin under sunlight exposure). This, and not food is normally the main source of vitamin D. Only women with low intake of dairy products (for Ca), fish products, eggs and vit. D-fortified foods (for vit.D) and poor exposure to sunlight may need supplementation.

Overheads 15

Zinc is essential for normal growth and development of foetus and placenta in pregnancy. Some studies indicate that low zinc status can cause foetal IUGR (intrauterine growth retardation) syndrome. However increased absorption of Zn may compensate for marginally low intakes. Moreover, at present there are no reliable methods for diagnosing zinc deficiency. Intake of iron supplements can interfere with Zn absorption.

Overheads 16-17

Vitamin C status is important in pregnancy and lactation due to the role of ascorbic acid in prevention of free radical formation and collagen synthesis. Smokers are especially at risk for compromised vit. C status. Vitamin C as well as the other water-soluble vitamins cannot be stored in the body, so regular dietary intake is essential. For the same reason concentrations of water-soluble vitamins (unlike fat-soluble vitamins and most minerals) in human milk are dependent on the diet of the nursing mother. Daily vitamin C requirements can be met by eating one orange, one green pepper or drinking 1/2 glass of fresh orange juice. Vitamin C in foods is destroyed by heating.

Overheads 18-19

The role of folate in prevention of pernicious (megaloblastic) anemia is well known. Folic acid is essential for new cell formation as it participates in nucleotide synthesis. However research of the last decade has shown the important role of folic acid in prevention of neural tube defects (NTD) such as spina bifida and anencephalus at the early stages of foetal development (see Medical Research Council Vitamin Study Research Group etc.; Department of Health etc. in Recommended Readings list). According to these studies, peri-conceptual supplementation with

4 mg/d folic acid reduced the risk of NTD recurrence in women who had previously had a NTD affected pregnancy by 72%. However, 95% of pregnancies resulting in NTD are first occurrences. Scientific evidence does not yet allow for assessment of an effective dose.

Currently it is advised that women who plan conception and pregnant women until the 12th week of pregnancy consume sufficient amounts (0.4 mg) of dietary folate or 0.4 mg of folic acid as a daily supplement. For women who previously had babies with NTD recommended dose of folic acid is 10 times higher - 4 mg/day. The critical period for preventing NTDs is often before pregnancy has been confirmed, and pre-conceptual supplementation is therefore vital. Folic acid-only supplements are preferable to multivitamin preparations. Folic acid should not be taken in high doses by women suffering from vitamin B₁₂ deficiency or by women taking drugs for epilepsy.

Overhead 20

Multivitamin supplements should be prescribed cautiously and only according to medical indications. A well balanced diet is likely to provide all the necessary vitamins and minerals whereas multivitamin abuse may have several disadvantages as outlined in the overhead.

Overhead 21

Those nutrients in breast milk whose concentration is most affected by the mother's intake are the water soluble vitamins, and to a lesser extent, the fat soluble vitamins. In contrast, with few exceptions, neither maternal intake or stores affect the amount of energy, protein or minerals secreted in breast milk. Where maternal intake can affect the secretion of nutrients into milk, there is usually a plateau above which a further increase in intake will no longer increase the concentration of the nutrient in milk. For the purposes of predicting risk of infant or maternal micronutrient deficiencies, the potential impact of maternal supplementation on breast milk composition, and for planning appropriate interventions, it is useful to classify micronutrients during lactation into two groups.

Group I Micronutrients: This group includes vitamin C, thiamin, riboflavin, vitamins B₆ and B₁₂, vitamin A, iodine and selenium. During lactation low maternal intake and stores of these nutrients are of most concern because they reduce the amount secreted in milk, and low breast milk concentrations can adversely affect infant development. Infant stores of most of these nutrients are low and readily depleted, increasing the infant's dependence on a consistently adequate supply from breast milk and/or complementary foods. The concentration in breast milk can be rapidly restored by increasing maternal intake.

Group II Micronutrients: Zinc and iron belong to a category of nutrients, including folate, vitamin D, calcium and copper, with the following characteristics: maternal intake (including supplements) and deficiency have relatively little effect on their secretion in breast milk; because milk concentrations are not reduced when the mother is deficient, she is vulnerable to further depletion during lactation. Maternal supplementation with these nutrients during lactation is more likely to benefit the mother than her infant. However, poor maternal intake or stores of these nutrients will have little effect on the amounts that infants will require from complementary foods. The recent study (Ortega et al. (1998), British J Nutrition 79:501-507) have shown that mothers with daily Ca intake >1100 mg tend to have higher Ca concentration in the mature breast milk, and that Ca concentration is inversely related to alkaline phosphatase levels (indicator of bone deterioration) in breast milk.

Regular exercise does not adversely affect volume, energy, lipid, lactose or mineral content of breast milk (Alyce et al. (1998), American J Clinical Nutrition, 68:345-349).

Handouts for participants:

- Serving sizes of different foods
- Food record scoring sheet
- Weight and household measure of foods containing 100 kcal (table)
- Weight and household measure of foods containing 6 g of protein (table)
- Iron content in different foods (table)
- Tables of recommended values for energy, protein, Ca, Fe, Zn, I, vit. C, folate
- Session overheads (21)

OVERHEADS

RECOMMENDATIONS ON NUTRIENT INTAKE FOR NON-PREGNANT, PREGNANT AND LACTATING WOMEN

OBJECTIVES

By the end of this session, you will be able to:

- explain the differences between nutrient requirements, recommended intake values and dietary guidelines
- list and describe international recommendations for energy, protein, Fe, I, Ca, Vit. D, Zn, Vit. C and folate intake before pregnancy and during pregnancy and lactation

Session 2, Overhead 1

INTERNATIONAL RECOMMENDATIONS AND DIETARY GUIDELINES

International recommended values

WHO	RNI	(reference nutrient intake)
Europe	PRI	(population reference intake)
USA	RDA	(recommended daily allowances)

- are set at the levels of RNI (sufficient for almost every individual)
- tend to overestimate individual nutrient requirements of the majority of people
- intended only for healthy individuals
- should be applied with caution at individual level
- excessive intake of some nutrients (e.g. energy, protein) may be undesirable

Dietary guidelines - translation of current scientific knowledge and recommended intake values into practical advice understandable by general public food based rather than nutrient based.

Session 2, Overhead 4

INDIVIDUAL REQUIREMENTS AND RECOMMENDED INTAKE VALUES

Individual nutrition requirements are highly variable

Some methods of measurement:

- direct calorimetry
- indirect calorimetry
- estimation using equations (e.g. Harris-Benedict)
- balance (intake-excretion) studies
- depletion-repletion studies

Recommended intake values - values derived from studies of nutrition requirements in large populations in order to set some standard recommendations for nutrient intake

Lower recommended nutrient intake - amount of nutrient that is enough for small amount of people (~5% of population) with lowest needs
Recommended nutrient intake - amount of nutrient that is enough for almost every individual (~95% of population), but may tend to be too high for most people
Estimated average requirement - estimate of average requirement of nutrient, is enough for about 50% of population

Session 2, Overhead 2

ENERGY INTAKE IN PREGNANCY

EAR (estimated average requirement) for non-pregnant women (over 19 yrs old):

WHO, Europe	1950-2000 kcal/day
USA	2200 kcal/day

individual recommendations should be based on current weight, nutritional status (BMI), physical activity level, weight goals

EAR for energy is used instead of RNI

There is controversy about average increase in energy intake during pregnancy:

Europe - increase by **200 kcal/day in 3rd trimester only**

50 g carbohydrates = 2 large slices (100 g) of bread

USA - increase by **300 kcal/day in 2nd and 3rd trimester**

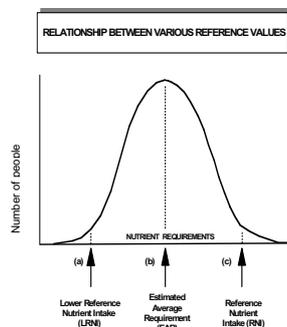
75 g carbohydrates = 3 large slices (150 g) of bread

Base individual recommendations on:

- pre-pregnancy nutritional status (BMI):
- underweight women (BMI<20) may need more energy
- actual weight gain pattern in pregnancy:
- adjust energy intake to achieve desirable weight gain
- physical activity levels: decreased physical activity --> lower energy needs

Session 2, Overhead 5

RELATIONSHIP BETWEEN VARIOUS RECOMMENDED VALUES



Session 2, Overhead 3

ENERGY INTAKE IN LACTATION

Average increase in energy intake during lactation:

WHO 450-480 kcal/day

Europe 380 kcal/day

USA 500 kcal/day

(equivalent to 200-300 g of extra bread per day)

- energy requirements are increased due to breast milk synthesis
- maternal metabolic efficiency in lactation is significantly improved in comparison with pregnancy
- fat stores accumulated during pregnancy can be used to satisfy energy needs of lactation
- increased energy intake does not result in increased milk production in well-nourished women
- sufficient amount of milk can be produced even by women with low dietary intake

Session 2, Overhead 6

PROTEIN

- about 925 g of new protein are synthesized and deposited during pregnancy in mother and foetus
- average production of breast milk during lactation - 850 ml/day
- average protein content of breast milk is 1.25 g/100 ml
- recommended protein intake in healthy non-pregnant women is 0.8 g/ kg body weight
- additional 6 g of protein is recommended during pregnancy and 11 g - during lactation (WHO)
- 100 g of bread is recommended for extra energy and thus will provide an additional 7 g of protein automatically
- most women already eat more protein than non-pregnant recommendation

Recommended protein intake, g/day

	non-pregnancy	pregnancy	lactation
WHO	45	51	56
Europe	47	48-60	63
USA	46	60	65
former USSR	75	105	115

Session 2, Overhead 7

IRON (continued)

- issue regarding routine iron supplementation (30 mg/day) is still controversial
- women with sufficient iron stores and sufficient iron content in the diet do not need extra iron supplements
- iron requirements in lactation normally do not exceed requirements of non-pregnant women (no menstrual losses in lactation and increased absorption)
- iron content of breast milk does not depend on iron intake of lactating woman

Recommended iron intake, mg/day (assuming 15% absorption)

	non-pregnant*	pregnancy	lactation
WHO	12.5	12.5	10.5
Europe	17-21	17-21	10
USA	15	30	15
former USSR	18	20	25

* all values for non-pregnant women are for adults (19 years and older)

Session 2, Overhead 10

PROTEIN (continued)

- foods that are good sources of protein are usually also the good sources of Fe, P, I, vitamins B₂, B₃, B₆, B₁₂.
- adequate energy intake from foods like bread, cereals and pasta is essential to assure new protein synthesis

Potential problems of excess protein intake include:

- animal protein is usually associated with fat
 - may contribute to age-related decline in renal function
 - may be associated with increased risk of certain cancers such as colon and breast cancer
 - very high intakes may increase demineralization of the bone
 - associated with high intake of homocystein which when not converted to cysteine (due to lack of folate) lead to atherosclerosis, cataract and tissue damage
 - very expensive and inefficient use of food production resources
- Session 2, Overhead 8

IODINE

- sufficient iodine intake in pregnancy and lactation is essential in prevention of maternal and foetal hypothyroidism
- insufficient iodine intake in pregnancy may have an adverse effect on foetus as early as 8-10 week of gestation
- iodine content of breast milk depends on iodine intake by lactating mother

Effects of maternal iodine deficiency may include:

- neonatal hypothyroidism, **cretinism**
- stillbirth, miscarriage
- low body weight at birth
- higher perinatal infant mortality
- maternal goitre and hypothyroidism

Recommended iodine intake, mcg/day

	non-pregnant*	pregnancy	lactation
WHO	150	200	200
Europe	130	130	130
USA	150	175	200

* all values for non-pregnant women are for adults (19 years and older)

Session 2, Overhead 11

IRON

- absorption of iron is variable (about 5-20% of iron taken with food is absorbed)
- haem iron (incorporated in meat and fish pigments) is relatively well absorbed - 20-30%
- non-haem iron from plant sources, dairy products and eggs is less well absorbed - 2-7%
- absorption of non-haem iron is facilitated by vitamin C, animal protein and some organic acids (found in citrus fruits and fermented milk products)
- absorption of non-haem iron is inhibited by
 - oxalates (in spinach, rhubarb, beans etc.),
 - phytates (unrefined cereals, legumes),
 - polyphenols (nuts, legumes)
 - high concentrations of Ca and Mg salts
 - tea, coffee
 - soy protein

Iron "cost" of pregnancy:

- iron incorporated in foetus, placenta, cord
- expansion of red cell volume
- blood loss at delivery

Compensatory mechanisms:

- cessation of menstrual losses
 - increased intestinal absorption
 - mobilization of existing iron reserves
- Session 2, Overhead 9

IODINE (continued)

- iodine content in fruits, vegetables, cereals, meat and dairy products depends on iodine content in soil, water and animal feed
 - sea fish and other sea food are the only rich natural sources of iodine
 - the best prophylaxis of hypothyroidism is consumption of iodized salt (25-50 mcg of KI or KIO₃ per g salt) and using iodine fortified animal fodder
 - state legislation on salt iodization for humans and animals plays major role in prevention of iodine deficiency disorders in the population
 - the problem is most serious in endemic regions where iodine content in soil and water is low
 - iodine deficiency disorders are still prevalent in the CIS countries
 - IDD is the major cause of preventable mental retardation in children
- Session 2, Overhead 12

CALCIUM

- Ca reserves of well-nourished women are very high
- about 30 g of Ca is accumulated in pregnancy to meet foetal needs and demands of lactation
- absorption of Ca increases up to two times in the second half of pregnancy thus reducing needs for increased intake
- absorption of Ca is decreased by high fibre foods
- Ca content of breast milk does not depend on calcium intake
- milk and dairy products (sour cream, yogurt, kefir, cottage cheese, hard cheeses etc.) are good sources of calcium (1 cup of milk contains about 250 mg of Ca)
- Ca supplementation (usually 600 mg/day) may be needed for women with low intake of dairy products

Recommended calcium intake, mg/day

	non-pregnant*	pregnancy	lactation
WHO	400-500	1000-1200	1000-1200
Europe	700	700	1200
USA	800-1200	1200	1200
former USSR	800	1000	1000

* all values for non-pregnant women are for adults (19 years and older) Session 2, Overhead 13

VITAMIN C

- vitamin C cannot be synthesized or stored in human body, so daily supply is required
- smoking inhibits vit. C absorption and increases vit. C requirements (due to increased free radical formation)
- vit. C in foods is destroyed by heating

Vitamin C:

- increase non-haem iron absorption
- enhance immune function
- is necessary for collagen synthesis
- has an antioxidant properties
- vit. C levels in maternal blood decrease during pregnancy
- foetus can concentrate vit. C at the expense of mother (vit. C levels in foetal blood at delivery are 2-4 times higher than in maternal blood)
- vit. C content in breast milk depends on mother's daily vit. C intake

Session 2, Overhead 16

VITAMIN D

- vitamin D is essential for Ca absorption and metabolism
- synthesis in skin by exposure to sunlight is the main source of vitamin D
- fish (fresh and canned), fish oil, eggs, butter, vit. D fortified margarine and milk (check label) are good sources of vitamin D
- intake of 10 mcg or 400 IU of dietary vitamin D is recommended in pregnancy and lactation
- women with low dietary intake and poor exposure to sunlight may need supplementation
- both Ca and vitamin D are important for prevention rickets in newborn infant
- vitamin D deficiency may result in osteomalacia and pelvis deformities in pregnancy

Session 2, Overhead 14

VITAMIN C (continued)

Recommended vitamin C intake, mg/day

	non-pregnant*	pregnancy	lactation
WHO	30	50	50
Europe	50	65	50
USA	60	70	95
former USSR	60-68	72	80

* all values for non-pregnant women are for adults (19 years and older)

Sources providing 50 mg of vit. C:

- 1 large orange
- 100 ml of fresh orange juice
- 90 g strawberries
- 1 medium grapefruit
- 1 large green pepper
- 2 medium potatoes

Session 2, Overhead 17

ZINC

- Zn is necessary for the normal growth and development of foetus and placenta
- some data suggest that Zn deficiency may cause intrauterine growth retardation of foetus
- Zn levels in maternal serum decline during pregnancy (dilution effect)
- when Zn intake is low (less than 7.3 mg/day) absorption of Zn increases; this may be sufficient to meet maternal needs without extra Zn supplements
- Zn absorption is decreased by Fe supplements
- at present there is no reliable method for diagnosing Zn deficiency
- only at-risk pregnancies are likely to benefit from Zn supplementation
- meat, fish, eggs and seafood are much better sources of Zn than vegetable products

Recommended zinc intake, mg/day

	non-pregnant*	pregnancy	lactation
WHO	6.5	7.3-13.3	11.7
Europe	7.1	7.1	12.1
USA	12	15	16-19

* all values for non-pregnant women are for adults (19 years and older) Session 2, Overhead 15

FOLIC ACID

- folate is essential for growth and division of cells (DNA, RNA synthesis)
- folate deficiency during pregnancy may cause megaloblastic anemia
- recent research suggests that folate status pre-conceptually and in early pregnancy is related to occurrence of **neural tube defects** (spina bifida etc.) in foetus
- the critical period for preventing neural tube defects is often before pregnancy is diagnosed
- folate in foods is destroyed by boiling
- good sources of folate: kidney, some vegetables (spinach, asparagus, cabbage, broccoli, cauliflower, lettuce), nuts, fortified breads and cereals, legumes, eggs, oranges, bananas, brewer's yeast

Recommended folic acid intake, mcg/day

	non-pregnant*	pregnancy	lactation
WHO	170	370-470	270
Europe	200	400	350
USA	180	400	280
former USSR	200	600	600

* all values for non-pregnant women are for adults (19 years and older) Session 2, Overhead 18

FOLIC ACID (continued)

- all women of reproductive age should eat more folate-rich foods and avoid over cooking them
- all women who are planning pregnancy should take 0.4 mg of folic acid as a daily supplement until the 12th week of pregnancy
- women who previously had babies with NTD should take a 4 mg folic acid supplement daily until the 12th week of pregnancy
- start folic supplementation as soon as pregnancy is suspected and continue until the 12th week of pregnancy
- folic acid-only supplements are preferable to multivitamin preparations

Session 2, Overhead 19

MULTIVITAMIN SUPPLEMENTS

Adequate food intake provides sufficient quantities of essential vitamins and minerals in pregnancy and lactation

Possible disadvantages of multivitamin supplementation:

- unnecessary expense
- long-term dependency
- poor absorption
- toxicity
- nutrient imbalances

Session 2, Overhead 20

NUTRIENTS IN BREAST MILK

Group I - dependent on maternal intake

- include I, Se, vitamins C, B₁, B₂, B₆, B₁₂, and A
- low maternal intake and stores cause low concentrations in breast milk
- infant stores are low and readily depleted
- increasing maternal intake can rapidly restore concentrations in breast milk

Group II - not dependent on maternal intake

- include energy, protein, Ca, Fe, Zn, Cu, folate and vitamin D
- maternal intake and/or deficiency have little or no effect on concentration in breast milk
- deficient mothers are at risk of further depletion in lactation
- supplementation is more likely to benefit mother than infant
- maternal intake has no effect on amounts that infants require from complementary foods

Session 2, Overhead 21

HANDOUTS

SERVING SIZES OF DIFFERENT FOODS

Bread, other cereals and potatoes (6-11 servings)

- 1 large slice of bread (about 30-40 g)
- 1/2 large roll
- 1 baranka (ring-shaped roll)
- 3 small crackers or sooshka
- 2 tbsp muesli
- 1/2 cup cooked pasta (macaroni, spaghetti etc.)
- 1/2 cup cooked cereal (rice, buckwheat or oatmeal)
- 3/4 cup (about 30g) ready-to eat dry cereal
- 1 medium potato (100g)

Vegetables and fruits (5-9 servings)

- 160 ml fruit or vegetable juice (pure 100% juice)
- 1/2 cup (about 100 g) of cooked or chopped raw vegetables
- 1 cup of green leafy vegetables (lettuce, spinach etc.)
- 1 medium tomato
- 1 medium fruit (orange, apple, banana etc.)
- 1/2 cup (about 100 g) of fresh berries, chopped, canned, or cooked fruit

Milk and dairy products (2-3 servings)

- 1 glass (300 ml) of milk (skim¹, lowfat or whole)
- 1 cup (about 200 ml) of yogurt/kefir
- 55 g of hard cheese (the size of matchbox)
- 1,5 cup (about 250 g) of cottage cheese

Meat, fish, eggs, beans and nuts (2-3 servings)

- 70-80 g of cooked meat or fish
- 2 eggs
- 1 cup (about 150-200 g) of cooked beans

Foods, containing fat and sugar

- 2 tsp. of butter, margarine or lard (10g)
- 2 tsp. of oil (10g)
- 1 tbsp. of mayonnaise (15g)
- 2 tsp. of sugar (10g)
- 1 heaped tsp. of jam or honey (10g)
- 1 small bar (about 60 g) of chocolate
- 1/2 slice of cake (30-40g)

¹ Important: this is the equivalent of 300mg Ca.

Weight and household measure of foods containing 100 kcal

Food item	Weight (g/ml)	Household measure
Breads, cereals		
Bread	40	1.5 thin slices
Rice	30	3/4 cup
Spaghetti, cooked	20	3/4 cup
Vegetables		
Legumes, dry	30	2 tbsp
Potato, boiled/baked	120	1 medium
Fruits		
Banana	100	1 medium
Orange	210	1 large
Apple, fresh	190	1 large
Grapes	140	1 large bunch
Strawberries	300	2 cups
Dairy products		
Whole milk, yogurt	150	2/3 cup
Skim milk	300	1 1/4 cup
Cheese-cheddar/swiss	25	2.5 cm cube
Nuts		
Peanuts, roasted	20	15 nuts

Weight and household measure of foods containing 6 g of protein

Food item	Weight (g)	Household measure
Breads, cereals		
Bread	75	3 thin slices
Rice, cooked	80	1 1/2 cup
Spaghetti, cooked	110	1 cup
Vegetables		
Legumes, dry	25	2 tbsp
Dairy products		
Milk, yogurt	175	3/4 cup
Cheese-cheddar/swiss	25	
Meats, fish		
Sirloin steak	25	
Chicken	25-30	
Egg	50-60	1 large
Tuna, canned	25	
Bacon	25	2 slices
Nuts		
Peanuts, roasted	20	15 nuts

Iron content in different foods

Food item	Weight (g)	Household measure	Fe (mg)
Breads, grains			
White bread	27	1 slice	0.7
Rice, cooked	18	1/3 cup	0.6
Hamburger bun	50	1	0.8
Fruits, vegetables			
Strawberries	150	1 cup	1.5
Orange	90	1 small	0.3
Spinach, cooked	100	1/2 cup	1.5
Peas, frozen	75	1/2 cup	1.5
Green beans, frozen	90	1/2 cup	0.5
Potato, baked	120	1 medium	0.9
Tomato	100	1 medium	0.6
Dried legumes	40	1/2 cup	2.2
Meat, fish			
Beef liver	30		2.5
Pork ham	30		0.9
Beef, lamb, veal	30		0.8
Chicken, white meat	30		0.4
Fish	30		0.3
Egg	60	1 large	1.2
Nuts			
Almonds, dry	30		1.5
Peanuts, roasted	30		0.6

Average increase in energy intake during pregnancy:

- **Europe** - increase by **200** kcal/day in **3rd trimester only**
- **USA** - increase by **300** kcal/day in **2nd and 3rd trimester**

Average increase in energy intake during lactation:

- WHO - by 450-480 kcal/day
- Europe - by 380 kcal/day
- USA - by 500 kcal/day

Recommended protein intake, g/day

	Non-pregn*	Pregnancy	Lactation
WHO	45	51	56
Europe	47	48-60	60
USA	46-50	60	65

Recommended iron intake, mg/day (assuming 15% absorption)

	Non-pregn*	Pregnancy	Lactation
WHO	12.5	12.5	10.5
Europe	17-21	17-21	10
USA	15	30	15
Former USSR	18	20	25

Recommended calcium intake, mg/day

	Non-pregn*	Pregnancy	Lactation
WHO	400-500	1000-1200	1000-1200
Europe	700	700	1200
USA	800-1200	1200	1200
Former USSR	800	1000	1000

Recommended iodine intake, mcg/day

	Non-pregn*	Pregnancy	Lactation
WHO	150	200	200
Europe	130	130	130
USA	150	175	200

Recommended zinc intake, mg/day

	Non-pregn*	Pregnancy	Lactation
WHO	6.5	7.3-13.3	11.7
Europe	7.1	7.1	12.1
USA	12	15	16-19

Recommended vitamin C intake, mg/day

	Non-pregn*	Pregnancy	Lactation
WHO	30	50	50
Europe	40	65	50
USA	60	70	95
Former USSR	60-68	72	80

Recommended folic acid intake, mcg/day

	Non-pregn*	Pregnancy	Lactation
WHO	170	370-470	270
Europe	200	400	350
USA	180	400	280
Former USSR	200	600	600

* all values for non-pregnant women are for adults (19 years and older)

GROUP WORK

Group Work 2

HOW CAN PREGNANT AND LACTATING WOMEN MEET THEIR NUTRITIONAL NEEDS?

Groups of 3-6

Participants are asked to analyze One Day Food Record Charts (Appendix A, section II) - dietary information, collected from pregnant or lactating women prior to the workshop. Information on serving sizes and a food record scoring sheet will be handed to participants to assist them in evaluation of the diet.

The following issues should be addressed in the discussion:

- variety of foods in the diet
- distribution of intake during the day
- approximately how many portions are consumed from each of the food groups
- how does the woman's diet compare to current dietary guidelines (e.g. Food Guide Pyramid)
- is she eating enough complex (breads, potatoes, pasta) vs simple (table sugar, candies) carbohydrates in the diet
- is the fat content of the diet likely to comply with current recommendations (<30% of energy from fat, <10% from saturated fat)
- whether energy and protein content of the diet is excessive or insufficient
- what minerals and vitamins are likely to be sufficient in the diet
- what minerals and vitamins are likely to be deficient in the diet
- what advice should be given to improve the diet (taking into account the additional information collected on women's diet history, life conditions etc.)
- Participants analyze the diet information individually and discuss in groups. Then each group chooses one case diet to report back on. Groups report chosen cases using flip chart to illustrate the diet and problem areas; and get feedback from colleagues.

Session 3

**NUTRITION-RELATED
CHALLENGES IN
PREGNANCY**

INSTRUCTORS NOTES

AIMS

The trainer's aims are to:

- help participants to understand what nutrition-related problems can arise during pregnancy and what are the possible causes of these
- help participants to be clear about the steps that should be recommended to rectify these problems

Overhead 1: Objectives

By the end of this session, participants will be able to:

- list and describe what nutrition-related problems can arise during pregnancy
- explain the possible causes of these problems
- explain what can be done to rectify the problems

Instructor should introduce the changes in gastro-intestinal tract, taste, appetite and nutrient metabolism as a part of the complex changes in virtually all the systems of the organism of pregnant and/or lactating woman. The most probable reasons (e.g. hormonal changes, mechanical pressure of enlarged uterus, changes in blood circulation etc.) for these changes may be presented and explained where applicable.

Overheads 2-3

Sideropenic (iron-deficient) anaemia of pregnancy may be common in some population groups, especially where iron intake/absorption are low and/or iron requirements are increased. Substantial expansion of erythrocyte mass increases iron requirements in the 2nd and 3rd trimester of pregnancy about 2-fold. The instructor should emphasize what dietary sources of iron should be recommended and what substances facilitate (animal protein, vegetables and fruits containing vitamin C) and inhibit (phytates, oxalates, some antacids etc.) iron absorption. Indications for iron supplementation and side effects of iron supplements should be discussed. Current recommendations in the U.S. suggest that higher doses of iron supplements should be accompanied with copper and zinc supplements as iron has a potential to decrease absorption of these microelements. Current European recommendations suggest intake of 100-200 mg of elemental iron daily for at least 3 month (the dose of 100 mg is preferred as it gives less GI side effects and a higher compliance to treatment). After anemia is corrected smaller doses of iron may be taken as daily or weekly supplements. Correct methods of taking iron supplements (between meals, with liquids other than milk, coffee and tea) should be emphasized as improper intake can substantially impair iron absorption from supplements.

If more than 30 mg of iron is required, the daily dose should be divided and taken at different times during the day for maximum absorption (the larger the dose, the lower the absorption rate). At least 3 hours should elapse before a subsequent dose, because both 30-mg and 60-mg doses of iron have been shown to block subsequent iron absorption even in anaemic subjects.

Overheads 4-6

In the discussion of weight gain during pregnancy which was in part started in Session 1 the instructor should explain what are the components of the weight gain and which of them may have more (e.g. maternal fat gain) or less (e.g. foetus, placenta) variability. Risks of both excessive and insufficient weight gain should be clearly stated and explained. The chart for monitoring weight gain during pregnancy should be introduced and explained, importance of regular weight monitoring should be emphasized. Weight gain recommendations for different weight categories of women are not absolute requirements, but rather suggestive guidelines and may be modified and/or adjusted in the course of pregnancy. Moreover, there has been some recent discussion (Feig and Naylor, 1998, Lancet 351: 1054-55) that these recommended weight gains are too high. It has been suggested that women with normal pre-pregnant BMI should only gain between 6,8 and 11,4 kg. Graph showing perinatal infant mortality rates depending on pre-pregnant weight and weight gain during pregnancy should be explained as supporting argument for current weight gain recommendations. Weight loss practices during pregnancy should be actively discouraged even for overweight and obese individuals. Principles of obesity management during pregnancy should be emphasized. See also the discussion in the instructor's notes to session 2 (overhead 6) on how the fat stored during pregnancy is utilized to satisfy the energy needs of lactation.

Overheads 7-8

Pre-eclampsia is very serious medical condition arising during pregnancy with yet unknown aethiology. Increased risk of pre-eclampsia in overweight and obese women should be emphasized. Dietary modifications, especially energy or fluid restrictions as well as diuretic administration are not proven effective in prevention or therapy of pre-eclampsia, and, furthermore, may have negative effect. Assessment and follow-up of obstetrician are essential, severe cases may require hospital treatment.

Overhead 9

Gestational diabetes mellitus is also associated with obesity as obesity may aggravate insulin resistance usually observed in the second half of pregnancy (effect of human placental lactogen). Careful assessment and follow-up (especially control of weight gain and glycaemic status) by nutritionist and endocrinologist are essential as gestational DM carries a serious risk of foetal and neonatal pathology. Basic principles of dietary diabetic control are mostly the same as in non-pregnant state. Routine screening of glucose tolerance status on 25-28 week of pregnancy is important, especially in obese and overweight pregnant women.

Overhead 10

Oedema, if mild and not accompanied by hypertension and proteinuria, usually do not require fluid or salt restriction and is resolved after the end of pregnancy.

Overheads 11-12

Changes in gastro-intestinal tract motility and secretion are largely attributed to the effect of progesterone which acts during pregnancy to inhibit contractility of smooth muscle of the uterus to maintain pregnancy. At the same time, it reduces also motility of GIT, tonus of the lower oesophageal sphincter, and, most probably, gastric secretion. This results in heartburn, nausea and constipation often observed in pregnant women. The causes for changes in taste and appetite during the early pregnancy are not well understood yet.

Overhead 13

The major physiological changes during pregnancy involve cardiovascular and respiratory systems. Significant increase in circulating blood volume (about 40% increase) and erythrocyte mass (20-25% increase) are accompanied by increase in cardiac output. Changes in respiratory system include an increase in lung ventilating capacity and minute ventilation rate. These changes are accompanied by an increase in basal metabolic rate which in turn increases energy requirements of pregnant women. Expansion of erythrocyte volume requires an additional supply of iron (although increased iron requirements are in part compensated by the fact that there is no menstrual blood loss during pregnancy). Fat deposition during the first half of pregnancy also requires extra energy. In the second half of pregnancy intensive growth of foetus and placenta occurs. Synthesis of the large quantities of new protein requires significant amount of energy. Energy is also required for the expansion of maternal tissues, such as the uterus and breasts.

The second half of pregnancy is characterized by increased insulin resistance of maternal tissues, which is mainly attributed to the effect of human placental lactogen - hormone synthesized by the placenta. This causes an increase in glucose and triglyceride levels in maternal blood. An increase in insulin resistance and blood glucose levels are probably physiological mechanisms to assure that foetus receives enough glucose (which is the primary metabolic fuel) from maternal blood.

In lactation synthesis of the breast milk requires a significant amount of energy (although there is still much controversy as to what is a true caloric cost of breast milk production). This energy can be in part provided by adipose tissue accumulated in the first half of pregnancy. That's why breastfeeding can have beneficial effect not only to baby, but to mother as well as it helps to utilize excessive fat and prevents overweight in the future.

Although all these changes can cause symptoms and certain discomfort, women should be advised that these symptoms are temporary, normally caused by pregnancy/lactation and usually do not require special medical treatment and/or dramatic changes in diet.

Possible effects of these changes on women's food choices should be discussed in the context of other factors influencing diet of these women.

Overheads 14-16

In the presentation of GIT-related problems (constipation, nausea & vomiting, heart burn, indigestion) the instructor should explain that the causes of these problems usually are physiological changes in pregnancy as well as possible shortfalls in the diet of pregnant women. Thus, many of these problems can be rectified using simple and easy-to-implement dietary modifications (e.g. small frequent meals, increase in fiber and fluid intake, avoidance of poorly tolerated foods etc.) and usually do not require sophisticated medical treatment. Advice to the women suffering from these problems should be focused on explanation of possible underlying mechanisms of the problem, explanation how relatively simple dietary changes can help to relieve the symptoms, and giving clear and practical recommendations. Some women with more severe symptoms may need follow-up observation and possible medical treatment if dietary modifications are not sufficient in rectifying the problems.

Instructor should emphasize the importance of gradual introduction of high fiber foods into the diet in order to allow the gastrointestinal tract to adjust. Sharp increase of fiber in the diet can cause increased intestine motility, excessive gas production and alterations in gut microflora. For nausea and vomiting nutritious carbohydrate foods such as bread and potato are highly

recommended. They are usually well tolerated and are good sources of both energy, protein and micronutrients.

Overhead 17

Indigestion and cramps, if infrequent, do not require further treatment and may resolve after the end of pregnancy. In any case they are not related to sodium status or intake, and, thus, any modifications in salt intake are unnecessary. If cramps are frequent and/or of abnormal duration and severity, further referral to the appropriate medical practitioner may be required.

Unauthorized alterations of calcium and phosphorus intake should be discouraged as they may aggravate the problem.

Handouts for participants:

- Fibre content in different foods (table)
- Pre-natal weight gain chart - for monitoring weight gain during pregnancy (graph)
- Perinatal mortality rates related to weight gain of mother during pregnancy (graph)
- Session overheads (17)
- Coloured blank paper and pens (for group work)
- Part 3: Healthy Eating during Pregnancy and Breastfeeding: a Booklet for Mothers

OVERHEADS

NUTRITION-RELATED CHALLENGES IN PREGNANCY

OBJECTIVES

By the end of this session, you will be able to:

- list and describe what nutrition-related problems can arise during pregnancy
- explain the possible causes of these problems
- explain what can be done to rectify the problems

Session 3, Overhead 1

OBESITY AND NORMAL WEIGHT GAIN

The average weight gain during pregnancy is 10-12 kg and made up as follows:

foetus , placenta, amniotic fluid	5 kg
maternal blood	1-1.5 kg
maternal tissue fluid	1-1.5 kg
uterus, breasts	1-1.5 kg
maternal adipose tissue	4 kg
or:	
water	7 kg
protein	1 kg
maternal fat	4 kg (deposited mainly in the first two trimesters of pregnancy)

Risks associated with obesity and/or excessive weight gain during pregnancy:

- hypertension, pre-eclampsia
- gestational diabetes
- urinary tract infections
- thrombophlebitis
- high birth weight (>4,500 g) constitutes the risk of obesity and diabetes for the child later in life
- difficult delivery, high perinatal mortality
- problems with weight control after pregnancy

Session 3, Overhead 4

ANAEMIA

- 20-30% increase in erythrocyte volume during pregnancy
- most significant (about 2-fold) increase in iron requirements occurs in 2nd and 3rd trimesters
- ability to satisfy increased iron requirements depends on pre-pregnant iron status and dietary intake of iron

Increased risk of anaemia:

- insufficient body stores of iron
- low dietary iron intake and inhibitors and enhancers
- increased iron requirements

Groups with high risk of anaemia:

vegetarians	lower socio-economic status
adolescents	multiple pregnancy
smokers	low caloric intake

40% of maternal perinatal mortality is in some way associated with anaemia in pregnancy

Anaemia is associated with:

- increased risk of puerperal infection
- low birth weight, premature delivery
- compensatory placental hypertrophy

Session 3, Overhead 2

OBESITY AND NORMAL WEIGHT GAIN (cont)

Risks associated with low body weight and/or insufficient weight gain in pregnancy:

- premature birth, low birth weight
- intrauterine growth retardation
- foetal death

*U.S. recommendations for weight gain in pregnancy

	Preconception body weight	Recommended weight gain (kg)	
LOW	BMI < 19.8	12.5-18.0	
NORMAL	BMI 19.9-26.0	11.5-16.0	
HIGH	BMI 26.1-29.0	7.0-11.5	
OBESE	BMI > 29.1	≥ 7	
Adolescents	12-16		
Twins	16-20.5		

* Recommended weight gain in the range 6.8 - 11.4 kg for women with normal pre-pregnant BMI is currently being discussed in the UK (Feig & Naylor, Lancet 1998)

Average normal weight gain in 2nd and 3rd trimester of pregnancy:

- well-nourished women 0.4 kg/week
- undernourished women 0.5 kg/week
- overweight women 0.3 kg/week

Session 3, Overhead 5

ANAEMIA (continued)

Diagnosis of anaemia:

haemoglobin < 110 g/l; haematocrit < 32%

If diagnosis of anaemia is established, therapeutic doses (50-100 mg/day) of iron should be administered

Possible side effects of iron supplements:

- decreased absorption of Zn and Cu
- nausea and constipation

U.S. recommendations:

- 60 mg Fe, 15 mg Zn, 2 mg Cu once anemia diagnosed
- decrease Fe dose to 30 mg, discontinue Zn and Cu once Hgb and Htc return to normal levels

European recommendations:

- 100-200 mg of Fe (as ferrous sulfate, fumarate or gluconate) for at least 3 months
- after anemia is corrected - 30-40 mg of Fe daily or 120 mg weekly

Iron supplements should be taken between meals, with fluids other than milk, tea and coffee

Session 3, Overhead 3

OBESITY AND NORMAL WEIGHT GAIN (cont)

Pregnant women should have weight check-ups during regular monthly visits to the gynaecologist

Weight gain less than 1 kg or higher than 3 kg may indicate the presence of:

- multiple pregnancy
- polyhydramnion
- generalized oedema, pre-eclampsia
- intrauterine growth retardation
- intrauterine foetal death

Management of obesity during pregnancy:

- weight gain of at least 6 kg during pregnancy, weight loss should be strongly discouraged
- low energy intake during pregnancy does not reduce risk of complications and may impair development of the foetus
- consume moderate amounts of nutritious food with sufficient content of essential nutrients (e.g. grains, legumes, potatoes, fruits and dairy products)
- individual assessment and follow-up by nutritionist are essential
- It's better to try to reduce obese woman's weight either before or after pregnancy

Session 3, Overhead 6

PRE-ECLAMPSIA

Occurs usually after the 20th week of gestation. Aetiology of this disorder remains unclear more common in **overweight and obese** women

Some other factors increasing risk of pre-eclampsia:

- young age
- primigravida
- low socioeconomic status
- inadequate intakes of protein, vitamin B₆, folic acid, calcium, magnesium and essential fatty acids

Energy restriction:

- does not decrease risk or help in management of pre-eclampsia
- may exacerbate pre-eclampsia by decreasing cardiac output and, thus, compromising foetal development

Session 3, Overhead 7

OEDEMA

- mild physiologic oedema is usually present in lower extremities in the 3rd trimester of pregnancy
- do not confuse this normal physiological condition with generalized oedema associated with pre-eclampsia
- may be caused by the pressure of the enlarged uterus on the veins returning blood from the legs
- requires no sodium restriction or other dietary modification

Session 3, Overhead 10

PRE-ECLAMPSIA (continued)

Sodium restriction:

- does not have substantial effect on weight gain or proteinuria
- low sodium diet can result in reduction of energy, protein and calcium intake
- if low sodium diet is prescribed advise not to decrease intake of calcium-rich foods

The best prevention of pre-eclampsia - weight reduction in obese women in advance of conception.

Session 3, Overhead 8

GASTRO-INTESTINAL TRACT

Major changes:

- decreased motility of the smooth musculature of gastro-intestinal tract
- decreased secretion of hydrochloric acid and pepsin in the stomach

Symptoms caused by the above changes:

- Oesophagitis due to decreased contractility of the lower oesophageal sphincter and to gastric reflux, with heartburn as a result
- Nausea due to reduced secretion of hydrochloric acid and pepsin and to reduced motility
- Constipation due to reduced bowel motility

Session 3, Overhead 11

GESTATIONAL DIABETES MELLITUS

More than 50% women that develop gestational DM are obese

- both pregnancy and obesity tend to alter carbohydrate metabolism
- placental hormones increase basal insulin secretion (human placental lactogen induces insulin resistance of maternal tissues)
- obesity can aggravate insulin resistance

Management:

- individualized assessment and advice by nutritionist and endocrinologist are essential
- careful monitoring of weight gain and glycaemic control
- restriction of simple sugars (table sugar) and increased intake of complex carbohydrates (bread, potatoes) may be advised
- pregnancy does not affect the basic principles of diet of diabetic

Assessment of glucose tolerance on 25-28 week of pregnancy is highly advised, especially in overweight or obese women

Session 3, Overhead 9

TASTE AND APPETITE

- **Appetite is increased**, in most cases starting with the first trimester of pregnancy (reflecting increase in energy and nutrient requirements)
- Marked **craving** for certain foods
- Marked **aversion** to certain foods
- **Dulling in the sense of taste**, e.g. sensitivity to salt

Session 3, Overhead 12

NUTRIENT METABOLISM

There is an alteration in homeostatic control of all major nutrients.
Basal metabolic rate increases during pregnancy and lactation

The first half of pregnancy:

- Predominance of anabolic processes
- Reserves of maternal fat tissue are increased (increase in fat stores to meet increased requirements of energy during lactation)

The second half of pregnancy:

- Intensive growth (i.e. weight gain) of foetus and placenta

Lactation:

- Synthesis of breast milk requires significant energy expenditure
- Breastfeeding is beneficial not only to baby, but also to mother, as it helps to utilize excessive fat deposited during pregnancy, and thus prevents obesity - especially with frequent pregnancies.

Session 3, Overhead 13

HEARTBURN

Occurs in 30-50% of pregnant women

Can appear as early as 3rd month of pregnancy

Symptoms are usually the worst in the third trimester

Possible causes:

- Relaxation of the lower oesophageal sphincter
- Pressure of the enlarged uterus on the stomach

Helpful advice:

- Avoid foods that tend to relax oesophageal sphincter:
- Fatty foods, chocolate, alcohol, mint
- Avoid foods that irritate mucosa: tomato and citrus juices, spicy foods etc.
- Milk and yogurt can provide short-term relief but Ca and protein contained in milk eventually can increase gastric acid secretion
- Small frequent meals, no large meals before the bedtime
- Rest and sleep well propped up, not lying flat
- Eat slowly, rest after meals

Advise women against taking antacids that **bind iron**

Session 3, Overhead 16

CONSTIPATION

35-40 % of all pregnant woman suffer from constipation

The main reason:

Relaxing effect of **progesterone** on the smooth muscle of the gut

Other possible reasons:

- Low intake of **dietary fibre**
- Decreased **physical activity**
- Administration of **iron supplements**
- Increased **water absorption** in the bowel

Haemorrhoids and varicose veins may develop as a result of chronic constipation

Prevention and treatment:

- Increase fluid intake (minimum 6-8 cups daily)
- Increase intake of high fibre foods (aim for 25-30 g of fiber daily)

These methods, if effective, are preferred to administration of laxatives.

Introduce fiber gradually so that digestive system have time to adjust to higher fiber intake.

Session 3, Overhead 14

INDIGESTION

Common in pregnancy, caused possibly by the increased pressure of enlarged uterus on GIT

Helpful advice:

- Avoid specific foods that are poorly tolerated
- Small frequent meals, no large meals at bedtime
- Eat slowly
- Sit straight when eating to take pressure off the stomach

Cramps

- Occurs mainly in legs and feet, usually at night
- Frequent cramps may indicate calcium imbalance and/or calcium-phosphorus imbalance
- Cramps are not related to sodium status and /or salt or sodium intake

Session 3, Overhead 17

NAUSEA AND VOMITING

Common in early pregnancy (weeks 6-16).

Symptoms are usually the worst around weeks 9-10

The causes are not well understood yet, some possible causes are:

- Hormonal changes in early pregnancy
- Psychological factors
- Vitamin deficiencies
- Changes in carbohydrate metabolism
- Iron supplementation

Helpful advice:

- Toast or plain biscuit with hot drink before rising in the morning
- Avoid trigger foods and smells
- Eat more nutritious carbohydrate foods (e.g. bread, rice, potatoes) and less fatty foods
- Frequent small meals (2 hr intervals) including bedtime snack

If iron deficiency develops, in addition to advice on how to improve iron intake and absorption, supplements in **enteric-coated** capsules should be prescribed.

Pregnant women with diagnosed Hyperemesis gravidarum should receive hospital treatment.

Session 3, Overhead 15

GROUP WORK

Group Work 3

DESIGN A SIMPLE LEAFLET GIVING NUTRITIONAL ADVICE TO MOTHERS

Groups of 3-6

Participants are asked to design simple and informative leaflet providing general healthy eating advice to pregnant and/or lactating women.(general topic like "Principles of Healthy Eating in Pregnancy and Lactation"). This leaflet should be based on pyramid (food group) concept and contain a minimum of 20 words.

Participants should be familiarized with the general principles of leaflet design.

They should try to make their leaflets:

- simple and easy to understand by pregnant and lactating women;
- colourful, able to capture attention of target audience;
- informative (containing all the necessary information participants want to communicate to mothers);
- containing positive and easy-to-implement messages.

Participants work on leaflet design in groups; present results to class and get feedback from colleagues.

A comprehensive booklet for mothers has been developed by WHO to accompany this training course entitled “Healthy eating during pregnancy and breastfeeding: a booklet for mothers”.

Session 4

SMOKING AND FOOD SAFETY

INSTRUCTORS NOTES

AIMS

The trainer's aims are to:

- help participants to be clear about risks associated with, and current recommendations concerning smoking, alcohol intake and excessive caffeine intake during pregnancy and lactation
- help participants to be clear about food safety principles, and recommendations concerning food safety, during pregnancy and lactation

Overhead 1: Objectives

By the end of this session, participants will be able to:

- describe risks associated with smoking, excessive alcohol and caffeine intake
- describe current recommendations concerning smoking, alcohol and caffeine intake during pregnancy and lactation
- describe food safety advice during pregnancy and lactation

Overheads 2-5

In discussion of smoking and alcohol intake during pregnancy and lactation instructor should emphasize that negative effects of heavy smoking and alcoholism are well documented. Effects of moderate or mild smoking and alcohol intake are not clearly understood yet, but most scientific sources consider full abstinence from smoking and alcohol as prudent and highly recommended. There is no evidence of any beneficial effect of alcohol or smoking in pregnancy and lactation.

The most well documented effect of smoking during pregnancy is decrease of birth weight. Alcoholism may result in foetal alcohol syndrome. It is especially important to abstain from alcohol before conception and in the first trimester of pregnancy as in these periods gametes and developing embryos are most susceptible to the toxic effects of alcohol. Both alcohol intake and smoking have the potential to reduce milk volume during lactation. Both alcohol and nicotine are secreted in human milk and thus, may have a direct negative effect on infant. Also, vitamin C concentration in breast milk of smoking mothers tend to be lower than in the breast milk of non-smokers (Ortega et al. (1998), J American College of Nutrition 17:379-384).

On the other hand, occasional moderate drinking or smoking are not contraindications to breast feeding. The instructor should emphasize that any decrease in smoking and alcohol intake during pregnancy and lactation are potentially beneficial to both mother and foetus/infant.

Overhead 6

Data concerning the adverse effects of heavy caffeine intake during pregnancy is controversial. Normal caffeine intake most probably does not increase the risk of any adverse outcomes during pregnancy. During lactation caffeine excreted in human milk can potentially increase infant's irritability, especially in premature babies. Current recommendations advise to control caffeine intake from medications and foods. Heavy coffee drinkers should be advised to limit their intake to 2-3 cups a day.

Overhead 7

Animal studies have demonstrated that excess intake of vitamin A during critical periods in embryonic development can have teratogenic consequences. There are limited human data that directly link teratogenicity in women exposed early in pregnancy to high doses of preformed vitamin A (retinyl and retinol esters). However, teratogenic effects from naturally occurring metabolites of vitamin A (trans-retinoic acid, 13-cis retinoic acid and their oxo-derivatives) are well-documented from case studies of women directly exposed to high doses of these metabolites within the first six weeks of pregnancy. Extensive epidemiologic studies have produced no evidence for teratogenicity in humans after 6 weeks of pregnancy.

Limited current evidence suggests that concentrated animal sources of vitamin A (e.g. animal liver) are utilized differently than preformed vitamin A supplements of similar retinol equivalence. Peak serum values of potentially teratogenic vitamin A metabolites from liver seem to be several-fold lower and occur later than when supplements are given. Vitamin A concentration in animal liver is also dependent on the amount of vitamin A provided in animal feed. (WHO 1998, Safe Vitamin A Dosage During Pregnancy and Lactation).

Thus, because of potentially toxic effects of megadoses of vitamin A, self-supplementation with vitamin A should be actively discouraged unless prescribed by a doctor. The most caution should be exercised during the periconceptual period and the first six weeks of pregnancy. Occasional consumption of cooked liver (e.g. weekly or less frequently in about a 50-70 g serving size) by pregnant women poses no significant teratogenic risk while providing a valuable source of other nutrients such as iron and folic acid.

Overheads 8-11

To avoid the risk of infections during pregnancy, women should be instructed about proper sanitary (washing hands, washing fruits and vegetables, wearing gloves for gardening etc.) and cooking (especially cooking, thawing and re-heating meat products, eggs and milk) practices. Pregnant women will be more likely to adhere to advice given if informed about the possible detrimental effects of certain infections on foetus. Proper practices in microwave cooking and reheating should be explained. Eggs should be well cooked. Pregnant women that have frequent contacts with cats should be specifically warned about the risk of Toxoplasmosis.

Handouts for participants:

- Ethanol content in some alcoholic beverages (table)
- Caffeine content in some foods and beverages (table)
- Hygiene in Food-Service and Mass Catering Establishments – Important Rules
- Overheads (11)

OVERHEADS

SMOKING AND FOOD SAFETY

OBJECTIVES

By the end of this session, you will be able to:

- Describe risks associated with smoking, excessive alcohol and caffeine intake
- Describe current recommendations concerning smoking, alcohol and caffeine intake during pregnancy and lactation
- Describe food safety advice during pregnancy and lactation

Session 4, Overhead 1

SMOKING

Adverse consequences of smoking during pregnancy may be due not only to effects of nicotine and carbon monoxide, but also to inadequate nutritional intake among smokers.

Smokers tend to have an increased basal metabolic rate and increased requirements of certain vitamins and minerals (e.g. vit. C, vit. E, iron).

Smoking during pregnancy increases risk of:

- Low birth weight (average decrease of birth weight in smokers compared to non-smokers is 127-274 g).
- Premature delivery, spontaneous abortion
- Placenta praevia

Smoking during lactation may result in decreased volume of milk and lower growth rate of the infant.

- Smoking should be avoided in baby's room.
- Smoking should be avoided before or during breastfeeding (the half-life of nicotine is 90 minutes).

Session 4, Overhead 4

ALCOHOL

Alcohol and Pregnancy

Alcohol consumption during pregnancy may lead to birth defects. Alcohol crosses placenta and enters foetal circulation.

Foetal alcohol syndrome:

- Prenatal and postnatal growth failure
- Microcephaly
- Eye changes including epicanthal fold
- Facial abnormalities
- Skeletal joint abnormalities

Consequences of heavy drinking during pregnancy include also:

- Spontaneous abortion, premature delivery
- Low birth weight
- Placental abruption

Effects of moderate alcohol consumption during pregnancy still remain unclear.

If problem drinkers limit their alcohol intake, even after conception, the course and outcome of pregnancy can be significantly improved.

Session 4, Overhead 2

SMOKING (continued)

Conclusions

Smoking during pregnancy and lactation should be actively discouraged.

Any reduction in the number of cigarettes smoked per day has a positive impact on birth weight.

Women who stop smoking during the first trimester of pregnancy have the same risk of foetal growth abnormality as the non-smokers.

Session 4, Overhead 5

ALCOHOL (continued)

Alcohol and Lactation

Alcohol is excreted into breast milk. The toxic metabolite of ethanol, acetaldehyde, was not found in breast milk.

- There is no evidence that alcohol consumption has a beneficial effect on any aspect of lactation
- Alcohol consumption in excess of **0.5 g/kg** of maternal weight may be harmful to infant, partly because of potential reduction in milk volume
- Occasional consumption of small amounts of alcohol are not considered to have a significant effect on the infant

Conclusions:

It is highly recommended to avoid alcohol completely during pregnancy and lactation.

Avoidance of alcohol before conception and in the first trimester of pregnancy is especially important.

If alcohol consumption cannot be excluded completely, limiting of alcohol intake to **1 drink per day** (10 -12g ethanol) should be recommended.

Session 4, Overhead 3

CAFFEINE

Caffeine is a stimulant of the central nervous system found in coffee, tea and cola beverages.

Caffeine crosses placenta and is excreted into breast milk.

Some inconclusive evidence suggested an association of heavy caffeine consumption with low birth weight, premature delivery, miscarriage and stillbirth.

There is no evidence of harmful effects of normal caffeine intake.

Heavy caffeine consumption during lactation can cause irritability and poor sleeping patterns in nursing infants.

Some data suggest negative effect of caffeine on iron content of milk and iron status of infant.

- An estimated dose of caffeine infant receives after a single cup of coffee is about 1.5-3.1 mg.
- The elimination half-life of caffeine is 80 hours in term newborns and 97.5 hours in premature babies.

Session 4, Overhead 6

VITAMIN A TOXICITY

Vitamin A requirement (600-700 micrograms or RE/day; 2000-2300 IU/day) does not increase during pregnancy.

Toxic effects of large doses of vitamin A are well known.

In the US there were documented cases of birth defects in women who have taken megadoses of vitamin A supplements during pregnancy.

In Britain in 1990 it was recommended for women who are, or likely to become, pregnant to avoid vitamin A supplements and liver products (liver products are very concentrated sources of vitamin A).

Suitable alternative sources of vitamin A: Red meats, eggs, margarine, carrots, tomatoes.

Multi-vitamin supplements issued by ante-natal clinic are safe if taken as recommended.

Session 4, Overhead 7

SALMONELLOSIS

Bacteria of the genus Salmonella are common in poultry and eggs; they can easily contaminate other types of meat, milk and dairy products.

In 1990 in the UK, of the food poisoning cases of known origin, 48% were associated with eggs, and 26% with poultry.

Incubation period of Salmonellosis is 24-48 hours
symptoms include stomach pain, vomiting, diarrhoea, fever and exhaustion.

An abrupt loss of water and electrolytes may be fatal for foetus.

Advice to pregnant women:

- Avoid raw eggs and uncooked egg dishes (mayonnaise, mousse, ice cream, raw eggs in drinks)
- Thoroughly cook poultry; cook eggs until yolk and white are solid

Session 4, Overhead 10

LISTERIOSIS

Disease caused by bacterium *Listeria monocytogenes*.

Disease is rare, but has high mortality rate.

Listeria can be transmitted transplacentally and cause miscarriage, stillbirth or septicemia in the newborn infant.

In some cases, the infection can be transmitted by contaminated milk or meat that were not heated/cooked properly.

Listeria can multiply at refrigerator temperature but is killed by heating.

Advice to pregnant women:

- Avoid soft ripened cheeses (Brie, Camembert etc.) made from pasteurized or non-pasteurized cow and goat milk
- Hard, processed and cottage cheeses are safe
- Re-heat ready-to-eat meals before serving
- Avoid liver pates and sausages unless canned

Session 4, Overhead 8

BOVINE SPONGIFORM ENCEPHALOPATHY

Fatal neurologic disorder of cattle, first identified in 1986.

Identified only when clinical symptoms occur.

EU Regulations:

Feeding of ruminants with protein derived from ruminants is prohibited.
Use of bovine offals (brain, spleen, thymus, intestine etc.) in human food is prohibited.

HEPATITIS A

AMOEBIASIS

HELMINTHS

Session 4, Overhead 11

TOXOPLASMOSIS

Disease caused by parasite *Toxoplasma Gondii*
the only vector of transmission to humans is cats.
Symptoms, if present, are similar to flu.

The rate of infection in pregnant women is 2 per 1000.

The parasite crosses placenta:

- 30-40% of the foetuses of affected mothers are infected, 3-4% are seriously affected
- Severity of effect on the foetus varies: the earlier infection occurs, the greater risk for serious congenital pathology.
- Possible outcomes include: hydrocephalus, microcephaly, chorioretinitis, jaundice, anemia, miscarriage, stillbirth etc.

Advice to pregnant women:

- Avoid contact with cats
- Wear gloves while handling cat excrements
- Never eat raw or undercooked meat (especially lamb, pork, sausages, hamburgers)
- Wash hands and kitchen surfaces after handling raw meat
- Wash fruits and vegetables thoroughly
- Wear gloves for gardening and wash hands

Session 4, Overhead 9

HANDOUTS

ETHANOL CONTENT IN SOME ALCOHOLIC BEVERAGES

Beverage	Serving size (ml)	Ethanol (g)
Regular beer	350	13
Light beer	350	11
Distilled spirits (vodka, cognac, brandy, gin, whisky)	30	11
Dry white wine	120	11
Red wine	120	13

CAFFEINE CONTENT IN SOME FOODS AND BEVERAGES

Food	Serving Size (ml)	Caffeine (mg)
Instant Coffee	180	61-72
Percolated coffee	180	97-125
Decaffeinated coffee	180	0.5-1.5
Tea	180	15-75
Cocoa	180	10-17
Cola beverages	350	32-65
Drugs/cold tablets	Tablet	30-32
Chocolate bar	Bar	60-70



HYGIENE IN FOOD-SERVICE AND MASS CATERING ESTABLISHMENTS

PERSONAL HYGIENE, CLEAN PREMISES AND KITCHEN UTENSILS
AS WELL AS HYGIENIC HANDLING OF FOOD PREVENT
FOODBORNE DISEASES ("FOOD POISONING")

IMPORTANT RULES

PERSONAL HYGIENE

◆ **Wear clean clothes!**

Why? To avoid contaminating food with microorganisms and any foreign objects. The cleaner the clothes, the lower the risk of contamination.

◆ **Always cover your hair while working in the kitchen!
Use headgear provided!**

Why? Because this prevents hair from falling into food.

◆ **Remove jewelry (rings, watches) before starting work!**

Why? Jewelry makes handwashing less effective.

◆ **Hands should always be washed before work and especially after visiting the toilet!**

Why? Hands can be contaminated with disease-causing microorganisms, particularly after visiting the toilet. In some situations, use of gloves may be advisable.

◆ **If suffering from an illness involving any of the following:**

Jaundice

Sore throat

Diarrhoea

Skin rash

Vomiting

Other skin lesions (boils, cuts, etc., however small)

Fever

Discharge from ear, eye and nose

report to the employer before commencing work!

Why? It may be necessary to be temporarily assigned to another task.

-
- ◆ **Wounds on hands and arms should be carefully bandaged with waterproof material!**

Why? Wounds may be infected with microorganisms which cause diseases.

- ◆ **Turn away from food and cover your nose and mouth when sneezing/coughing!**

Why? Even healthy people have microorganisms in their nose and throat. Use a paper handkerchief which should then be thrown away. Hands should be washed afterwards.

- ◆ **Refrain from smoking!**

Why? Cigarette ash and butts can fall into food.

HYGIENIC HANDLING OF FOOD

- ◆ **Perishable food should be stored under refrigeration!**

Why? Multiplication of most microorganisms is slowed down or sometimes stopped by chilling. Therefore food should be cooled to a temperature of 10°C, preferably lower.

- ◆ **Perishable food should not be stored too long, even at refrigeration temperature!**

Why? Chilling prevents the growth of many microorganisms. For some, however, chilling only slows down the growth.

- ◆ **Thoroughly defrost frozen meat and poultry before cooking!**

Why? If all parts are not completely defrosted, the temperature increase in some thicker parts of the product, e.g. chicken breast, may not be sufficient to kill all microorganisms during cooking.

- ◆ **Discard all drips accumulated during defrosting of meat and poultry, and thoroughly wash refrigerator shelves, table tops or utensils if soiled!**

Why? These drips may contain disease-causing microorganisms.

- ◆ **Cook food thoroughly!**

Why? Thorough cooking will kill microorganisms. But remember that thorough cooking means that all parts of the food must reach a temperature of at least 70°C. Use special thermometers if in doubt!

◆ **Keep cooked food hot - at a temperature of at least 60°C!**

Why? Most microorganisms multiply at temperatures between 10 and 60°C. Therefore, food which is ready for consumption, but needs to be stored for some time, should be kept either hot (more than 60°C) or be cooled quickly (below 10°C).

◆ **Refrigerate cooked food in shallow containers!**

Why? Shallow containers allow for faster cooling than deeper pans.

◆ **Reheat cooked food to at least 70°C!**

Why? Proper reheating kills microorganisms which may have developed during storage. This rule also applies when left-overs are added to freshly cooked food.

◆ **Keep cooked food separate from raw food!**

Why? This reduces the risk of cross-contamination.

◆ **When preparing mixed dishes, which will be consumed cool, e.g., potato or noodle salads, always cool the cooked component before adding other ingredients!**

Why? Large amounts of hot food cool down very slowly, and during that period microorganisms from other ingredients may multiply.

◆ **All work with perishable food must be carried out quickly!**

Why? The longer the food is exposed to the warmth of the kitchen, the higher is the risk of an increase in microorganisms.

◆ **Cooked food should not be touched by hand!**

Why? Microorganisms are present even on a clean hand and may be transferred to food.

PREMISES AND KITCHEN UTENSILS

◆ **Keep kitchen area and adjoining rooms clean!**

Why? Every food scrap, crumb or spot is a potential reservoir of germs.

◆ **Keep kitchens tidy!**

Why? Tidy kitchens are more easily kept hygienically clean. Personal belongings, for example, should be left in the cloakrooms provided.

◆ **Frequent cleaning up as you go along ensures hygienic kitchens!**

Why? Dried and encrusted left-overs are hard to remove from surfaces and utensils. The working area must therefore be cleaned thoroughly after each process of production.

◆ **Cloths and drying towels that come into contact with dishes and utensils should be changed every day!**

Why? Thorough washing at high temperatures removes dirt and kills micro-organisms. Separate cloths should be used for cleaning the floors, and these also require frequent washing.

◆ **Protect kitchen and storage area from insects and other vermin!**

Why? These pests may carry disease-causing organisms.

◆ **Keep dangerous/poisonous substances, e.g. detergents, disinfectants and insecticides outside the kitchen area in labelled and closed containers!**

Why? Accidents can easily occur when food and poisonous substances are confused.

◆ **Avoid overcharging the cold-storage equipment!**

Why? This leads to a slow and ineffective chilling of the food, which may promote an increase in microorganisms.

◆ **Do not change dish washer timings/techniques/temperatures!**

Why? Food particles may remain on the objects in dish washers and bacteria may survive if the temperature is not correct or the specified amount of detergent is not used or the timing is inadequate. The manufacturers' guidelines must be followed when using equipment.



For further information contact:

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Herstellung:

GROUP WORK

Group Work 4

DEVELOP AN ACTION PLAN TO OVERCOME OBSTACLES TO IMPLEMENTING DIETARY GUIDELINES

Groups of 3-6

Participants are asked to develop an action plan that will allow to overcome existing obstacles and effectively implement current dietary recommendations for non-pregnant, pregnant and lactating women.

Participants should apply results of their analytical work in sessions 1, 2 and 3. From the analyses of interviews of health professionals (group work 1) and dietary intake of pregnant women (group work 2) participants will be able to identify and summarize existing problems that require corrective action. From discussion of factors affecting food choice in session 1 and development of simple guidelines for healthy eating in session 3 participants will identify factors that could be improved by developing and implementing a food and nutrition policy for women.

Some issues that can be addressed in the action plans are:

- how to improve knowledge of health professionals about current dietary recommendations and guidelines;
- how to make health professionals more interested in providing dietary advice to their patients;
- what else can be done to improve nutritional education of pregnant and lactating women;
- how to modify existing and/or develop and implement new screening procedures to identify women that require specialized referral to nutritionist;
- whether state educational programs for pregnant and lactating women are adequate and how they can be modified
- any other policy issues that should be addressed

Participants discuss the problem in groups; present results to class and get feedback from colleagues.

Session 5

NUTRITIONALLY COMPROMISED MOTHERS AND THE NEED FOR SPECIALIZED REFERRAL

INSTRUCTORS NOTES

AIMS

The trainer's aims are to:

- help participants to understand what vegetarian and vegan diets are and how vegetarians and vegans can eat healthily during pregnancy and lactation
- help participants to understand principles and procedure of nutritional screening in pregnancy and lactation
- help participants to be clear about selecting pregnant and lactating women with nutritional problems that will benefit from specialized referral to nutritionist

Overhead 1: Objectives

By the end of this session, participants will be able to:

- describe specific features of vegetarian and vegan diets and list nutrients that tend to be deficient in these diets
- list major dietary recommendations for persons who are on vegetarian or vegan diet during pregnancy and lactation
- describe the process of nutritional screening of pregnant and lactating women and list the main questions that should be asked
- list groups of women that are likely to be nutritionally compromised and explain the reasons

Overheads 2-6

In the former Soviet countries, women and their families may be forced into becoming vegetarians because of poverty. Lack of money may mean they are no longer able to afford meat.

In discussion of vegetarian diets instructor should explain that actual content of these diets can vary substantially from individual to individual; so that careful assessment what person actually eats and thus what nutrients are most likely to be deficient in her diet, is necessary. Advice to vegetarians and vegans during pregnancy and lactation should be individualized. Vegan diets that exclude all foods from animal sources are most likely to be deficient in several important nutrients. Nutrient deficiencies that can develop during pregnancy and lactation in persons on vegetarian/vegan diet may affect both mother's health and development of foetus/infant. Thus, dietary assessment and counseling of these women may be beneficial, especially for women on the more restrictive vegan diet.

Overhead 7

The instructor can start the presentation with an explanation of the general principles of nutritional screening. Screening procedure should be both short (so that it can be used routinely during the scheduled check-up visits); simple (so that all health care professionals can be easily trained to perform nutrition screening) and effective (so that it actually enables to recognize nutritionally compromised women). Regular weighing of women should be performed routinely during the monthly check-ups as it provides valuable information about changes in nutritional and health status of the patient. Questions in the screening interview should be focused on the assessment of the adequacy of the woman's diet according to her physiological requirements. Of primary concern is adequacy of energy, iron, iodine, calcium, vitamin D and folate intake. To

make an accurate assessment interviewers should be well trained and know the nutrient composition of foods from different food groups. Besides evaluation of women's food intake, the other factors that can interfere with adequate diet and influence nutrient requirements (such as poverty, smoking, alcoholism, psychological stress, physical activity etc.) should be taken into consideration. The set of screening questions presented at the overhead is not a dogma but rather a core around which individualized screening procedures based on the local (regional) conditions should be structured. The ultimate goal of screening is detection of women that are at nutritional risk and may require further detailed assessment, consulting and treatment by nutritionist.

Overhead 8

After this general discussion instructor presents some major at-risk groups of women that are likely to need such a specialized referral and discusses with participants how women from these groups can be detected and why these women are likely to be at nutritional risk.

Exclusion of major food group from the diet: such women are likely to be deficient in nutrients that are mainly provided by the foods from the excluded food group. Good examples are vegetarian and especially vegan mothers discussed in detail in session 4. Participants may be asked whether there are any regional cultural or religious factors that can predispose for the restriction or exclusion of foods from any particular food group. Health professionals should be well aware of such factors and adjust screening procedures accordingly.

Severely restricted diet: women may restrict their diet during pregnancy and lactation for several reasons. As discussed before, dieting in an attempt to lose weight should be actively discouraged during pregnancy. If there is suspicion that a woman is following a weight-loss diet she should be counseled appropriately. In these cases careful assessment and persuasive advice by nutritionist may be critically important. Diets severely restricted in calories are also likely to be low in important nutrients. Women restricting their diets for medical reasons may also need sound advice how to adjust their diets to meet the nutrient and energy needs of pregnancy and lactation. Groups that restrict their diets because of food allergies/intolerances and concurrent illnesses will be discussed separately. Also, one should always keep in mind that poverty, poor living conditions or low income may also lead to severe dietary restrictions and/or exclusion major food groups from the diet (e.g. expensive items like meats, fruits etc.).

Food allergies: exclusion of one or a few food items from the diet usually does not pose serious nutritional problems especially if those items can be substituted by foods with similar nutrient composition. More serious problems can arise if all or nearly all foods from a certain food group (or all or nearly all good sources of certain nutrient) are excluded from the diet. A good example is lactose intolerance which may lead to exclusion of all or nearly all dairy products from the diet. Elimination of foods from the diet of lactating woman to treat allergy or colic in breastfed infant should be discouraged unless there is well documented evidence (elimination trial) that shows that the mother or infant are indeed sensitive to this particular food.

Heavy drinking: alcohol intake in pregnancy and lactation was discussed in detail in session 4. In practice, it is extremely important to detect women that habitually consume excessive amounts of alcohol and/or are likely to be involved in binge drinking episodes. These women may be likely to confabulate and make up the stories about their eating habits in order to conceal drinking practices. Heavy drinkers may have multiple nutrient deficiencies because of poor food intake, although energy intake in these patients may be adequate due to high caloric value of alcohol.

Growing adolescents: this group of women requires special attention. Growing adolescents have higher nutrient requirements than adults because of the necessity to sustain growth and

development not only of the foetus but also of their own body. On the other hand, adolescent mothers are more likely to be poor, unemployed and unmarried. They also are more likely to be involved in substance abuse (alcoholism, smoking, drug intake) and dieting in order to lose weight. All these factors tend to compromise food intake which, combined with increased requirements, may have substantial adverse consequences both on mother and baby. Referral to a nutrition specialist will allow adolescent mothers to not only obtain qualified assessment and treatment, but also increase their general knowledge about a healthy diet and lifestyle.

Multiple pregnancy: women with this condition may have additional nutrient requirements compared with singleton pregnancy, they also are more likely to have health complications and nutrition-related problems in pregnancy, so that assessment and advice of nutritionist may be beneficial.

Closely spaced pregnancies: women with inadequate nutritional status and food intake are likely to have depleted nutrient stores after one pregnancy/lactation cycle. If these women enter next pregnancy without having enough time for repletion and their food intake remains inadequate they are at risk of developing multiple nutrient deficiencies which may have negative effect on subsequent pregnancy and lactation outcome.

Abortion and miscarriages: until recently it was believed that diet has little or no effect on miscarriages or spontaneous abortions. Recent studies, as discussed in session 3, showed that folate status may have effect on the occurrence of the neural tube defects. Thus women with miscarriages in anamnesis may benefit from improvement of their folate status as well as nutritional status in general.

Concurrent illness (e.g. DM, Crohn's disease etc.): chronic diseases can affect nutritional status in several ways. Certain diseases may impair digestion and/or absorption of certain nutrients, modify nutrient metabolism, change basal metabolic rate etc. Also, some diseases require specialized diets with restriction or elimination of certain foods. Women with these conditions require thorough assessment and careful adjustment of their diets to the needs of pregnancy and lactation.

Above/below ideal weight: substantial deviations from ideal weight may indicate the presence of serious nutritional problems. Such a women are likely to require individualized assessment of nutrient requirements and dietary advice as well as individual adjustment of weight gain goals in pregnancy.

Excessive weight gain: excessive weight gain is usually undesirable and often is result of excessive energy intake, although other possible causes of abnormally high weight gain should be considered (e.g. polyhydramnion, multiple pregnancy etc.). Weight and weight gain are discussed in detail in sessions 1 and 3.

Rapid weight loss postpartum: Rapid postpartum weight loss is defined as losing more than 8 kg during the first postpartum week or losing more than 9 kg during the first postpartum month or losing more than 2 kg/month after the first postpartum month. As discussed above, the fat stored during pregnancy is necessary to meet the caloric needs of breast milk production. Thus, women who plan to breastfeed should be discouraged from going on a diet or starting a strenuous exercise program, especially during the first months of lactation. Slow weight loss of 0,5-1 kg/month is recommended. Variations in this pattern should be discussed with a dietitian.

Overhead 9

Using the underlying science and information about dietary behaviour, possibilities of how to influence healthy food choice can be discussed with each woman.

OVERHEADS

NUTRITIONALLY COMPROMISED MOTHERS AND THE NEED FOR SPECIALIZED REFERRAL

OBJECTIVES

By the end of this session, you will be able to:

- Describe specific features of vegetarian and vegan diets and list nutrients that tend to be deficient in these diets.
- List major dietary recommendations for persons who are on vegetarian or vegan diet during pregnancy and lactation.
- Describe the process of nutritional screening of pregnant and lactating women and list the main questions that should be asked.
- List groups of women that are likely to be nutritionally compromised and explain the reasons.

Session 5, Overhead 1

VEGAN DIET

Requires especially careful planning.
Administration of nutrient supplements is usually required.

The main issues of concern:

Vitamin B₁₂:

- Found only in animal sources
- Essential for cerebral development of the foetus
- Administration of B₁₂ supplements is usually required in vegans (2.0 micrograms/day)

Calcium:

- Dietary calcium may be very low due to exclusion of milk and dairy products
- Calcium requirements are especially high during lactation
- Alternative sources of calcium: soy milk, soy cheese (although some soy milk may have very low calcium content).
- Administration of calcium supplements is usually required (250-300 mg/day during pregnancy, 600 mg/day during lactation).

Session 5, Overhead 4

VEGETARIANISM

Vegetarians

Persons who live wholly or principally on vegetable food, who on principle abstain from animal food (but may consume eggs or dairy products).

Vegans

Persons who consume no animal products at all and whose diet is totally vegetable and cereal based (no eggs or dairy products).

Exclusion of one or several food groups from the diet can lead to deficiency of certain important nutrients.

Vegetarian diet can be a very healthy way to eat.

Careful planning is needed to ensure an adequate intake of all essential nutrients, especially in pregnancy and lactation.

Session 5, Overhead 2

VEGAN DIET (continued)

Vitamin D

- Vitamin D deficiency may cause neonatal rickets and maternal osteomalacia.
- Problem is especially important if there is limited exposure to sunlight.
- Vitamin D intake from dietary sources is recommended during pregnancy and lactation.
- Some plant sources of vitamin D include: vitamin D-fortified vegetable margarine, cereals and soy milk
- Administration of vitamin D supplements may be indicated (10 micrograms or 400 IU per day).

Iron:

As for vegetarians.

Protein:

- Plant food may contain insufficient amounts of certain essential amino acids.
- Wide selection of cereals, seeds, vegetables, fruits, nuts and legumes is necessary.
- To achieve a better combination of amino acids different plant foods should be eaten together (e.g. pulses and cereals).

Session 5, Overhead 5

VEGETARIAN DIET

A vegetarian diet which includes milk, dairy products and eggs is easily adjusted to requirements of pregnancy and lactation.

Usual principles of planning using food groups apply.

The main issues of concern:

Iron:

- The major source of readily absorbed iron is absent
- Adequate iron intake from plant sources is essential
- To ensure proper absorption of dietary iron foods rich in vitamin C should be taken along with iron sources
- Administration of iron supplements may be indicated

Fat:

- Some types of vegetarian diets may contain excessive amounts of fat (from cheese, nuts, pastry, milk products etc.)
- Fat intake should be controlled

Session 5, Overhead 3

VEGAN DIET (continued)

Zinc

Zinc is essential for development of foetus and placenta.
Content in fruits and vegetables depends on the composition of the soil.
Administration of zinc supplements may be indicated in some cases (15 mg/day).

Conclusions:

Assessment and advice of nutritionist is essential for women on vegan diet.

Although vegetarian diet is not so restrictive as vegan, some pregnant women may still require detailed dietary advice.

Session 5, Overhead 6

SCREENING

Regular weighting of women at scheduled check-up visits, careful monitoring of weight changes.

Questions

- Are vegetables and fruits eaten regularly?
- Are energy-rich carbohydrate foods (bread, pasta, potatoes, rice, buckwheat etc.) eaten regularly?
- How frequently are the meat products consumed?
- Are calcium-rich foods (dairy products) consumed regularly?
- Are iron-rich foods eaten regularly? (also - ask about foods - inhibitors and enhancers of Fe absorption).
- Is the mother using iodized salt?
- Is there an adequate exposure to UV light; if no - are vit. D - fortified foods included in the diet?
- How much fluid is consumed daily?
- Is the mother a vegetarian or vegan?
- Is the mother restricting her food intake in an attempt to lose weight or to treat certain medical condition?
- Are there life circumstances (e.g. poverty, substance abuse, marital status, living conditions etc.) that may interfere with an adequate diet?

Session 5, Overhead 7

SOME AT-RISK GROUPS

- Exclusion of a major food group from the diet
- Severely restricted diet
- Food allergies, intolerances and avoidances
- Heavy drinking
- Smoking
- Adolescent mother
- Multiple gestational pregnancy
- Closely spaced pregnancies
- History of abortions, miscarriages
- Concurrent illness, e.g. DM, Crohn's disease
- Above/below ideal weight
- Excessive or inadequate weight gain
- Rapid weight loss postpartum

Session 5, Overhead 8

Food choice

- Mechanism – why do we eat what we do?
- Preferences (taste)
- Food neophobia (reluctant to try or dislike new foods)
- Dietary behaviour
- Culturally adopted dietary behaviour (examples)
- Physiologically adapted dietary behaviour (e.g. preference for sweet, salt tastes)
- Aversion (inborn/acquired)
- Motivation for change

Session 5, Overhead 9

GROUP WORK

Group Work 5 **CASE STUDIES**

Groups of 3-6

Each group of participants is given one of the four case studies. Participants are asked to work on the case study and answer the questions posed. Each group then nominates a spokesperson who presents the case study and conclusions to class. Participants discuss the problem in groups; present results and get feedback from colleagues.

CASE STUDY 1

Olga, 22 years old, primigravida. She came to her regular check-up visit to obstetrician. Obstetrician suspected **protein deficiency** ("she eats too little protein and her albumin levels are low") and woman was referred to you for assessment and dietary advice.

Social history

Married. Both she and her husband live in the city and study in the university. They rent an apartment because their parents live in the country. Olga receives a small stipend, her husband works part-time nights as a taxi driver. After they pay rent very little money is left for food, so they often visit their parents over the weekends and get some food (mainly vegetables and milk) from them.

Medical history

First pregnancy, singleton, uncomplicated, 29 weeks. No chronic diseases in anamnesis. Non-smoker, consumes alcohol occasionally (1-2 times a month) in small amounts (1-2 glasses of wine). Pre-pregnant BMI - 18.5; weight gain in pregnancy - 8 kg.

Physical exam and lab data

Blood pressure, pulse - normal. Hb - 120 g/l. Plasma albumin - 38 g/l.
Urinalysis - normal.

Dietary history

Prepares meals at home for herself and husband. Diet consists mainly of bread, grains and vegetables. They can rarely afford to buy meat and "they don't like it too much anyway". They regularly eat eggs and drink whole milk which they get mainly from their parents in the country.

24-hour recall

Breakfast - 2 boiled eggs, 2 slices of bread with butter and jam, 1/2 cup of apple and carrot salad, 1 cup of milk.

Lunch - sandwich (2 slices of bread, butter, about 40 g of tuna, slice of tomato and onion), 1 apple, glass of mineral water

Dinner - vegetable soup with macaroni (1 cup), 1 slice of bread, spaghetti (1 cup) with tomato sauce, 1/2 cup of vegetable salad (cucumbers and onions in sour cream), 1 cup of coffee with milk (about 1/2 glass of milk)

Supper - mashed potatoes (1/2 cup), baked beans (about 150 g or 1 cup), 1 apple, 1 cup of tea with milk (about 1/2 glass of milk), 1 slice of bread with honey.

Assess Olga's diet in general and particularly her protein intake. What will be your advice?

Answer to case study 1

Olga's diet contains at least minimum recommended amount of servings from all the major food groups (participants may count approximate amount of servings for each of the food groups).

Meat group - 2,5 servings (remind participants that 1 cup of beans count as 1 meat serving)

Dairy group - 2 servings

Fruits and vegetables group - about 5-6 servings

Bread and cereals group - about 9-10 servings

Protein intake: there are at least 10 servings of foods containing 6 g of protein in Olga's diet (refer participants to the table of protein-containing foods) which comes to about 60 g of protein.

No further increase in protein intake is necessary.

Her albumin levels are within the normal range (35-50 g/l), they may be closer to the lower range in part because of the dilution effect (expansion of plasma volume).

CASE STUDY 2

Anna, 30 years old, second pregnancy. She came to her regular check-up visit to obstetrician. Obstetrician suspected **iron deficiency** ("she looks pale, complains of fatigue and has low haemoglobin") and woman was referred to you for assessment and dietary advice.

Social history

Married. Lives with the husband and a 3-year daughter in their own apartment in the city. Works as a teacher of physics in the secondary school. Husband, a foreman at the large plant, used to have a good salary, but presently because of the economical hardships his salary is low and paid irregularly. Because of this she had to return to work soon after her first labor. Her salary and the money from the few private lessons she gives are often the major source of income for the family. They usually buy food at the farmer's markets and in the grocery shops.

Medical history

Second pregnancy, singleton, 32 weeks. in the first trimester (8-12 weeks) experienced nausea and vomiting. First pregnancy, 3 years ago, resulted in normal labor in term (girl, 2.900 kg). No chronic diseases in anamnesis. Non-smoker, doesn't consume alcohol. Complaints of occasional fatigue and constipation. Pre-pregnant BMI - 24.5; weight gain in pregnancy - 11 kg.

Physical exam and lab data

Blood pressure 110/60, pulse - 72/min. Hb - 112 g/l, haematocrit - 33%.
Urinalysis - normal.

Dietary history

Prepares meals at home, takes lunch with her at work. Usually eats meat or eggs at least two times a day.

24-hour recall

Breakfast - cooked oatmeal (1/2 cup), 1 fried egg, 1 slice of bread with butter, 1 cup of tea

Lunch - sandwich (2 slices of bread, 2 slices of bologna, 1 slice of hard cheese, butter), 1 apple, 2 cups of tea

Dinner -vegetable soup with kidney beans, 1 slice of bread, mashed potatoes (1 cup), small beef cutlet, 1/2 cup of spinach, 2 cups of tea

Supper - 1/2 cup of cooked rice and beans, 1 pork sausage, 1/2 cup of cucumber salad in vegetable oil, 2 cups of tea, 1 slice of bread with butter and jam.

Assess Anna's diet and particularly iron intake.

What dietary advice would you give? Does she need iron supplements?

Answer to case study 2

Anna's diet already contains plenty of iron sources (eggs, meats, spinach, beans etc.). However, there may be a problem of absorption of non-haem iron. She consumes such an inhibitors of iron absorption as tannin (in tea), phytates (in oatmeal and legumes), polyphenols (in legumes).

On the other hand, her diet is low in vitamin C and organic acids which are enhancers of iron absorption. She may be advised to reduce consumption of tea and include in the diet some good sources of ascorbic acid, such as orange juice, raw tomatoes or tomato paste, green peppers etc.

Iron supplements, if prescribed, may not be well absorbed and may aggravate her constipation. Moreover, her iron levels are presently within the normal range for pregnancy (Hb higher than 110g/l; haematocrit higher than 32%), some decrease in iron levels may be due mainly to haemodilution.

Some other possible problems with Anna's diet that can be mentioned:

- low consumption of fruits and vegetables which may result in inadequate intake of antioxidant vitamins A and C, some B vitamins and dietary fiber;
- low consumption of dairy products which are a good source of calcium; high intake of saturated fat-containing foods (butter, sausages, fried egg, processed meats).

CASE STUDY 3

Marina, 18 years old, primipara. She came to the doctor with concerns about her breastfeeding and was referred to you for assessment and dietary advice.

Social history

Married. Just graduated from secondary school. Lives with her husband's parents in a private house. Husband is a local businessman. Marina is a housewife, but presently doesn't do much of housework. Family is wealthy and "can afford just about any food they want".

Medical history

First pregnancy, uncomplicated, resulted in normal delivery in term. Male healthy baby, birth weight 3,200 g. No chronic diseases in anamnesis. Smokes about 8-10 cigarettes a day. Presently she is 3 weeks postpartum, breastfeeding. She was advised to follow a strict breastfeeding timetable (every 4 hours), but baby "seems like not getting enough milk: always irritated, tugs at the nipples, doesn't sleep much at night, so husband's parents are very concerned". She was advised that beer is a good cure of "hypogalactia", so she drinks about 2 glasses of beer a day. Her husband also took her to his friend "homoeopathist" who prescribed her some pills "to enhance milk production".

Physical exam

Mother's BMI - 26.5, gained 1 kg postpartum. Lab analyses - normal. Present weight of the baby - 3,650 g. Observation of breastfeeding: mother is not supporting her baby's back and buttocks firmly, the baby tugs the nipple causing the soreness.

Dietary history

Usually she or her mother-in-law prepare the meals at home for the family.

She usually eats:

- omelet and coffee for breakfast;
- a couple of chocolate candies with 2 cups of coffee for lunch (she feels fatigue if she doesn't drink at least 3-4 cups of coffee a day);
- beef or chicken soup, mashed potatoes with smoked ham or steak and tossed salad for dinner;
- salami sandwich and 2-3 pieces of cake with a glass of tea or milk for dinner;

She likes meats but doesn't eat too many fruits. Her husband often brings her expensive fruits like bananas, kiwi or grapefruits, but she and her parents are concerned that they will cause "diathesis" (allergic reaction) in baby.

How well supported are her concerns about hypogalactia? What modifications of her diet, lifestyle and breastfeeding practices would you suggest? What would be your advice concerning the agents she takes to enhance milk production?

Answer to case study 3

There is no objective evidence that Marina produces too little milk (she should be reassured that baby gains weight normally).

Marina's diet tends to be low in several important nutrients, especially in water-soluble vitamins because of the low fruit and vegetable consumption. This may result in low concentrations of these vitamins in breast milk.

Consumption of more domestically grown fruits and vegetables should be advised.

Her intake of dairy products may be insufficient as well.

On the other hand, her energy, protein and fat intake may be too high. This may have caused her weight gain postpartum and may put her at risk of obesity in the future life.

Smoking may inhibit milk ejection reflex and milk production. Thus, smoking should be actively discouraged, especially smoking in baby's room and/or before breastfeeding.

A decrease in coffee intake may be advised (as it may be in part a cause of baby's irritability).

A more relaxed breastfeeding schedule should be advised as it may better meet the baby's needs. Marina should also be shown how to properly support the baby and how to breastfeed correctly.

Point for discussion

There is no scientific evidence yet that any agents enhance milk production. It is breastfeeding that is crucial, especially how the baby is attached to the mother's breast. Beer consumption in large doses should be discouraged (alcohol transfer into breast milk, adds to excess energy intake by the mother etc.)

CASE STUDY 4

Tamara, 32 years, breastfeeding after her third pregnancy. At the check-up visit she was diagnosed with anaemia, undernutrition and significant weight loss, so that termination of breastfeeding was suggested. Referred to you for assessment and dietary advice.

Social history

Widowed. Recently (about 3 weeks ago) she and her children (daughters 3 and 8 years old, son 3 months old) immigrated as refugees from the region of the ethnic military conflict. Presently unemployed, receives small money allowance for refugees and some food from humanitarian aid. She has relatives in the city and lives in their apartment. Her elderly parents remain in the region of the military conflict. Husband was killed about 2 months ago.

Medical history

Third delivery, premature (at 37 weeks), after pregnancy complicated with late toxicosis. Gave birth to male baby, birth weight 2,550 g. Significant (about 800 ml) blood loss at delivery. Anaemia in anamnesis, first diagnosed during her second pregnancy (3 years ago). Presently she is 3 months postpartum, breastfeeding. Smokes about 1 pack of cigarettes a day. Occasionally consumes alcohol "in order to relax" (1-2 shots of vodka about 1-2 times a week). Complaints of permanent stress, insomnia, lack of appetite. Baby is exclusively breastfed, but Tamara was advised on several occasions to start giving baby the imported formula which she can get from her humanitarian aid. She was told that this will "save her energy and provide baby with more nutritious and vitamin-rich food".

Physical exam

Mother's BMI - 17.8. Weight loss in last 2 months - 5 kg. Present weight of the baby - 4,800 g. Mother's lab data: Hb - 95 g/l; haematocrit - 29%; microcytosis; plasma albumin - 30 g/l.

Dietary history

Tamara eats very little because of reported "lack of appetite" and because often she has only so much food to feed her older children and little is left for her. Her diet consists mainly of bread, vegetables (potatoes, cabbage, beets, carrots etc.) and pasta. She drinks about 1 glass of milk a day and eats meat or fish about 2-3 times a week (she receives powdered milk and some canned fish and meat from humanitarian aid). Her estimated daily energy intake is about 1400 kcal. She takes no vitamin/mineral supplements.

What advice would you give concerning Tamara's diet and lifestyle?

Would you recommend termination or reduction of breastfeeding? Why?

Does she need iron supplementation?

Answer to case study 4

Tamara should be discouraged from termination or reduction of her breastfeeding. In discussion instructor emphasize the fact that even undernourished, stressed and anaemic mothers are able produce sufficient amounts of breast milk. Breast milk is clearly superior to a formula for Tamara's baby. Positive effects of breast milk as compared to formula may be briefly discussed with participants as time allows.

Cessation or substantial reduction of smoking and alcohol intake should be actively encouraged. Iron and possibly folate and vitamin B12 supplements should be prescribed for her anaemia.

The woman should be encouraged to increase her energy intake and to consume plenty of carbohydrate-rich foods, especially breads and vegetables which tend also to be good vitamin sources.

Regional authorities may be contacted to assist Tamara with food and living conditions. If she does receive infant formula free with humanitarian aid she should be encouraged to prepare it for herself and her older children (as a custard or pudding).

GROUP WORK

Group Work 6

FINALIZE AND PRESENT ACTION PLANS

Groups of 3-6.

Each group appoints the group leader who is responsible for presenting the group's version of the action plan.

Participants finalize development of action plans they started in group work 4. Analyses of the current situation regarding food and nutrition policy for pregnant and lactating women and the possible ways of improvement are discussed in groups and presented.

Group presentations are followed by feedback from colleagues and general class discussion. This discussion may allow integrating of the group plans into one final plan that participants will try to implement upon their return to place of work.

Participants discuss the problem in groups; present results, get feedback from colleagues and discuss final plan.

Suggested Readings for the Instructor

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- Institute of Medicine 1992 Nutrition During Pregnancy and Lactation: An Implementation Guide, Washington, National Academy Press
- Institute of Medicine 1991 Nutrition During Lactation, Washington, National Academy Press
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HEALTHY FOOD AND NUTRITION FOR WOMEN AND THEIR FAMILIES

Training Course for Health
Professionals

**Part 2: Pre-course reading and
assignments for participants**

2001

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WHO Regional Office for Europe, Copenhagen

Please note:

Two assignments are to be completed before the course, therefore participants should receive this Pre-course document at least 10 days before the course.

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1. Workshop Description

This workshop is one in a series developed for the countries of eastern Europe and the New Independent States (CCEE/NIS). The series is focused on health providers who serve women and children, specifically young girls between the ages of 5 and 19 and women during the childbearing and early childbearing periods. The unborn foetus, new-born, and infant through the first year of life is the second major focus. The workshops emphasize selected factors related to health status, the health system, and health providers in order to reduce maternal and infant mortality and morbidity.

2. Course Goals

The overall goal of this workshop is to promote maternal and infant health. The workshops are designed to develop health providers professional and managerial capabilities and create awareness among health providers to make lasting improvements in the quality and extent of services for the population's most vulnerable groups. These groups are young girls, pregnant women and mothers, and their infants during the first years of life.

The specific goal of this workshop is to enable health professionals to provide sound nutritional advice, based on current scientific evidence, to pregnant and lactating women or those about to become pregnant.

3. Objectives

Upon completion of the course, the participant will be able to:

1. increase knowledge level of nutritional status and food intake in relation to pre-conceptual, pregnant and lactating women.
2. be aware of the factors affecting food choice during pre-conception, pregnancy and lactation
3. understand the nutritional requirements during pre-conception, pregnancy and lactation.
4. increase their knowledge level of food and health safety during pre-conception, pregnancy and lactation
5. recognise the women who would benefit from referral to a specialist in nutrition or a medical practitioner.
6. recognise the steps which are needed to develop a nutrition policy for women and their families.

4. Format

The workshop group meets for eight hours for three consecutive days. The trainer serves as the facilitator of the workshop which is designed to be both participatory and interactive.

5. Homework

Prior to coming to the workshop, the trainer has asked each participant to read over the documentation and reading materials at home. In addition, the participant has been asked to prepare some work that requires thinking, data collection, and some interviewing of colleagues. These materials are part of the workshop and are used as case material during the workshop. The home work is sent to each participant at least 10 days prior to the workshop (Annex A).

6. Required Readings

Attached is required reading to help prepare the participant for the three-day workshop. Again, these have been provided so that better use can be made of workshop time during the three-day period. This reading includes the **Dietary Reference Values** (Annex B) developed for the United Kingdom and is a similar concept to that used in the former Soviet Physiological Norms. In addition, a paper on **Key Issues in Nutrition** (Annex C) should be read before attending the workshop.

7. Course Schedule

Day 1

9.00	Welcome,overview of workshop and Presentation of participants	Facilitator, Participants
10.00	Session 1: Nutritional status and food intake of non-pregnant, pregnant and lactating women	Facilitator
11.00	Tea and coffee	
11.15	Session 1: Nutritional status and food intake of non-pregnant, pregnant And lactating women (continued)	Facilitator
12.15	Group work 1: How important is nutritional status and food intake?	Work groups
13.30	Lunch	
14.30	Session 2: Recommendations on nutrient intake for non-pregnant, pregnant and lactating women	Facilitator
15.45	Tea and coffee	
16.00	Session 2: Recommendations on nutrient intake for non-pregnant, pregnant and lactating women (continued)	Facilitator
16.30	Group work 2: How can pregnant women meet their nutrient needs?	Work groups Participants
17.15	End-of-day evaluation	

NB: This Course Schedule is a guide and can be adjusted according to the needs of the course participants. The schedule assumes simultaneous interpretation. Time has not been set aside for consecutive interpretation.

Day 2		
9.00	Warm up exercises Group work 2: How can pregnant women meet their nutrient needs? (continued)	Work groups
10.00	Session 3: Nutrition related problems in pregnancy	Facilitator
11.00	Tea and coffee	
11.15	Session 3: Nutrition related problems in pregnancy (continued)	Facilitator
12.15	Group work 3: Design a simple leaflet giving nutritional advice to mothers	Work groups
13.30	Lunch	
14.30	Session 4: Smoking and food safety	Facilitator
15.45	Tea and coffee	
16.00	Group work 4: Develop a plan of action to overcome obstacles to implementing dietary guidelines.	Work groups
17.15	End-of-day-evaluation	Participants

Day 3

9.00	Warm up exercises Session 5: Nutritionally compromised mother and the need for specialized referral	Facilitator
10.00	Group work 5: Case studies	Work groups
11.00	Tea and coffee	
11.15	Group work 6 Finalise and present action plans	Work groups
13.00	Final evaluation	Participants

8. Evaluation

Two types of evaluations are expected. The first, formative or on-going and the second summative or end of workshop.

FORMATIVE or ON-GOING: At the end of each day of the workshop, you will be asked three questions:

- What were the most significant learnings for you today?
- What happened to create the learning for you?
- If there were no significant learnings, why not? What could be done differently?

This evaluation is done verbally and discussed among the participants.

SUMMATIVE or END OF WORKSHOP:

You will be asked to complete a written final evaluation form at the end of the workshop.

Annex A – Pre-course assignments

Homework I

Interview 2-3 health professionals who are consulted regularly by pregnant and/or lactating women. Administer the following structured questionnaire to each health professional: (add any other comments on the back).

QUESTION	ANSWER		
1 Do you believe that body weight and iron status of a woman is important during (a)pre-conception, (b)pregnancy and (c)lactation?	(a) YES NO	(b) YES NO	(c) YES NO
2 Do you believe that the food intake of a woman is important during (a)pre-conception, (b)pregnancy and (c)lactation?	(a) YES NO	(b) YES NO	(c) YES NO
3 If you responded ‘YES’ to any of the questions in 1 and/or 2 can you say briefly what your reasons are?			
4 Do you give dietary advice to pregnant or lactating women?	YES NO		
5 Describe the advice which you give (or provide a copy if this is available in written format)	Written copy available? YES / NO		
6 What is the main dietary problem you encounter?			
7 Do women who consult you usually <i>ask</i> for dietary advice?	YES NO		
8 Do you routinely give dietary advice even if the women who consult you do not ask for advice?	YES NO		
9 How many women seem interested in receiving diet advice?	NOBODY 50-80%	< 20% > 80%	20-50% ALL
10 How many women seem to implement dietary advice?	NOBODY 50-80%	< 20% >80%	20-50% ALL

Homework II

Find a women who is pregnant or lactating and, on the following 24 hour food record chart, write down *everything* she ate and drank the previous day, after questioning her very carefully and thoroughly for at least 30 minutes.

ONE DAY FOOD RECORD CHART

List below only in the first and second columns all the food the woman ate and drank during the previous day. The five righthand columns will be completed during a workgroup session at the course. You may take notes of any important factors that influence the food choice of the woman. This information will be useful for the development of individualized dietary recommendations.

Foods eaten at:	Amount	Breads & cereals	Fruits & vegetables	Milk & milk products	Meat & alternatives	Extras (fats, oils sweets)
Breakfast						
Snack						
Midday meal						
Snack						
Evening meal						
Snack						
Total number of foods eaten from each group						

If a food falls into more than one category, ✓ the appropriate groups. For example, macaroni cheese will fall into 'milk and milk products', 'meat and alternatives' and 'bread and cereals'.

Annex B:. Dietary Reference Values

A Guide

**Prepared for the Department of Health by
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Vitamins

VITAMIN A

THIAMIN (Vitamin B₁)

RIBOFLAVIN (Vitamin B₂)

NIACIN (Vitamin B₃)

VITAMIN B₆

VITAMIN B₁₂

FOLATE

PANTOTHENIC ACID

BIOTIN

VITAMIN C

VITAMIN D

VITAMIN E

VITAMIN K

OTHER ORGANIC COMPOUNDS

Minerals

CALCIUM (1 mmol = 40 mg)

PHOSPHORUS (1 mmol = 30.9 mg)

MAGNESIUM (1 mmol = 24.3 mg)

IRON (1 mmol = 56 mg)

ZINC (1 mmol = 65 mg)

SODIUM (1 mmol = 23 mg)

POTASSIUM (1 mmol = 39.1 mg)

CHLORIDE (1 mmol = 35.5 mg)

COPPER 1 μ mol = 63.5 μ g

IODINE 1 μ mol = 127 μ g

SELENIUM 1 μ mol = 79 μ g

OTHER MINERALS

References

Glossary of Terms and Abbreviations

Tables and figures

Introduction

How many calories should I eat so as not to get fat?

Is a 6ft shotputter who eats 140 g of fat a day increasing his risk of having a heart attack?

How much vitamin C does a 6 year old need?

A study of students' diets showed that they ate, on average, 20 g dietary fibre a day. Is this enough?

All four questions, and many more like them, may be answered only if there is some sort of 'standard'. This standard would give direct answers to questions of the "How much do I need?" type. It would also provide a yardstick against which people's nutrient intakes could be measured to provide answers to the "Is it enough?" type of question.

It all sounds so simple and so easy, but it isn't.

It is precisely because it sounds easy but isn't that there has been so much misinterpretation of experiments to find out how well people are fed.

'Standards' in the form of Recommended Intakes for Nutrients (DHSS 1969) and Recommended Daily Amounts (RDA) of food energy and nutrients (DHSS 1979) have existed in the UK for over 30 years. But some of the people who have used them did not always understand how they had been derived, how they were intended to be used and the degree of accuracy which ought to be attributed to them. In particular, these 'standards' were often used – wrongly – to assess the adequacy of the diet of an individual.

In order to try to overcome the 'abuses' of the figures, and to update them in the light of recent information about nutrient requirements, the Chief Medical Officer asked the Committee on Medical Aspects of Food Policy (COMA) to set up a Panel to consider the matter. The Panel prepared the Government publication *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom*. (DH 1991)

In the past, revisions of recommendations have provided updated versions of previous figures. The present Panel decided to base its conclusions on a review of the original scientific literature on human nutrient needs and intakes.

The full Report contains a summary of the research which led the Panel to make its recommendations so it is, perhaps, not surprising that the full report runs to more than 200 pages.

This research is important for anyone who wants to understand the scientific basis for the Panel's conclusions. In an ideal world, everyone who needs to use the figures would read the full report. But this shorter publication has been prepared for those wishing to grasp quickly the practical

significance of the full report, including those individuals who want to understand its relevance to their own diet. It is intended to give readers information about

- what the figures are
- how they were derived
- the degree of confidence they should have in each of them
- how the figures should be used

Why the difficulty?

Deciding how much protein or vitamin C or calcium a person should eat for optimal health is difficult for many reasons, not least because there is no definition of optimal health.

Individual variation

People differ from each other in the amounts of energy and nutrients they need.

Given this individual variation, how can energy or nutrient recommendations be made which are intended for everyone in a particular population group? How does one represent this range of need by just one figure?

An absorbing problem

A further difficulty in making recommendations for nutrient intake is that the absorption of some nutrients is far from complete. More than 90% of the proteins, fats and carbohydrates in food are digested and absorbed, but only about 15% of the iron eaten gets into the body. Even this proportion is not fixed – it depends on need (how low body stores are), other dietary constituents and the form in which the iron occurs in food. If two people have exactly the same need for iron but one absorbs twice as much as the other, then to get the same amount of iron in the body, the poor absorber will need to eat twice as much iron as the good absorber. What intake figure should be used for the standard?

Is prevention of deficiency signs enough?

What function of a nutrient does one consider in deciding on levels of intake? For example, it is well known that vitamin C deficiency results, sooner or later, in scurvy with bleeding gums, teeth dropping out and wounds failing to heal properly. It is not too difficult to find out the amount of vitamin C which will prevent those deficiency symptoms, but would larger amounts confer any other benefits beyond the anti-scurvy function of vitamin C?

The need for standards

Much work in nutrition is based on finding out what people eat, translating the foods into nutrients and comparing the amounts of those nutrients with standards.

The need for some type of standard is not in dispute. The question is, what should the standard be?

If the aim is to ensure that almost everyone in the country or group gets enough of every nutrient, the figures chosen should, clearly, be high enough to cover the needs of people who have high requirements. Inevitably, this means that, if the people with average or lower-than-average needs eat that much, they will be getting far more than they need. Provided the extra consumption is not harmful, there is no biological disadvantage in setting standards at the top of the range. But it could mean that many people would strive to eat amounts of nutrients they don't need. This could be expensive and wasteful.

The amounts of most nutrients which may be consumed by some people in excess of their needs are most unlikely to be harmful. The same cannot be said of energy.

If the standard for energy intake of a group of people were designed to be enough for those individuals with high needs, it would be too much for most people in the group. If all the members of the group strove to consume that much energy, many of them would become too fat ... which is clearly undesirable.

A more sensible approach, and the one which has been adopted by the Panel, is to set energy standards at the average need, knowing that some people will need more and some will need less. This thinking was the basis of the RDIs and RDAs made in 1969 and 1979 respectively. Essentially, the figures for nutrients were enough or more than enough to cover the needs of almost every healthy person in the country while those for energy were set at the estimated average requirement.

Problems in use – individuals and groups

Recommended figures have been abused mainly because there has been confusion between the term 'individual need for' and 'recommended intake of a nutrient. In reality, almost all people need less than the 'recommended amounts' of a nutrient.

Erring on the side of caution and setting recommendations for nutrient intake at the upper end of the range, as previous figures have done, makes sense if the sole objective is to set a figure in order to minimise the risk of deficiency in a population.

The trouble was, and is, that many users of the standard want to be able to assess the adequacy or otherwise of *individuals'* diets. The 1969 and 1979 figures were not designed to be, and should not be, used for this purpose. But they were.

Suppose an individual was found to be eating 10% less thiamin than the RDI or RDA. What could one say about the adequacy of this individual's thiamin intake? The correct answer is 'very little' ...for two reasons. The first is that dietary surveys to find out what people eat can only give an indication of food intake. But even if this practical problem could be overcome, there is the inherent difficulty that RDIs and RDAs were deliberately set high to ensure that they were enough even for people with high needs. Almost all people need less – some a bit less, most a lot less. It is likely that

the individual eating 10% less thiamin than the RDA was eating enough or more than enough for his needs. But there was no way of telling by using the RDI or RDA.

Despite these sources of error, some people would have compared the individual's thiamin intake with the standard and concluded (probably quite wrongly) that this individual was thiamin deficient.

The 1969 and 1979 "recommended" figures were designed to be used to assess the adequacy of the diets of *groups* of people to help minimise the risk of undernutrition. Any group may be expected to include people with high needs and people with low needs. If the results of a dietary survey revealed that the average nutrient intake for the group was near the RDA, one could conclude that the chance of undernutrition in any individual was small and that most people in the group were getting enough or more than enough.

How much is too much?

High intakes of some nutrients can have undesirable effects. Even so, some members of the public believe that, 'if a little is good, more must be better'. Although the diets of most people in the UK do not result in intakes of any vitamins or minerals that have undesirable effects, the possibility nevertheless exists.

It must be remembered, too, that, as nutrition issues are taken up and certain causes championed by the media, there will be a temptation for people to take food supplements such as vitamin and mineral tablets. This could well increase the likelihood of intakes of nutrients that are dangerously high.

It would, therefore, be useful to have some indication of the relative risks and benefits of high intakes of nutrients. The 1969 and 1979 recommendations gave no such guidance and this has been looked at for the first time by the Panel.

The Need For More Than One Standard

Nutritionists need to use reference values for energy and nutrients for different purposes . It would be useful to be able to assess the adequacy of the diets of groups of people and of individuals. Sometimes it is necessary to know the level of intake that will be enough even for people with high needs but some nutrients are toxic if taken in large amounts – so, how much constitutes too much?

All of these issues have been addressed by the Panel in considering the new 'Dietary Reference Values'. So it is not surprising that they have produced, not one set of figures, but up to four for some nutrients.

DEFINITIONS

Energy, protein, vitamins and minerals

ESTIMATED AVERAGE REQUIREMENT (EAR) – the Panel’s estimate of the average requirement or need for food energy or a nutrient. Clearly, many people will need *more* than the average and many people will need *less*.

REFERENCE NUTRIENT INTAKE (RNI) – an amount of a nutrient that is enough for almost every individual, even someone who has high needs for the nutrient. This level of intake is, therefore, considerably higher than most people *need*. If individuals are consuming the RNI of a nutrient, they are most unlikely to be deficient in that nutrient.

LOWER REFERENCE NUTRIENT INTAKE (LRNI) – the amount of a nutrient that is enough for only the small number of people with *low* needs. Most people will need more than the LRNI if they are to eat enough. If individuals are habitually eating *less* than the LRNI they will almost certainly be deficient.

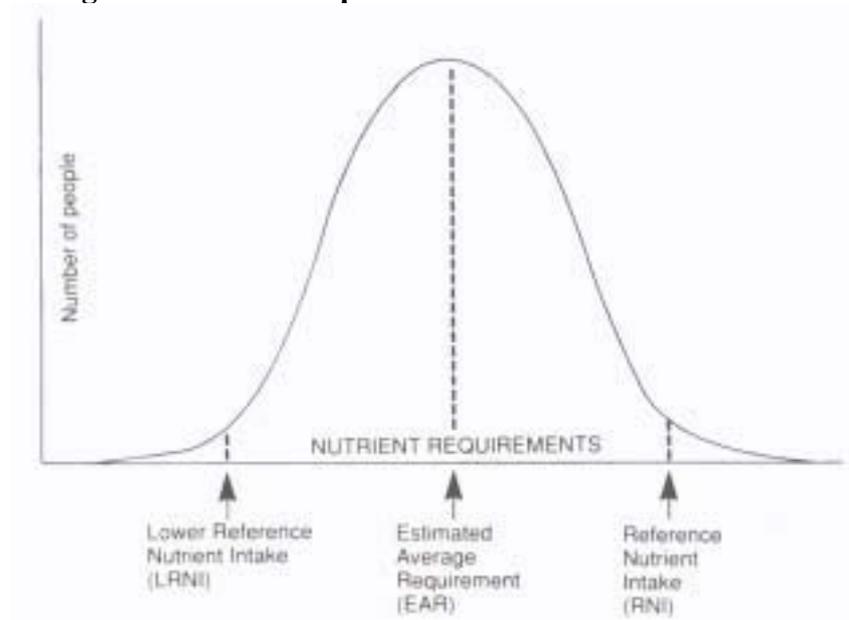
SAFE INTAKE – a term normally used to indicate the intake of a nutrient for which there is not enough information to estimate requirements. A safe intake is one which is judged to be adequate for almost everyone’s needs but not so large as to cause undesirable effects.

DIETARY REFERENCE VALUES (DRVs) – a general term used to cover all the figures produced by the Panel – LRNI, EAR, RNI, and safe intake.

All DRVs are intended to apply to healthy people; they do not make any allowance for the different energy and nutrient needs imposed by some diseases.

By using the word ‘reference’, the Panel hoped that users will not interpret any of the figures as *recommended* or desirable intakes but will use the most appropriate set of figures for any given situation and use them as a general point of reference rather than as definitive values set in tablets of stone. Figure 1 shows how LRNI, EAR and RNI are related to each other.

Figure 1 Relationship between various reference values



The Lower Reference Nutrient intake is enough for only a small number of people (about 3% of the population who have low needs). It is not enough for most people

The Estimated Average Requirement for energy or a nutrient is the amount which any stated group of people will, on average, need.

The Reference Nutrient Intake is the amount of a nutrient which is enough for at least 97% of the population.

Fats, sugars and starches

These nutrients differ from proteins, vitamins and minerals in that there are no deficiency signs or symptoms that are specifically associated with a low intake of fats or sugars or starches. (They are, of course, major contributors to energy intake, an inadequate intake of which results in weight loss.)

There is a requirement for essential fatty acids, but this is extremely low and will almost certainly be met if energy intake is adequate.

With that exception, there is no *requirement*, as such, for fats, sugars or starches. And within the confines of overall energy needs, neither is there a lower value below which deficiency is likely nor an upper limit beyond which undesirable effects are likely. There can be no LRNI or EAR or RNI.

Nevertheless, research has shown that the proportions in the diet of fats – in particular of certain fatty acids – starches and sugars may affect health. The Panel therefore considered it important that the Dietary Reference Values should give some guidance on the desirable intakes of these nutrients; intakes which, in the light of present knowledge, seem to be conducive to good health and to

minimising the risk of developing diseases such as heart disease or cancer. For these nutrients, Dietary Reference Values are given as average contributions to dietary energy for *groups* of people.

Non-starch polysaccharides

This term effectively replaces ‘dietary fibre’ (see p. 21). Research in recent years has helped to clarify the role that non-starch polysaccharides (NSP) play in the body. The Panel has suggested a Dietary Reference Value based on an estimated desirable average intake, and the expected range of individual intakes around that figure.

How Should Dietary Reference Values Be Used?

Assessment of diets of groups of people

To assess the likely adequacy of the diet for a group of people, it might be useful to compare *average intakes* with *average requirements*. But this by no means guarantees that all individuals within the group are eating enough to satisfy their own needs.

It is possible that some of the people with low needs are eating more than average and more than they need. More importantly, it is possible that people with high needs are eating less than the average and are, therefore, not eating enough.

To ensure that the risk of deficiency within the group is very small, the *average* group intake should be at the level of the RNI.

Assessment of an individual's diet

DRVs may help to give an indication of the likely adequacy of an individual person's diet, but great care needs to be taken in using figures for this purpose

If a person is regularly consuming less than the LRNI, it is very likely that that individual will not be getting enough. Someone consuming the RNI or more is most unlikely to be deficient.

If a dietary survey reveals that an individual's consumption of a nutrient was somewhere between the LRNI and the RNI, it is not possible to say whether or not the amount of the nutrient is adequate because it is not known whether the person has a high, average or low requirement. But the closer the intake is to the LRNI the more likely deficiency becomes.

Planning food supplies for large groups

The objective is to ensure that everyone gets enough of every nutrient to satisfy individual needs. So, the needs of those with high nutrient requirements must be catered for and it is wise to use RNI, even though it means that more food and nutrients are supplied than the sum of each individual's requirements.

Nutrition labelling

Nutrition labels are used by individuals, and what is appropriate for *groups* may not be appropriate for *individuals*. '4 mg of iron per 100 g of food' doesn't mean much to many people. Knowing that a 125 g portion supplies 40% of what they need may mean more, and that is the form in which the Panel recommends that food labelling should in future convey information about nutrient content. The Panel recommends that, whenever possible, because the RNI would provide more than most people need, nutrient content should be expressed as a percentage of the EAR, which would be interpreted as just that – an *average* requirement.

A Note of Caution!

The Panel emphasised that, for most nutrients, there were insufficient data to set the EAR or LRNI or RNI or safe intake with any great confidence. Some of the data used in deriving the figures are based on dietary surveys which, in themselves, are not absolutely precise.

So, IT IS IMPORTANT THAT ALL DIETARY REFERENCE VALUES FOR PROTEINS, VITAMINS AND MINERALS ARE TREATED CAUTIOUSLY AS *INDICATIONS* OF THE RANGES OF REQUIREMENTS LIKELY TO BE FOUND WITHIN THE UK POPULATION. EQUALLY, THE VALUES FOR ENERGY, FATS, SUGARS AND STARCHES ARE INTENDED TO BE *INDICATIONS* OF APPROPRIATE INTAKES.

Conclusions of the Panel

The Panel considered requirements, and set Dietary Reference Values for, energy and 33 nutrients – proteins, fats, sugars, starches, non-starch polysaccharides (NSP), 13 vitamins and 15 minerals of known importance to human health. Eighteen other minerals were also considered.

The Panel set figures for people of all ages, including young infants who are formula fed, but it endorsed the recommendations of other expert groups that breastmilk is the best food for healthy, term infants for the first six months.

Format

The information in each of the following sections is given, as far as possible, in a uniform format. A small amount of information about how the recommendations were reached is included. (The COMA Report contains much more detail on this aspect of the Panel's work as well as a considerable amount of information about the functions of the nutrients.)

The actual figures are the main item. Where applicable, Lower Reference Nutrient Intakes (LRNIs), Estimated Average Requirements (EARs) and Reference Nutrient Intakes (RNIs) are given. For many nutrients there is also guidance on the health effects of high intakes. For nutrients such as fats, starches and sugars, Reference Values are given as their proposed desirable average contribution to dietary energy.

Energy

The Estimated Average Requirements for different age groups are based mainly on observations of energy expenditure. But observed intakes have also been taken into account, especially for 3 to 10 year-old children.

Children and Adolescents

EARs are based on present lifestyles and activity levels. There is broad agreement that an increase in energy *expenditure* for many people over the age of 1 year would be desirable for health, but the Panel has not included this 'prescriptive' increase in its figures for *intake*. To do so would be unlikely, by itself, to lead to increased physical activity but might encourage people to eat more energy than they are presently eating – with undesirable consequences for body weight.

Table 1 *Estimated Average Requirements for Energy
Children and adolescents aged 0 to 18 years*

Age	EAR – MJ/d (kcal/d)	
	Boys	Girls
0–3 mo	2.28 (545)	2.16 (515)
4–6 mo	2.89 (690)	2.69 (645)
7–9 mo	3.44 (825)	3.20 (765)
10–12 mo	3.85 (920)	3.61 (865)
1–3 yr	5.15 (1230)	4.86 (1165)
4–6 yr	7.16 (1715)	6.46 (1545)
7–10 yr	8.24 (1970)	7.28 (1740)
11–14 yr	9.27 (2220)	7.92 (1845)
15–18 yr	11.51 (2755)	8.83 (2110)

Adults

Energy needs are determined largely by basal metabolic rates (BMR) and physical activity levels. EARs for energy intake are expressed as multiples of the BMR – ie BMR multiplied by a factor which is determined by the level of physical activity. This factor is referred to as the *physical activity level* (PAL). So,

$$\text{EAR} = \text{BMR} \times \text{PAL}$$

A PAL of 1.4 is applicable to most people in the UK. It represents very little physical activity at work or in leisure time.

PALs of 1.6 for women and 1.7 for men represent moderate activity during work time and during leisure.

PALs of 1.8 for women and 1.9 for men represent high levels of physical activity at work and during recreational activities.

Table 2 *Estimated Average Requirements for Energy
Adults (assuming low activity levels at work and leisure) (PAL = 1.4)*

Age	EAR – MJ/d (kcal/d)	
	Males	Females
19–49 yr	10.60 (2550)	8.10 (1940)
50–59 yr	10.60 (2550)	8.00 (1900)
60–64 yr	9.93 (2380)	7.99 (1900)
65–74 yr	9.71 (2330)	7.96 (1900)
75+ yr	8.77 (2100)	7.61 (1810)

Pregnant women

Although energy is needed during pregnancy to support the growth of the fetus and to enable fat to be deposited in the mother's body (for later use during lactation), considerable reductions occur in physical activity and metabolic rate to help to compensate for the increased needs .

The Panel concluded that the need to increase energy intakes during pregnancy is limited to a modest increment during the last trimester only. The *increase* in EAR above pre-pregnancy intake is 0.8 MJ/d (200 kcal/d) for the final three months only. But women who were underweight at the start of pregnancy may need to eat more.

Lactating women

Breastfeeding is an energy-demanding activity because breastmilk has to contain enough energy to supply the needs of the growing infant. Even taking into account the fact that body fat stored during pregnancy is used to supply some of that energy, additional energy intake, over and above pre-pregnancy intakes, is needed during lactation.

As soon as weaning begins, the mother's energy needs begin to return to their pre-pregnancy levels. For the purpose of setting EARs, breastfeeding mothers are classified in two groups. Group 1 mothers are those whose breastmilk supplies all or most of the infant's food only for the first 3

months. Group 2 mothers are those who supply all or nearly all the infant's energy and nutrient needs for 6 months or more.

Table 3 *Additional Estimated Average Requirements for Lactating Women*

Stage of breastfeeding	Additional EAR – MJ/d(kcal/d)	
up to 1 mo	1.9 (450)	
1 to 2 mo	2.2 (530)	
2 to 3 mo	2.4 (570)	
	Group 1	Group 2
3–6 mo	2.0 (480)	2.4 (570)
more than 6 mo	1.0 (240)	2.3 (550)

Protein

Figures are mainly based on data from nitrogen balance studies and the recommendations in the World Health Organisation report, *Energy and Protein Requirements*. (WHO 1985).

Previously, Recommended Protein Intakes/Amounts in the UK have not been based on *needs* but on the fact that people in the UK who are accustomed to taking at least 10% of their energy as protein are not protein deficient.

The 1991 figures are based on estimates of *need* and make allowance for the fact that, although about 90% of protein in food is digested, only about 70% of protein in food is incorporated into body tissue. Even so, the figures for both EAR and RNI are considerably lower than the 1979 Recommended Daily Amounts.

The protein RNIs for all adults aged 19 years and over are 0.75 g/kg/d.

Figures for children and pregnant and lactating women allow for:

- i growth in children
- ii growth of fetal and maternal tissue in pregnant women
- iii breastmilk production in lactating women

The figures are valid only if the needs for energy and all other nutrients are met. If energy needs are not met, dietary protein is used preferentially as a source of energy rather than the 'raw material' for

tissue growth and repair. DRVs are based on the assumption that the protein is of high quality; in other words that the essential amino acid composition in food proteins is close to the human body's need. The normal mixed UK diet provides protein of such quality.

Table 4 Dietary Reference Values for Protein

Age	EAR – g/d	RNI – g/d
0–3 mo	–	12.5 ^a
4–6 mo	10.6	12.7
7–9 mo	11.0	13.7
10–12 mo	11.2	14.9
1–3yr	11.7	14.5
4–6 yr	14.8	19.7
7–10 yr	22.8	28.3

Table 4 *continued*

Age	EAR – g/d		RNI – g/d	
	Males	Females	Males	Females
11–14 yr	33.8	33.1	42.1	41.2
15–18 yr	46.1	37.1	55.2	45.4
19–49 yr	44.4	36.0	55.5	45.0
50+ yr	42.6	37.2	53.3	46.5

Additional amounts to be added to pre-pregnancy DRVs

Pregnant women	+6	+6
Lactating women up to 6 mo	+11	+11
6+ mo	+8	+8

^a No figures given by WHO. RNI calculated from recommendations of COMA 1980. (DHSS 1980)

Guidance on high intakes

Because there is some evidence that very high protein intakes may aggravate poor or failing kidney function, and because the Panel could find no proven benefit of protein intakes in excess of the RNI, they concluded that intakes should not exceed twice the RNI.

Fat and Fatty Acids

Definitions

Triglyceride. The form in which most fats occur in food. A triglyceride consists of three fatty acid molecules attached to a glycerol molecule. A given weight of fatty acids is, therefore, equivalent to a larger weight of fat (triglyceride).

Fatty acid. A molecule consisting mainly of a carbon chain (of variable length) with hydrogen attached. About 16 different fatty acids make up the bulk of the fatty acids in food.

Saturated fatty acid (SFA). One which contains the maximum possible number of hydrogen atoms. The most abundant SFA in foods are myristic acid with 14 carbon atoms in the chain (C14), palmitic acid with 16 carbon atoms (C16) and stearic acid (C18).

Monounsaturated fatty acid. This is usually a long chain fatty acid in which 2 hydrogen atoms are 'missing'. The most common one in food is oleic acid with 18 carbon atoms.

Polyunsaturated fatty acid (PUFA). Usually a long chain fatty acid in which more than two hydrogen atoms are 'missing'. The most common ones are linoleic acid with 4 hydrogen atoms missing and linolenic acid with 6 hydrogen atoms missing. These two PUFA are known as the essential fatty acids (EFA) because they cannot be made in the body.

Cis and trans. Terms used to indicate the spatial arrangement of atoms in a molecule such as an unsaturated fatty acid. Naturally occurring unsaturated fatty acids are usually in the *cis* configuration.

Dietary fats (triglycerides) are important at two distinct levels of intake.

Essential fatty acids

There is a specific requirement for linoleic acid and one form of linolenic acid, alpha-linolenic acid. Hence these two are called 'essential fatty acids' (EFAs).

Although deficiency does not occur in free-living people eating a 'normal' diet, it is possible to estimate the minimum intakes for infants, children and adults.

The Panel concluded that linoleic acid should provide at least 1% and alpha-linolenic acid should provide at least 0.2% of total energy intake.

Total fat intake

People in the UK, as in other western countries, are accustomed to eating far more fat than is needed just to prevent essential fatty acid deficiency. Much research effort has been put into trying to find out whether or not the present high levels of fat intake are detrimental to health, and particularly whether it is a contributory cause of heart disease and/or some cancers.

After reviewing the considerable amount of evidence on the effect of diet on blood cholesterol levels, heart disease and cancers, the Panel concluded that:

- i. The higher the blood cholesterol level in a population group or individual the greater the risk of heart disease
- ii. Increasing the intake of C14 and C16 saturated fatty acids raises blood cholesterol levels
- iii. Linoleic acid and its derivatives lower blood cholesterol; linolenic acid and its derivatives inhibit clot formation
- iv. Monounsaturated fatty acids probably have no effect on blood cholesterol levels
- v. Dietary cholesterol has a relatively small effect on blood cholesterol levels
- vi. Trials to try to alter heart disease rates by reducing blood cholesterol levels have generally resulted in lower incidences of heart disease but have not affected total mortality rates
- vii. There is not enough evidence to demonstrate conclusively a link between the intake of fat or any fatty acid and cancer, but the evidence that is available makes it wise to caution against unlimited intakes of fat or of any fatty acid
- viii. Typical UK diets contain small amounts of *trans* fatty acids. Although there have been suggestions that *trans*-fatty acids may increase the risk of heart disease, there is not enough information about their effects on health to draw any firm conclusions about intakes. But, for the sake of prudence, intakes should not rise above the current estimated average level.

Dietary Reference Values for fat and fatty acids

In arriving at Dietary Reference Values for fatty acids, the Panel recognised that any such values would be rather arbitrary, because, apart from EFAs, there is no absolute need for fat or any fatty acid and, within overall energy needs, no well-defined signs or symptoms of deficiency or excess intake. Nevertheless, because of the relationship between fat and certain fatty acids on the one hand, and coronary heart disease and cancers on the other, the Panel decided that Reference Value would be useful.

The DRVs for fat are derived by adding up the reference values for the individual types of fatty acids – *cis*-polyunsaturated, *cis*-monounsaturated, *trans* and saturated – and adjusting the amount to take account of the weight of glycerol. The Panel considered that the likely effects (both beneficial

and detrimental) on health of the specific components of fat were more important than total fat intake *per se*.

Table 5 Dietary Reference Values for Fatty Acids and Total Fat

	Population average intake as % energy*	
	including alcohol	excluding alcohol
Saturated fatty acids	10	11
<i>Cis</i> -monounsaturated fatty acids	12	13
<i>Cis</i> -polyunsaturated fatty acids	6	6.5
including linoleic acid 1 linolenic acid 0.2		
<i>Trans</i> -fatty acids	2	2
TOTAL FATTY ACIDS	30	32.5
Equivalent to TOTAL FAT	33	35

* Alcohol is taken to contribute, on average, 5% of energy intake.

^a The individual *maximum* is 10% of energy.

Note: These figures assume that the protein intake remains at current levels of about 15% of energy which is higher than the RNI.

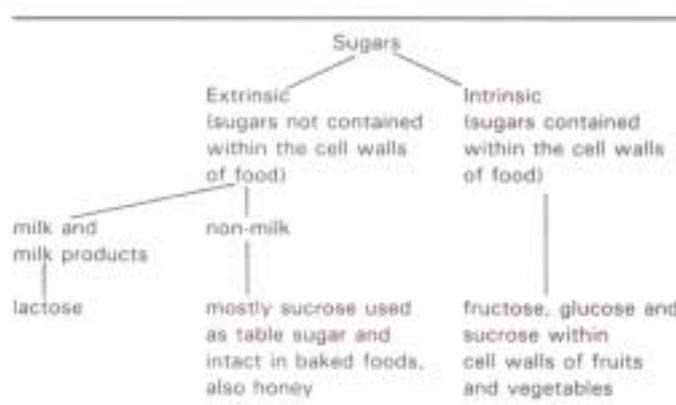
Sugars and Starches

Sugars

The food sugars which are most important in human nutrition are the monosaccharides – glucose and fructose – and the disaccharides – sucrose and lactose. Some physiological effects of sugars are determined at least as much by their physical form as by their chemical structures.

In deriving DRVs, the Panel considered three groups of sugars – intrinsic sugars, milk sugar (lactose) and non-milk extrinsic sugars. (see Figure 2).

Figure 2 Classification of Sugars



No detrimental effects on dental health or health in general can be attributed to lactose in milk and milk products or to intrinsic sugars. Neither is there any lower intake below which deficiency symptoms occur.

Non-milk extrinsic sugars (mainly sucrose), on the other hand, play a significant role in causing tooth decay (although a number of other factors, principally fluoridation, affect its occurrence). In this context, the frequency of consumption is at least as important as the total weight of sugars eaten. But the Panel considered that DRVs expressed as a percentage of energy intake would be easier to use than a figure based on weight or frequency of consumption. Very high intakes of non-milk extrinsic sugars (in the region of 30% of energy intake) may be associated with raised blood cholesterol and insulin levels in some people.

Starches

People need more energy than they can, or should, derive from protein, fat, sugars and alcohol. If they need to eat less fat and non-milk extrinsic sugars, they may need to compensate by eating more starches.

There are no known detrimental effects of high or very high starch intakes (provided, of course that requirements for energy, protein, EFAs, vitamins and minerals are met).

Dietary Reference Values

The DRV for non-milk extrinsic sugars is about 60 g/d, representing 10% of total energy intake. This is an average figure for the UK population.

The Panel gave a Dietary Reference Value of 37% of total energy from starch, intrinsic sugars and lactose in milk and milk products, but could not justify giving a separate figure for each of these carbohydrates.

It must be emphasised that the figures of 10% for non-milk extrinsic sugars and 37% for other available carbohydrates are based on the fact that, in reality, on average, 5% of energy comes from alcohol and current intakes of protein are about 15% of energy (ie above the RNI). If alcohol is excluded from the calculations, the DRVs become 11% for non-milk extrinsic sugars and 39% for starches, intrinsic sugars and lactose in milk and milk products.

Table 6 Dietary Reference Values for Sugars and Starches

	Non-milk extrinsic sugars % energy	Starches, intrinsic sugars and lactose in milk and milk products % energy
If alcohol is included and protein is at current level of about 15%	10	37
If alcohol is excluded and protein is at current level of about 15%	11	39

Non-Starch Polysaccharides

The term 'dietary fibre' has become widely used by the public and regarded by most of them as 'the part of food that isn't digested'. Unfortunately, perhaps, it isn't that simple. Attempts to analyse the non-digestible part of food revealed just what a complex mixture of compounds – most of them polysaccharides – it encompasses. And different analysts obtained different results because they used different methods.

To try to get some standardisation of method and terminology, the Panel accepted the term 'non-starch polysaccharides' and the analytical method of Englyst and Cummings (1988).

Using older methods to analyse dietary fibre, the average UK consumption was estimated to be about 20 g/person/d. Using the newer method to analyse NSP, this figure becomes about 11 to 13 g.

The Panel concluded that an intake of NSP which was higher than the present average intake would be desirable. Although much remains to be established about the role of the various components of NSP in health, present evidence suggests that:

- i. The water-soluble components of NSP may help to lower blood cholesterol levels
- ii. NSP intake, especially insoluble components, is correlated with stool weight
- iii. Low stool weights, which occur with NSP intakes below 12 g/d, are associated with increased risk of bowel disorders such as cancer and gall stones
- iv. Some NSP components found especially in wheat bran contain a substance called phytate which may bind minerals such as calcium, iron, zinc and copper and make them unavailable.

There is no evidence of any long term adverse effects, but care needs to be taken by people such as the elderly whose diets may be only marginally adequate in minerals.

Dietary Reference Values

The Panel proposed an average intake of NSP, based on their effect on stool weight, of 18 g/d for adults with an expected range of individual intakes from 12 g/d to 24 g/d. Because of their smaller body weight, children should eat less. The range of polysaccharides which constitutes NSP is most easily obtained by eating a range of NSP-containing foods – cereals, fruit and vegetables.

Because of the bulk of NSP-rich foods, there is a small risk that, if eaten to excess, they may prevent children eating enough to satisfy energy needs.

Guidance on high intakes

There is no evidence that intakes of NSP above 32g/d are associated with any ill effects. But no increase in stool weights occurs with intakes greater than this. So the Panel saw no virtue in exceeding 32 g/d.

Vitamins

VITAMIN A

Dietary vitamin A is measured as retinol equivalent because, as well as the ready-formed vitamin (retinol) in foods of animal origin, β carotene in plant foods is converted to retinol in the body. 6 μ g β carotene is equivalent to 1 μ g retinol.

Adults

Previously, vitamin A requirements have been derived from depletion/repletion studies. But these tend to give overestimates of requirements. A better method – the one used to calculate DRVs – is to estimate the amount of dietary vitamin A needed to build and maintain a specified body store in the liver. DRVs are based on calculations of intakes needed to maintain a liver store of 20 μ g retinol/ 9 liver . This is the same basis as was used by FAO/WHO (1988).

There are no recommendations about the proportion of vitamin A which should be derived from β carotene and from retinol. Although there is some evidence that β carotene may offer some protection against cancer, the Panel considered that the evidence was insufficient to make specific recommendations.

Infants

Values are based on the fact that 100 $\mu\text{g}/\text{d}$ from breast milk is adequate to prevent deficiency. But it is probably not enough to build and maintain a body store of the vitamin. Reference intakes for infants are, therefore, higher than 100 $\mu\text{g}/\text{d}$.

Children

No experimental data are available to establish the vitamin A requirements of children. There is a requirement for growth as well as the maintenance of body stores and DRVs are based on the assumption that there is a gradual transition from the requirements of infants to those of adults.

Guidance on high intakes

β carotene is not toxic but intakes of retinol in excess of need, if taken over a long period of time, may be dangerous. They may lead to liver and bone damage and other problems.

Regular intakes should not exceed 7500 $\mu\text{g}/\text{d}$ for women or 9000 $\mu\text{g}/\text{d}$ for men. An intake of retinol in excess of 3300 $\mu\text{g}/\text{d}$ is hazardous during pregnancy because it may cause birth defects. Women who are pregnant or may become pregnant need to avoid excessive intakes.

Table 7 Dietary Reference Values for Vitamin A μg retinol equivalent/d

Age	LRNI		EAR		RNI	
0–12 mo	150		250		350	
1–3 yr	200		300		400	
4–6 yr	200		300		400	
7–10 yr	250		350		500	
11–14 yr	250		400		600	
	Males	Females	Males	Females	Males	Females
15–50+ yr	300	250	500	400	700	600
Additional amounts to be added to pre-pregnancy DRVs						
Pregnant women	+100					
Lactating women	+350					

THIAMIN (Vitamin B₁)

Thiamin is needed for the release of energy from carbohydrates, alcohol and fats, Requirements are, therefore, related to the metabolism of these nutrients.

Basing thiamin intakes on *total energy intakes* is easier and does not result in any significant inaccuracies. The RNI was set at 0.4 mg/1000 kcal for most groups of people.

No increments per 1000 kcal are needed during pregnancy and lactation. Increased energy intakes at these times will result in proportional increases in daily thiamin intakes.

Guidance on high intakes

Long term intakes of more than 3 g/d (about 1000 times the RNI) may have undesirable effects in adults.

Table 8 Dietary Reference Values for Thiamin mg/1000 kcal

Age	LRNI	EAR	RNI
0–12 mo	0.20	0.23	0.30
from 1 yr	0.23	0.30	0.40
<i>Examples of DRVs (mg/d)</i>			
Men 19–49 yr	PAL = 1.4	Energy intake = 2550 kcal	
	0.60	0.80	1.00
Women 19–49 yr	PAL = 1.4	Energy intake = 1940 kcal	
	0.40	0.60	0.80

RIBOFLAVIN (Vitamin B₂)

Riboflavin has an essential role in the release of energy from proteins, fats and carbohydrates. For sedentary men and women, riboflavin requirements may be correlated with energy intakes but this relationship does not hold for more active people. The Panel decided, therefore, to express DRVs for riboflavin on a daily intake basis.

Information on typical UK intakes, intakes associated with high excretion of the vitamin and measures of tissue saturation were all taken into account to derive the DRVs.

Guidance on high intakes

Absorption of riboflavin in the intestine is limited by its poor solubility. So it is most unlikely that enough could be absorbed to be dangerous. Intakes of 120 mg/d for 10 months were not associated with any adverse effects.

Table 9 *Dietary Reference Values for Riboflavin mg/d*

Age	LRNI		EAR		RNI	
0–12 mo	0.2		0.3		0.4	
1–3 yr	0.3		0.5		0.6	
4–6 yr	0.4		0.6		0.8	
7–10 yr	0.5		0.8		1.0	
	Males	Females	Males	Females	Males	Females
11–14 yr	0.8	0.8	1.0	0.9	1.2	1.1
15–18 yr	0.8	0.8	1.0	0.9	1.3	1.1
19–50+ yr	0.8	0.8	1.0	0.9	1.3	1.1
Additional amounts to be added to pre-pregnancy DRVs						
Pregnant women	+0.3					
Lactating women	+0.5					

NIACIN (Vitamin B₃)

Two related compounds – nicotinic acid and nicotinamide – are both called niacin. They form parts of coenzymes involved in the oxidative release of energy. Requirements are, therefore, related to energy needs.

In addition to the pre-formed vitamin occurring in foods, one of the essential amino acids, tryptophan, may be converted in the body to niacin. In most people, the conversion is

$$\text{niacin} = \frac{\text{tryptophan}}{60}$$

The exception is pregnant women who convert tryptophan about twice as efficiently.

So, total vitamin activity (expressed as niacin equivalent) is derived from the preformed vitamin plus the amount made in the body from tryptophan.

For people taking enough high quality protein to maintain nitrogen balance, the tryptophan content is enough to satisfy niacin needs. There is, therefore, no need for the pre-formed vitamin in the diet.

Guidance on high intakes

Very high doses – in the region of 3 to 6 g/d – of nicotinic acid may cause liver damage. Doses in excess of 20+ mg/d may cause dilation of blood vessels in the skin but this effect wears off after a few days of repeated administration.

There is no evidence that very large amounts of niacin confer any benefit for healthy people.
Adults, children and infants

Requirements for niacin are estimated from measurements of urinary excretion of the vitamin's metabolites and the amount of NADP (one of the coenzymes) in the body.

DRVs are expressed as amounts per 1000 kcal and, with one exception, are the same for people of both sexes and all ages. Lactating women probably need additional niacin to maintain adequate levels in breast milk, over and above the increased intake that will occur as a result of increased energy intake at this time. This has been expressed as an additional weight of niacin equivalent per day.

Table 10 Dietary Reference Values for Niacin mg niacin equivalent/1000 kcal

Age	LRNI	EAR	RNI
All ages	4.4	5.5	6.6
Additional amounts to be added to pre-pregnancy DRVs			
Lactating women	+2.3 mg/d		
<i>Examples of DRVs (mg/d)</i>			
Men 19–49 yr	PAL = 1.4	Energy intake = 2550 kcal	
	11.2	14.0	16.8
Women 19–49 yr	PAL = 1.4	Energy intake = 1940 kcal	
	8.5	10.7	12.8

VITAMIN B₆

Vitamin B₆ is a mixture of compounds that are all interconvertible. They are of central importance in the body's protein metabolism. Requirements are, therefore, related to the amounts of amino acids that are metabolised and DRVs are based on current protein intakes in the UK.

Adults and children

Requirements have been estimated mainly from measuring blood vitamin B₆ levels and changes in the metabolism of two amino acids – methionine and tryptophan – during depletion and repletion studies.

Although blood concentrations of vitamin B₆ fall during pregnancy, there is no evidence of any benefit in raising these levels. Neither is there any evidence of additional need (measured on a µg /g protein basis) during lactation.

Oral contraceptives do not increase requirements for the vitamin.

Infants

DRVs for formula-fed infants are based on the vitamin B₆ concentration in breastmilk. Guidance on high intakes

Very high intakes of vitamin B₆ may help to counter some of the undesirable side effects of contraceptive steroids in some women. However, high intakes have been associated with impaired function of sensory nerves. The amounts of the vitamin involved have varied from 50 mg/d to 2 to 7 g/d. Return to normal intakes has led to the return of normal or near normal nerve function.

Table 11 *Dietary Reference Values for Vitamin B₆ µg/g protein*

Age	LRNI	EAR	RNI
0–6 mo	3.5	6	8
7–9 mo	6	8	10
10–12 mo	8	10	13
from 1 yr	11	13	15

Examples of DRVs (mg/d) based on actual protein intake (14.7% of total energy) and EARs for energy

	mg/d		
Men 19–49 yr		Energy intake = 2550 kcal	
	1.0	1.2	1.4
Women 19–49 yr		Energy intake = 1940 kcal	
	0.8	0.9	1.2

VITAMIN B₁₂

Vitamin B₁₂ is needed to help produce the myelin sheaths around nerves and is also involved with folic acid in the metabolism of some amino acids. Deficiency of vitamin B₁₂ leads to megaloblastic anaemia and neurological problems.

Adults

DRVs have been derived from three types of study – intakes of groups known to eat few vitamin B₁₂-containing foods but who do not have megaloblastic anaemia; amounts of the vitamin needed to effect a slow cure of vitamin B₁₂ deficiency anaemia; and the response – of anaemic patients to parenteral vitamin B₁₂. The RNI of vitamin B₁₂ is enough not only to prevent anaemia but also to create liver stores of the vitamin.

Infants and children

DRVs are based on the amount of the vitamin that was needed to cure megaloblastic anaemia in infants fed breastmilk which was low in vitamin B₁₂.

Values for children have been interpolated between the values for infants and adults.

Guidance on high intakes

High intakes of vitamin B₁₂ are not dangerous. Injected amounts as large as 3 mg/d have not been associated with harmful effects.

Table 12 *Dietary Reference Values for Vitamin B₁₂ µg/d*

Age	LRNI	EAR	RNI
0–6 mo	0.10	0.25	0.30
7–12 mo	0.25	0.35	0.40
1–3 yr	0.30	0.40	0.50
4–6 yr	0.50	0.70	0.80
7–10 yr	0.60	0.80	1.00
11–14 yr	0.80	1.00	1.20
15+ yr	1.00	1.25	1.50
Additional amounts to be added to pre-pregnancy DRVs			
Lactating women	+0.5		

FOLATE

Folate is the generic name for a large number of compounds derived from folic acid. Although some forms of folate in foods are more available than others, the commonest forms – the tetrahydrofolates – are also among the most easily absorbed and the most active. DRVs refer to total folate.

Adults

Liver stores, and red blood cell and serum folate concentrations are all indicators of folate status. DRVs are based on the amounts of dietary folate needed to maintain these indices at 'normal' levels and the amounts needed to prevent or cure folate-deficiency megaloblastic anaemia.

There is increased need for folate in late pregnancy in order to maintain serum and red cell folate at pre-pregnancy levels.

Infants and children

The DRVs for formula-fed infants are based on the amounts of folate needed to achieve growth rates, weight gains and haemoglobin concentrations similar to those of breastfed infants. Levels for children have been interpolated between those for infants and adults.

Guidance on high intakes

Although high folate intakes may lead to reduced zinc absorption, the Panel considered the danger of high intakes of folate to be slight and did not set an upper level of intake.

Table 13 *Dietary Reference Values for Folate µg/d*

Age	LRNI	EAR	RNI
0–12 mo	30	40	50
1–3 yr	35	50	70
4–6 yr	50	75	100
7–10 yr	75	110	150
11+ yr	100	150	200
Additional amounts to be added to pre-pregnancy DRVs			
Pregnant women	+100		
Lactating women	+60		

PANTOTHENIC ACID

Pantothenic acid is involved in the release of energy from fats, carbohydrates, proteins and alcohol. Although it is possible to measure blood and urine levels of the vitamin, it is not easy to interpret the values to arrive at desirable intake levels.

Adults and children

There are no DRVs for pantothenic acid but the Panel considered that current UK intakes of 3 to 7 mg/d are adequate or more than adequate.

Infants

The Panel endorsed the value of 1.7 mg/d (equivalent to 3 mg/1000 kcal) recommended by DHSS (1980).

Guidance on high intakes

High intakes of pantothenic acid are not dangerous and intakes of 10 g/d as calcium pantothenate for six weeks were associated with only mild and reversible gastro-intestinal disturbances.

BIOTIN

There have been no studies of biotin requirements but current intakes are 10 to 70 $\mu\text{g}/\text{d}$ and there is no evidence of biotin deficiency. The Panel concluded that intakes of 10 to 200 $\mu\text{g}/\text{d}$ were both adequate and safe.

Guidance on high intakes

Very little information is available but intakes up to 200 $\mu\text{g}/\text{d}$ are certainly safe.

VITAMIN C

Humans, unlike most animals, do not synthesise vitamin C and therefore have a dietary requirement for this nutrient. Animals which synthesise their vitamin C have tissues which are saturated with the vitamin. There has been considerable debate about whether or not intakes in humans should be large enough to achieve the same state of tissue saturation.

Such a high level of intake is not necessary for vitamin C to perform its known functions of promoting wound healing and preventing the symptoms of scurvy.

DRVs are based on the amount of vitamin C needed to prevent the signs and symptoms of scurvy, on vitamin C turnover studies and on biochemical indices of vitamin C status in humans.

Adults and children

10 mg/d of vitamin C is sufficient to prevent and to cure all the clinical signs of scurvy. But it is not enough to give measurable plasma levels of the vitamin. Vitamin C begins to appear in plasma at intakes of about 30 mg/d and reaches a maximum concentration with intakes of about 70 mg/d. Significant amounts of vitamin C are present in plasma when intakes are 40 mg/d.

The EAR has been calculated by interpolation between 10 mg selected as the LRNI and 40 mg as the RNI.

The additional DRVs for lactation are enough to provide adequate vitamin C levels in breastmilk and to maintain maternal stores.

Smoking increases vitamin C requirements significantly.

Infants

DRVs are based on the amounts of vitamin C which prevent scurvy.

Guidance on high intakes

Intakes at levels of 20 times the RNI, or more, have been associated with diarrhoea and increased risk of developing oxalate kidney stones in susceptible people. There is no conclusive evidence that amounts of 1 g or more of vitamin C offer protection against the common cold, cancer or any other disorder. If people who are used to such high intakes suddenly revert to 'normal' intakes, they may develop signs of scurvy.

Table 14 *Dietary Reference Values for Vitamin C mg/d*

Age	LRNI	EAR	RNI
0–12 mo	6	15	25
1–10 yr	8	20	30
11–14 yr	9	22	35
15+ yr	10	25	40
Additional amounts to be added to pre-pregnancy DRVs			
Pregnant women	+10		
Lactating women	+30		

VITAMIN D

Vitamin D is needed for the absorption of calcium and its utilisation in the body.

In the UK, people whose skins are exposed to the sun's ultraviolet radiation are capable of synthesising enough vitamin D during the months of April through October to satisfy needs during those months and to build up liver stores to last through the other five months of the year .

DRVs are based on the need to maintain adequate blood levels of a metabolite of vitamin D – 25-hydroxyvitamin D – throughout the year. This substance is converted in the kidney to 1,25-

dihydroxyvitamin D – the active compound which promotes calcium absorption and deposition in bone.

Adults

As long as the skin is exposed to the sun during the summer months, winter plasma levels of 25-hydroxyvitamin D remain above 8 ng/ml and no dietary source of vitamin D is needed .

But, for people who do not go out in the sun enough, a dietary supply is necessary. This is particularly important for older people.

Asian women and children, who may not eat foods which are good sources of vitamin D and who choose to cover their skin, may also need a dietary supply of the vitamin.

Infants and children

Calcium, and therefore vitamin D, needs are high to allow for rapid bone growth. Winter breastmilk may be low in vitamin D unless mothers take vitamin D supplements. To maintain plasma 25-hydroxyvitamin D levels in infants and children up to the age of 4, a dietary source of vitamin D is recommended.

Guidance on high intakes

Excessively high intakes of vitamin D are more dangerous for infants than for adults. Intakes of 50 $\mu\text{g}/\text{d}$ have been associated with hypercalcaemia in children.

Table 15 *Dietary Reference Values for Vitamin D $\mu\text{g}/\text{d}$*

Age	RNI
0–up to 6 mo	8.5
6 mo–3 yr	7.0
4–64 yr	0 provided skin is exposed to sun
65+ yr	10.0
Pregnant and lactating women	10.0

VITAMIN E

Vitamin E is an antioxidant and requirements are determined, in large measure, by the amount of polyunsaturated fatty acids (PUFA) in the body and thus the PUFA content of the diet.

Adults

PUFA intake varies widely and so the Panel concluded that it was not possible to set DRVs for vitamin E. But safe intakes have been set at more than 4 mg/d for men and more than 3 mg/d for women.

Infants

Safe intakes are based on the vitamin E content of breastmilk. Infant formulae should provide not less than 0.3 mg/100 ml and not less than 0.4 mg/g PUFA.

An indication of appropriate intakes may also be derived by relating vitamin E intake to the DRY for PUFA intake (6% of total energy) suggested by the Panel.

Table 16 *Examples of Average Intakes*

These daily intakes are based on 0.4 mg vitamin E equivalent/g PUFA; PUFA = 6% total energy intake	
mg/d	
Men 19-49 yr	Energy intake = 2550 kcal 7
Women 19-49 yr	Energy intake = 1940 kcal 5

Guidance on high intakes

Few adverse effects have been reported from doses of vitamin E up to 3200 mg/d.

VITAMIN K

Vitamin K is the precursor of several compounds needed to enable blood to clot. Clotting time, therefore, gives an indication of vitamin K status.

Adults

Few studies have been made to estimate adults' vitamin K requirements or to gather accurate data on the vitamin K contents of foods.

Too little information exists to establish accurate DRVs for vitamin K but intakes of 1 µg/kg body weight/d are safe and seem to be adequate.

Infants

Haemorrhagic disease is a rare life-threatening condition caused by vitamin K deficiency in early life. To protect against its occurrence, many paediatricians recommend that new born babies receive a single dose of vitamin K, usually at birth. Thereafter, an intake of 10 $\mu\text{g}/\text{d}$ (equivalent to 2 $\mu\text{g}/\text{kg}$) is suggested as both safe and adequate.

Guidance on high intakes

Naturally-occurring vitamin K is free from harmful effects even when taken in milligram quantities ie at least 100 times the safe intake. But the Panel concluded that synthetic preparations of menadione (a form of vitamin K) are better avoided.

OTHER ORGANIC COMPOUNDS

Foods contain thousands of other organic compounds, some of which have biological effects. The Panel reviewed the literature on compounds such as caffeine, lecithin, ornithine, bioflavonoids and para-amino benzoic acid but was not convinced that any of them is a dietary essential. The only two possible exceptions are taurine and carnitine which may be needed by premature infants.

Minerals

CALCIUM (1 mmol = 40 mg)

Ninety-nine per cent of the calcium in the body is in bones and teeth. One per cent is in blood plasma and soft tissues. Over 90% of bone tissue is laid down during the childhood years of growth. Bone mass reaches a peak at about the age of 30 to 35 years and thereafter declines progressively. In women at about the time of the menopause, the rate of bone loss increases markedly. The Panel could find little evidence that increasing dietary calcium at any age would help to reduce bone loss.

Determining calcium requirements is difficult for several reasons. Adaptation to both high and low intakes occurs, but it occurs slowly. Most balance studies have not been continued for a long enough period to allow adaptation to occur. At dietary calcium intakes of about 800 mg/d absorption is about 20%. If intakes are as low as 250 mg/d, about 70% is absorbed.

Infants

DRVs for calcium are based on calcium balance studies and calculation of the intakes that would be needed to achieve the retention of 160 mg calcium/d. Absorption of calcium from infant formulae has been taken as 40% .

Children

DRVs for children have been calculated from a daily retention of 70 mg/d at 1 year rising to 150 mg/d at the age of 10 years. Absorption has been taken as 35%.

Adolescents

DRVs are based on a mean absorption of 40% and daily retention of 300 mg for males and 250 mg for females.

Adults

Although adults are not accumulating new bone tissue, most experience urinary calcium loss of about 150 mg/d. The loss depends to some extent on the amount of dietary calcium. What is not known is the extent to which calcium loss may be reduced if dietary calcium is reduced.

DRVs are given in the context of the typical UK diet, ie a protein intake which is 15% of total energy and calcium absorption of 30% .

During pregnancy, calcium absorption increases and no additional calcium is generally needed. An exception is the pregnant adolescent whose needs for dietary calcium both for herself and for the developing fetus are particularly high.

There is no conclusive evidence that a high calcium intake in the elderly prevents bone loss but information is scanty. For peri- and post-menopausal women receiving oestrogen therapy, calcium supplements may permit a reduced effective oestrogen dose.

Guidance on high intakes

Increased intake of calcium leads to progressively reduced rates of absorption. Accumulation of calcium may be caused by failure of the body's control mechanism, not by high dietary intakes. The Panel was not convinced that any benefit would accrue from intakes as high as 2 g/d which are sometimes recommended for the prevention or treatment of osteoporosis. But, because high intakes of calcium are not associated with any detrimental effects, it may be prudent for those at particularly high risk of osteoporosis to take diets which are richer in calcium.

Table 17 Dietary Reference Values/or Calcium mg/d

Age	LRNI		EAR		RNI	
0–12 mo	240		400		525	
1–3 yr	200		275		350	
4–6 yr	275		350		450	
7–10 yr	325		425		550	
	Males	Females	Males	Females	Males	Females
11–14 yr	450	480	750	625	1000	800
15–18 yr	450	480	750	625	1000	800
19+ yr	400	400	525	525	700	700
Additional amounts to be added to pre-pregnancy DRVs						
Lactating women	+550					

PHOSPHORUS (1 mmol = 30.9 mg)

The major part of the phosphorus in the body is associated with calcium in bone. These two minerals are present in roughly equimolar amounts but (because they have different atomic weights) not in equal weights.

Infants, adults and children

DRVs for phosphorus are based on DRVs for calcium – when measured in mmol. For infants, it is particularly important that this balance between calcium and phosphorus is maintained.

Table 18 *Dietary Reference Values for Phosphorus mg/d*

Age	LRNI		EAR		RNI	
0–12 mo	185		310		400	
1–3 yr	155		215		270	
4–6 yr	215		270		350	
7–10 yr	250		325		425	
	Males	Females	Males	Females	Males	Females
11–14 yr	350	370	580	480	770	620
15–18 yr	450	370	580	480	770	620
19+ yr	310	310	400	400	540	540
Additional amounts to be added to pre-pregnancy DRVs						
Lactating women	+425					

Guidance on high intakes

The calcium:phosphorus ratio is far less important for adults than for infants. For infants, the Ca:P ratio should be 1.2: 1 to 2.2: 1. For adults, a maximum intake of phosphorus should be 70 mg/kg body weight – about 4.5 g/d for a 65 kg man.

MAGNESIUM (1 mmol = 24.3 mg)

The human body is very efficient in regulating its magnesium content. Any intake higher than 2 g/d passes through the intestine unabsorbed. The lower the intake, the more efficient the kidneys are at conserving magnesium and the higher the proportion absorbed in the intestine.

For these reasons, symptoms of magnesium excess or deficiency rarely occur and it is difficult to establish the requirement for the mineral.

Adults

DRVs have been derived from balance studies undertaken using a typical UK diet. So they take account of the proportion of magnesium that is likely to be absorbed.

No additional magnesium is needed in pregnancy because absorption increases and magnesium is liberated from the mother's body store.

Infants

Values are based on the magnesium content of breastmilk.

Table 19 *Dietary Reference Values for Magnesium mg/d*

Age	LRNI		EAR		RNI	
0–3 mo	30		40		55	
4–6 mo	40		50		60	
7–9 mo	45		60		75	
10–12 mo	45		60		80	
1–3 yr	50		65		85	
4–6 yr	70		90		120	
7–10 yr	115		150		200	
11–14 yr	180		230		280	
15–18 yr	190		250		300	
	Males	Females	Males	Females	Males	Females
19+ yr	190	150	250	200	300	270
Additional amounts to be added to pre-pregnancy DRVs						
Lactating women	+50					

IRON (1 mmol = 56 mg)

Iron forms the central part of the haemoglobin molecule of red blood cells.

In males and post-menopausal women iron is conserved efficiently. Iron in red blood cells is recycled and daily losses via faeces, urine and sloughed cells from the gut are small. Infants and children need additional iron to enable blood volume and muscle tissue to increase. The biggest variable in iron requirements of women of child-bearing age is the menstrual loss of blood.

Adults

A major difficulty in setting DRVs for iron is the variability in absorption. This is taken to be about 15% for people eating a mixed diet but may be less for people who do not eat foods of animal origin. Some dietary components such as vitamin C promote absorption, others, such as tannin in tea, inhibit it.

DRVs for men and post-menopausal women are calculated from the losses of iron – estimated to be about 0.86 mg/d, and an assumed absorption of 15%.

In women of child-bearing age, menstrual iron losses add considerably to total iron need, but these losses are particularly variable. And it is possible that, in women with high menstrual losses, more than 15% of dietary iron is absorbed. Taking all these factors into account, the EAR for women of child-bearing age is based on the amount of iron which, the Panel considered, is enough to meet the needs of 75% of women. The RNI is enough to cover the needs of 90% of women, leaving about 10% with higher menstrual losses and higher dietary iron needs.

The Panel concluded that, for these women, additional iron is best taken as iron supplements.

The increased needs of pregnancy should be met without a further increase in iron intake because of cessation of menstrual losses and the mobilisation of some of the mother's stores. Dietary supplementation may be needed by mothers with low iron stores.

Infants and children

DRVs are based on estimated losses plus the amounts of iron needed for increasing blood and tissue masses and for the accumulation of an iron store. They assume an absorption of 15% .

Guidance on high intakes

High intakes of iron are dangerous for a small number of people with pathologically high rates of absorption of dietary iron. The condition cannot be controlled just by reducing dietary iron.

For children with normal absorption, iron may be toxic if a single dose of 20 mg/kg is taken. For adults, a single dose of 100 g can be lethal.

Table 20 Dietary Reference Values for Iron mg/d

Age	LRNI		EAR		RNI	
0–3 mo	0.9		1.3		1.7	
4–6 mo	2.3		3.3		4.3	
7–12 mo	4.2		6.0		7.8	
1–3 yr	3.7		5.3		6.9	
4–6 yr	3.3		4.7		6.1	
7–10 yr	4.7		6.7		8.7	
	Males	Females	Males	Females	Males	Females
11–18 yr	6.1	8.0*	8.7	11.4*	11.3	14.8*
19–49 yr	4.7	8.0*	6.7	11.4*	8.7	14.8*
50+ yr	4.7	4.7	6.7	6.7	8.7	8.7

* About 10% of women with very high menstrual losses will need more iron than shown. Their needs are best met by taking iron supplements.

ZINC (1 mmol = 65 mg)

Zinc is involved in several enzyme systems and is part of the structure of cell membranes. About 60% is in skeletal muscle and 30% in bone.

Absorption of zinc from a typical UK diet is about 30% but greater (assumed to be 50%) at intakes around the Lower Reference Nutrient Intake. Absorption also increases during pregnancy so no additional intake is necessary at that time. The concentration of zinc in pancreatic juice is high but much of the mineral is reabsorbed. So losses of zinc are, generally, low.

Adults

DRVs have been derived from calculations of basal losses, studies of zinc turnover and metabolic studies of patients on total parenteral feeding.

Infants and children

DRVs for infants have been derived by adding estimated needs for growth to basal losses. Those for children are interpolated from adult values.

Table 21 *Dietary Reference Values for Zinc mg/d*

Age	LRNI		EAR		RNI	
0–6 mo	2.6		3.3		4.0	
7 mo–3 yr	3.0		3.8		5.0	
4–6 yr	4.0		5.0		6.5	
7–10 yr	4.0		5.4		7.0	
11–14 yr	5.3		7.0		9.0	
	Males	Females	Males	Females	Males	Females
15+ yr	5.5	4.0	7.3	5.5	9.5	7.0
Additional amounts to be added to pre-pregnancy DRVs						
Lactating women	0–4 mo	+6.0				
	4+ mo	+2.5				

Guidance on high intakes

Acute ingestion of 2 g of zinc produces nausea and vomiting. Long term intakes of 50 mg/d interfere with copper metabolism.

SODIUM (1 mmol = 23 mg)

Sodium is a vital component of the fluid bathing all cells. It is closely involved with control of body fluid content. It has long been known that the amount of dietary sodium needed to perform its vital functions is only a fraction of the amount most people in the UK take. The mature healthy kidney is capable of regulating body sodium very accurately.

What is not clear is whether intakes in considerable excess of need are detrimental to health.

Adults

DRVs are based on the facts that:

- i. current intakes (average of 3.2 g/d) are far in excess of need
- ii. lowering the sodium intake of the whole population may be of some benefit in reducing the prevalence of high blood pressure and heart disease but the size of the changes expected is not yet certain
- iii. there is a relationship between sodium intake and a rise in blood pressure with age

- iv. about 10% of the population may have a genetic predisposition to develop sodium-related high blood pressure at sodium intakes above 3.2 to 4.7 g/d

The Panel was not able to give figures for EARs for sodium but did set LRNI and RNI, both of which are below present average intakes.

If sweating increases – because of increased physical activity or exposure to high temperatures – there may be significant sodium losses. So, additional sodium may be needed. But adaptation occurs over a short period so that the sodium concentration in sweat decreases and sodium requirements return to normal.

Infants and children

Lower Reference Nutrient Intakes for infants up to 6 months of age are based on the sodium content of breastmilk. Thereafter they have been calculated from daily losses in faeces, skin and urine with an allowance for the sodium needed in the increasing volume of body fluid.

Table 22 *Dietary Reference Values for Sodium mg/d*

Age	LRNI	RNI
0–3 mo	140	210
4–6 mo	140	280
7–9 mo	200	320
10–12 mo	200	350
1–3 yr	200	500
4–6 yr	280	700
7–10 yr	350	1200
11–14 yr	460	1600
15+ yr	575	1600

Guidance on high intakes

Although quantitative information on high sodium intakes is lacking, the Panel concluded that intakes of more than 3.2 g/d may lead to raised blood pressure in susceptible adults.

POTASSIUM (1 mmol = 39.1 mg)

Potassium is predominantly in the fluid inside cells. Together with sodium, its role is to enable substances to move into and out of cells, to enable nerves and muscles to function and to maintain a balance between the fluid inside and outside cells.

Total body potassium is a reflection of the amount of lean tissue (mainly muscle) present. An 'adequate' intake of potassium facilitates the removal of excess sodium and therefore may help to prevent high blood pressure.

Adults

Although much remains to be discovered about the effects of sodium and potassium on blood pressure, the Panel decided that it would be prudent for potassium intakes to be such that excess sodium can be excreted. No EARs could be established, but LRNI and RNI have been set.

Infants and children

DRVs are based on the amounts of potassium needed for growth and estimated losses via skin, urine and faeces.

Table 23 *Dietary Reference Values for Potassium mg/d*

Age	LRNI	RNI
0–3 mo	400	800
4–6 mo	400	850
7–9 mo	400	700
10–12 mo	450	700
1–3 yr	450	800
4–6 yr	600	1100
7–10 yr	950	2000
11–14 yr	1600	3100
15+ yr	2000	3500

Guidance on high intakes

Intakes of about 18 g/d have been shown to cause temporary increases in blood potassium and the Panel advised that customary intakes should not exceed this level.

CHLORIDE (1 mmol = 35.5 mg)

Chloride is the major element which balances sodium and potassium in cells. The Panel concluded that intakes of chloride should equal sodium intakes. DRVs can be calculated from sodium DRVs by multiplying by 1.54 to allow for their different molecular weights.

COPPER 1 μmol = 63.5 μg

There is only a small amount of information about the need for copper, and the Panel was able to set only RNIs.

Table 24 *Dietary Reference Values for Copper mg/d*

Age	RNI
0–12 mo	0.3
1–3 yr	0.4
4–6 yr	0.6
7–10 yr	0.7
11–14 yr	0.8
15–16 yr	1.0
18+ yr	1.2
Amounts to be added to pre-pregnancy DRVs	
Lactating women +0.3	

Guidance on high intakes

Although high intakes of copper are harmful, little detailed information is available. In some countries, copper levels of 1.6 mg/l in drinking water have been associated with toxic effects.

IODINE 1 μmol = 127 μg

Iodine is needed for the production of thyroid hormones which help to control metabolism, and in infants, to ensure normal development of the nervous system.

Adults

DRVs have been derived from studies of habitual intakes and the incidence of iodine-deficiency goitre. No EARs could be established but values for LRNIs and RNIs have been set.

Infants

DRVs for infants are based on studies of the iodine content of breastmilk.

Table 25 *Dietary Reference Values for Iodine $\mu\text{g}/\text{d}$*

Age	LRNI	RNI
0–3 mo	40	50
4–12 mo	40	60
1–3 yr	40	70
4–6 yr	50	100
7–10 yr	55	110
11–14 yr	65	130
15+ yr	70	140

Guidance on high intakes

Excessively high intakes of iodine cause hyperthyroidism and some people are more sensitive than others to iodine. An upper intake of $17 \mu\text{g}/\text{kg}/\text{d}$ or no more than $1000 \mu\text{g}/\text{d}$ has been set.

SELENIUM $1 \mu\text{mol} = 79 \mu\text{g}$

Selenium is part of an enzyme that helps to prevent structures inside cells being oxidised. The amount of this enzyme increases with increasing selenium intake up to a point. Thereafter, additional dietary selenium has no effect on the amount of the enzyme. Levels of the mineral in blood, tissues and urine all reflect dietary intake. About 55% of dietary selenium is absorbed.

The Panel found no evidence that high intakes of selenium help to prevent cancer or that smoking or oral contraceptives increase selenium requirements.

DRVs have been set for LRNI and RNI but insufficient information about human requirements was available to enable the Panel to set EARs.

Table 26 Dietary Reference Values for Selenium $\mu\text{g}/\text{d}$

Age	LRNI	RNI		
0–3 mo	4	10		
4–6 mo	5	13		
7–9 mo	5	10		
10–12 mo	6	10		
1–3 yr	7	15		
4–6 yr	10	20		
7–10 yr	16	30		
11–14 yr	25	45		
	Males	Females	Males	Females
15–18yr	40	40	70	60
19+ yr	40	40	75	60
Lactating women	+ 15		+ 15	

Guidance on high intakes

The upper intake has been set at $6 \mu\text{g}/\text{kg}/\text{d}$ for adults.

OTHER MINERALS

The Panel considered many other minerals and was able to set Safe Intakes for several of them.

Table 27 Safe Intakes for Other Minerals

Molybdenum	50–400 $\mu\text{g}/\text{d}$ adults 0.5–1.5 $\mu\text{g}/\text{kg}/\text{d}$ infants, children and adolescents
Manganese	more than 1.4 mg/d adults 16 $\mu\text{g}/\text{kg}/\text{d}$ infants and children
Chromium	more than 25 $\mu\text{g}/\text{d}$ adults 0.1–1.0 $\mu\text{g}/\text{kg}/\text{d}$ children and adolescents
Fluoride	0.05 mg/kg/d upper limit for infants and young children

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Glossary of Terms and Abbreviations

Terms relating to weight measurement

g	gram.
mg	milligram or 10^{-3} g or one-thousandth of 1 g.
μ g	microgram or 10^{-6} g or one-millionth of 1 g.
ng	nanogram or 10^{-9} g or one-thousand-millionth of 1 g.
kg	kilogram or 10^3 g or 1000 g.
mmol	millimole = amount of an element or compound equal to the atomic or molecular weight in 9×10^{-3} .

Terms relating to energy

kcal	kilocalorie = 10^3 or 1000 calories. A unit used to measure the energy value of food.
kJ	kilojoule = 10^3 or 1000 joules. A unit used to measure the energy value of food 1 kcal = 4.184 kJ.
MJ	megajoule = 10^6 J or 1 million joules.
BMR	Basal Metabolic Rate. Rate at which the body uses energy when the body is at complete rest. Values depend on sex, body weight. For a 65 kg man, BMR is about 7.56 MJ/d. For a 55 kg woman, BMR is about 5.98 MJ/d.

PAL Physical Activity Level. A multiple of BMR; the ratio of overall daily energy expenditure to BMR. Values range from 1.4 (for a person with light energy expenditure in work who has non-active leisure pursuits) to 1.9 for a man in energy-demanding work whose leisure time pursuits are also energy demanding.

Terms relating to energy and nutrient intakes

RDI Recommended Daily Intakes of Nutrients for the United Kingdom, 1969.

RDA Recommended Daily Amounts of Food Energy and Nutrients for Groups of People in the United Kingdom, 1979.

DRV Dietary Reference Value. A term used to cover LRNI, EAR, RNI and safe intake.

EAR Estimated Average Requirement of a group of people for energy or protein or a vitamin or mineral. About half will usually need more than the EAR, and half less.

LRNI Lower Reference Nutrient Intake for protein or a vitamin or mineral. An amount of the nutrient that is enough for only the few people in a group who have low needs.

RNI Reference Nutrient Intake for protein or a vitamin or mineral. An amount of the nutrient that is enough, or more than enough, for most (usually at least 97%) people in a group. If average intake of a group is at RNI, then the risk of deficiency in the group is very small.

Safe intake A term to indicate intake or range of intakes of a nutrient for which there is not enough information to estimate RNI, EAR or LRNI. It is an amount that is enough for almost everyone but not so large as to cause undesirable effects.

Terms relating to fat

Fat Dietary fat – usually triglycerides ie 3 fatty acid molecules joined to 1 molecule of glycerol.

Fatty acid A molecule of variable length consisting mainly of a carbon chain to which hydrogen atoms are attached.

(EFA) Essential fatty acid. One which cannot be made in the body and which must be supplied by food.

(SFA) Saturated fatty acid. One which contains the maximum possible number of hydrogen atoms.

Monounsaturated fatty acid. One in which each molecule has 2 hydrogen atoms missing. As a result, the molecule is said to contain one double bond.

(PUFA) Polyunsaturated fatty acid. A fatty acid in which each molecule has i more than 2 hydrogen atoms missing. As a result, the molecule is said to contain, respectively, 2 or 3 or 4 double bonds.

cis and *trans* isomers. Terms which relate to the spatial arrangement of atoms in molecules such as monounsaturated or polyunsaturated fatty acids. Most fatty acids which occur naturally in foods are *cis*.

Cholesterol. It may be ingested in foods such as egg yolk and offal, but most is made in the body. An essential component of every living cell wall, it is transported round the body in blood and may be converted to vitamin D.

LDL Low density lipoprotein. One of several proteins in the blood which transport cholesterol around the body. LDL is thought to be the form in which cholesterol is deposited in artery walls.

Terms relating to carbohydrates

Monosaccharides. Single-molecule sugars which include glucose and fructose.

Disaccharides. Sugars whose molecules consist of 2 monosaccharides joined together. Examples are sucrose (consisting of 1 glucose and 1 fructose molecule) and lactose consisting of 1 glucose and 1 galactose molecule.

Polysaccharides. Carbohydrates whose molecules consist of many monosaccharides eg starch which is many glucose molecules joined together.

NSP. Non-starch polysaccharides. A precisely measurable component of foods. The best measure of 'dietary fibre'.

Simple sugars. Monosaccharides and disaccharides.

Intrinsic sugars. Any sugar which is contained within the cell wall of the food.

Extrinsic sugars. Any sugar which is not contained within cell walls. Examples are the sugars in honey, table sugar and lactose in milk and milk products.

Non-milk extrinsic sugars. Extrinsic sugars except lactose in milk and milk products.

Terms relating to proteins

Amino acid. One of 20 molecules which, when joined together, make up proteins. There are many different types of proteins in food and the human body. The nature of each depends on the types of amino acids present, their proportions and the order in which they occur.

Essential amino acid. An amino acid which cannot be made in the body – either at all or not fast enough for the body's need – and which must be taken in food. There are 8 for adults and 10 for infants.

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- 1 Relationship between various Reference Values
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Annex C: Key Issues in Nutrition

KEY ISSUES IN NUTRITION

1. What is Nutrition?

1.1 What is Food ?

Food is anything we can eat and our body can use. It may be derived from animal, vegetable or mineral sources, and consists of a wide variety of chemical substances. We obtain the chemicals that make up the body's cells from the chemicals in food. Our choice of foodstuffs therefore influences our body's composition and function; consequently a wise choice of foods will contribute towards maintaining a healthy body.

Table 1. Components of food in the total diet

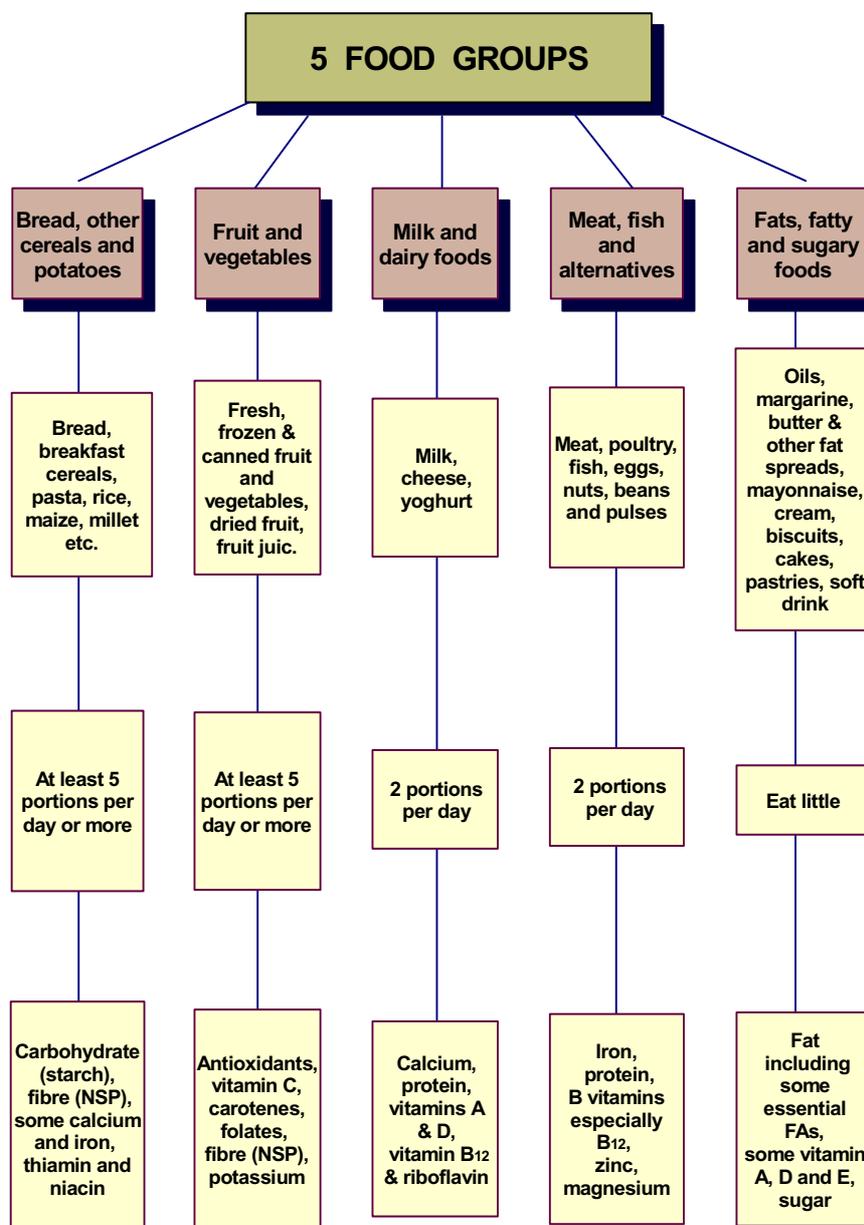
1. Water
2. Carbohydrate
3. Fat
4. Protein
5. Fibre (non-starch polysaccharides)
6. Alcohol
7. Vitamins
8. Minerals
9. Trace elements
10. Antioxidant compounds
11. Flavours (natural & added)
12. Colours (natural & added)
13. Natural poisons (e.g., cyanide)
14. Pharmacologically active substances (e.g., caffeine)
15. Additives (e.g., preservatives)
16. Contaminants (e.g. pesticides)

Nutrients are the chemical components of food that nourish the body are about 50 distinct nutrients depending on classification, which can be grouped into seven broad classes: carbohydrates, proteins, fats, vitamins, minerals, water and fibre. Some foods contain all seven classes, others contain only one or two. Many consist largely of water, with carbohydrate, protein and fat next in abundance and the other classes frequently present in much smaller amounts. The human body is made of similar materials in roughly the same proportions. There are many chemicals in food that are not nutrients ('non nutrients') as well. Many of the chemicals and chemical combinations in foods contribute to their flavour, texture, colour and taste. Some of these are useful to the body, some are not, and a very few may even be harmful. Food choice may also be influenced by a number of factors, including our knowledge of nutrition and its relation to health.

1.2 What is nutrition?

Nutrition is the process by which the human body obtains and utilises the nutrients in food. Its study involves the science of food composition, and the function of nutrients within the body, and also the nutritional needs of individuals of different ages, activities and life styles. Since people differ in size and activity, good nutrition for one person may not be suitable for another. When food is ingested it initially undergoes digestion in the stomach, small intestine and large intestine, a process that releases the individual nutrients and permits their absorption, or entry into blood and body tissues. In the tissues the nutrients are metabolised; that is, they undergo chemical changes to carry out their special functions.

GUIDELINES FOR HEALTHY EATING



1.3 What do the nutrients do?

Nutrients have many roles: some supply the body with energy; some are used to build, repair and maintain tissues; and some regulate body functions. Our well-being depends upon an adequate consumption of each of the seven classes. Essential nutrients are those that the body cannot make for itself - they must be obtained from the diet.

2. Energy-providing nutrients

The body requires energy for the maintenance of body processes, such as breathing, digestion and maintaining body temperature, as well as for growth and the performance of daily activities such as sitting, walking and running. The word 'energy' has been used here in the nutritional sense of 'provider of fuel' and not in the sense of providing zest and vitality. High-energy foods do not necessarily affect how we feel. Food products are sometimes promoted as mood-changers on the basis of their energy value, but this is simply a reflection of the double-meaning of 'energy'.

Traditionally, we have measured food energy in Calories, or kilocalories. Now we use kilojoules (kJ), of which we need between about 6000 and 14 000 a day. How much energy each body needs depends upon several factors:

- Age - Young bodies are growing rapidly and as growth tapers off at adulthood less energy is needed.
- Size - Bigger, more-muscled bodies need more energy to do their daily work.
- Activity - This is a most important factor. Young adults, playing football, skiing or riding bikes, use and therefore need a lot of energy. As adults mature they tend to do less of the strenuous activities and thus need to reduce their food energy intake.

The accompanying table 2 summarises the energy density of different types of foods. Notice the large amount of energy provided by fat; thus foods that are mostly fat - such as butter, margarine, chocolate or the fat on meat - are very energy-dense and usually yield 30 to 35 kJ per gram. Too much of these foods will overload the body with energy, which it will then store as body fat.

Foods that contain a lot of water or fibre will normally yield much less energy; boiled potatoes, for example, yield only 3.5 kJ per gram, about 10% of the amount in a gram of butter. Fruits and vegetables such as apples, tomatoes and salad greens yield even less than this and you are therefore not likely to get fat eating these foods. Of course if vegetables are cooked in fat or generously garnished with butter then the energy content will be considerably higher. Excess protein in the diet also provides energy, and if energy intake is low the body will use dietary protein as well as body protein to meet its energy needs.

Alcohol provides a significant amount of energy - about 29 kJ per gram. Thus an excess of alcoholic drinks can lead to obesity.

Table 2. Energy density of foods

Energy density	Energy per serve		Food
	kJ	kcal	
Minimal	0-40	0-10	Water; tea, coffee, lemon juice, soda-water, low-calorie soft drinks, stock, clear soups and broths
Low	20-240	5-60	Fruits including: apple, apricot, berries, grapefruit, mandarins, melons, mango, orange, pawpaw, peach, pineapple, plum, strawberry; unsweetened juices Vegetables including: asparagus, beans, broccoli, cabbage, capsicum, carrot, coleslaw, cauliflower, celery, chives, cucumber, garlic, gherkin, lettuce, marrow, mushrooms, onions, parsley, pumpkin, radish, silverbeet, spinach, tomato, turnip, zucchini (courgettes) Skim milk, cottage cheese
Moderate	240-480	60-120	Fruits including: avocado, banana, fig, grapes, dried fruits, glace fruits Vegetables including: baked beans, corn, peas, potatoes cooked with fat/oil/butter or mayonnaise, soybeans, parsnip Lean meats, chicken, offal meats Eggs, cheese, fish (unless cooked in batter, oil/fat/butter) Unsweetened cereals, breads, crispbreads Whole milk, plain yoghurt Canned fruits with sugar
High	480-1200	120-300	Milk shakes, ice cream confections, sweetened yoghurt, cream, cream, cheese spreads, fatty meats, sausages, salami, pasta dishes with sauces, hamburgers, plain cakes, biscuits, sweetened cereals, thick and cream, soups, museli bars, sauces and mayonnaise
Very high	1200-4000	300-1000	meat pie, pasties, sausage rolls, fried fish and chips, fried chicken, supersize hamburgers, pizza, fried Chinese take-away, dishes, sweets, iced and cream cakes, pastries, chocolates

Table 3. Energy expenditure associated with activities

Level of activity	Energy used		Activity
	kJ/hour	kcal/hour	
Minimal	240	60	Sleeping, resting
Very light	480	120	Sewing while sitting; desk work, secretarial; playing a musical instrument
Light	720	180	Light bench work; ironing; light gardening; food preparation
Moderate	960	240	Walking briskly; tending a busy shop; house-cleaning; tennis
Heavy	1200	300	Jogging; netball; factory and outdoor manual labour, scrubbing floors
Very heavy	1800+	360+	Fast running; swimming; shovelling earth; skiing, competition football
Exceedingly heavy	2400+	600+	(Not prolonged) heavy lifting; stressful carrying; skiing uphill; fast rowing

3. Carbohydrate

There is no specific dietary requirement for carbohydrate because energy can also be derived from protein, fat and alcohol. However, a diet that does not contain it can lead to muscle breakdown, ketosis and dehydration. In fact, it is recommended that most of us should increase our carbohydrate intake to provide about 50-55% of total energy foods.

It is useful to divide carbohydrates into two main groups which are further divided depending on source and function:

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. sugars (mono & disaccharides) <ol style="list-style-type: none"> a. extrinsic <ol style="list-style-type: none"> i. milk sugars ii. non milk sugars b. intrinsic | <ol style="list-style-type: none"> 2. polysaccharides <ol style="list-style-type: none"> a. starch b. non starch polysaccharides (NSP) <ol style="list-style-type: none"> i. soluble ii. non soluble |
|---|---|

3.1 Sugars

Glucose is the most commonly occurring monosaccharide and most carbohydrate in food is ultimately converted to glucose during digestion. Fructose is the other common monosaccharide (found mostly in fruit products) whilst galactose is found less commonly. Glucose and fructose bind together to form the disaccharide sucrose. Maltose consists of two glucose units and lactose is a product of galactose and glucose. Because of their differing impact on health and particularly dental decay sugars are often classified as:

Intrinsic sugars are those contained within the cell walls of food, e.g. sugars in whole fruits and vegetables.

Extrinsic sugars are those not contained within the cell structure of a food. Because lactose does not have the same impact on dental health it is included as a separate category of milk sugars within the extrinsic sugars.

Besides providing energy, sugars also produce the sensation of sweetness. Each sugar contributes the same amount of energy (kilojoules) to our diet regardless of its sweetness - except if the sugar is not completely absorbed, as may happen with sorbitol. Different sugars do not taste equally sweet, and the degree of sweetness of a food is often not a good indication of the amount of sugars present. For example, maltose is only half as sweet as sucrose, and lactose (or milk sugar) is even less so.

3.2 Polysaccharides

Starch is the main form of carbohydrate in our food. It is composed of large numbers of glucose units linked together to form straight or branched chains. They exist in granules of varying sizes which are characteristic for each plant and mostly insoluble in water. Foods that contain a lot of starch granules are therefore difficult to digest. Starchy foods are usually cooked to improve digestibility and give a more desirable texture and flavour and during the ripening of fruit, starch is changed into sugars. When starch is heated without water as occurs in the production of breakfast cereals, it can result in the production of starch which is indigestible. This is known as *resistant starch* and some scientists argue it should be considered as fibre rather than starch.

3.3 Non-starch polysaccharides

It is now clear that other polysaccharides apart from starch are found in plant products and have a profound effect on human health. These polysaccharides found in the cell walls of vegetables, fruits, pulses and cereal grains are known as non-starch polysaccharides which together with non-food products such as lignin make up what used to be known as fibre. The non-starch polysaccharides in wheat, maize and rice are mainly cellulose and related materials, but those in fruits, vegetables and the cereal oats, barley and rye also contain pectin and gums which are soluble. Soluble and insoluble NSP has different effects within the body as outlined in Table 4. It was originally believed that NSP was not digested to any large extent and those did not contribute to the energy of the diet. Recent studies have shown quite large amounts of digestion of NSP in the large bowel leading to production of volatile fatty acids which provide reasonable levels of energy when absorbed into the blood and metabolised.

Table 4. Effects of Dietary Fibre (NSP) during Digestion

Stage	Effect	insoluble NSP	soluble NSP
Ingestion of food	Higher volume, longer mastication and ingestion	+	+
	Reduced energy density of the diet	+	+
	Increases satiety	+	+
Stomach	Delays gastric emptying	+	++
Small intestine	Binding of nutrients	++	+
	Reduces rate of glucose, amino acid and cholesterol absorption		+
	Delays starch hydrolysis	+	
Large intestine	Alters intestinal microflora	+	
	Decreases transit time	+	
	Increases faecal bulk	+	
	Increased production of short-chain fatty acids	++	++

3.4 Glycaemic Index

The concept of the glycaemic index was proposed in America in 1984 by Jenkins. He and his colleagues studied the effects of different carbohydrate foods and found that they produced different blood glucose responses independent of the amount of carbohydrate they contained. The glycaemic index was suggested as a method of classifying foods on the basis of increasing blood glucose responses. It can be defined as the glycaemic response to individual foods in relation to that of glucose or bread.

$$\text{Glycaemic Index} = \frac{\text{3 Hour Glucose Area (food)}}{\text{3 Hour Glucose Area (glucose or bread)}} \times 100$$

Where glucose area = the area under the three hour post-prandial blood glucose curve

It has been suggested that a system based on these glycaemic indices could replace the conventional carbohydrate exchange system which is based solely on the quantity of carbohydrate. In practice this has been difficult to achieve, as glycaemic index studies have not always given consistent results. This is possibly because the glycaemic effect of a food can vary according to the way it is cooked or processed and the glycaemic effect of a mixed meal can also be different from that of a single food. Table 5 gives examples of factors which can influence the glycaemic effect of a carbohydrate containing food.

Table 5. Factors influencing glycaemic effects of carbohydrate foods

Factors influencing glycaemic effect of carbohydrate
Quantity
Biochemical nature
Form (i.e. whether intact or disrupted)
Temperature
Water content
Fibre content

Research is continuing into the concept of the glycaemic index, but it is probably still too complicated and inconsistent to be used directly with diabetics or population groups.

4. Protein

Body tissues are composed of proteins and of protein-lipid and protein-carbohydrate compounds, with a unique arrangement for each specialised tissue. The metabolic functions within the tissues depend upon the presence of special protein catalysts termed enzymes. Antibodies and some hormones also consist of protein.

Body proteins are synthesised as they are needed from the basic protein components called amino acids, which we obtain from the proteins in food. It is the number and the sequence of these 20 common amino acids that determines the characteristics of each special protein in the body. The human body can synthesise many of them, but not the eight essential amino acids, or at least not in sufficient amounts (see table 6). Consequently, for making body proteins some food protein containing these essential amino acids must be included in the diet.

Table 6. The essential and non-essential amino acids

Essential amino acids		non-essential amino acids	
isoleucine	phenylalanine	alanine	glutamine
leucine	threonine	arginine	glycine
lysine	tryptophan	aspartic acid	proline
methionine	valine	Asparagine	serine
		cysteine	tyrosine
histidine (in infants only)		glutamic acid	

Foods of animal origin such as meat, milk, cheese and eggs are often described as high-quality protein foods because they contain a good supply of essential amino acids. In addition, they contain these in about the right ratio for humans, which is not surprising since human tissues are not so very different biochemically from animal tissues.

Vegetable materials, on the other hand, differ greatly from human tissues, so the amino acids supplied by vegetable foods are not as closely matched to human requirements. Thus, vegetable proteins may be deficient in one or more of the essential amino acids. However, we may combine a range of plant protein foods in the diet so that an amino acid excess in one food balances a deficiency in another. Thus a suitable mixture of plant proteins eaten in the one meal may in fact be as good nutritionally as the proteins of meat or milk. For example, peanut butter and bread contain a combination of complementary plant proteins producing a high quality protein meal.

Cooking can alter the amino-acid composition of protein and this usually results in desirable flavour and browning development. Very little nutritional value is lost.

Table 7. Protein content of some common foods

	Grams protein		Grams Protein
Animal food sources		Plant food sources	
Meat - lean, cook, 100g	20	Soybeans, boiled, 1/2cup	11
Chicken/BBQ or boiled, 100g	27	Beans, boiled, 1/2 cup	8
Milk, whole, 1 cup'	8	Peas, boiled, 1/3 cup	5
Milk, skim, 1 cup*	8	Lentils, boiled, 1 cup	8
Cheese, cheddar, 30 g	8	Nuts 25 g	6
Cheese, cottage, 30 g	4	Cereals slices, 30 g	4
Fish, 1 fillet, 100 g	17	Bread, 2 slices, 60 g	5
Eggs, 1 medium, 60g	6	Rice/corn, cooked, 1 cup	2
		Vegetables, 1/2 cup, 100 g	3.5
		Sugar, alcohol	0
*1 cup= 240 mL			

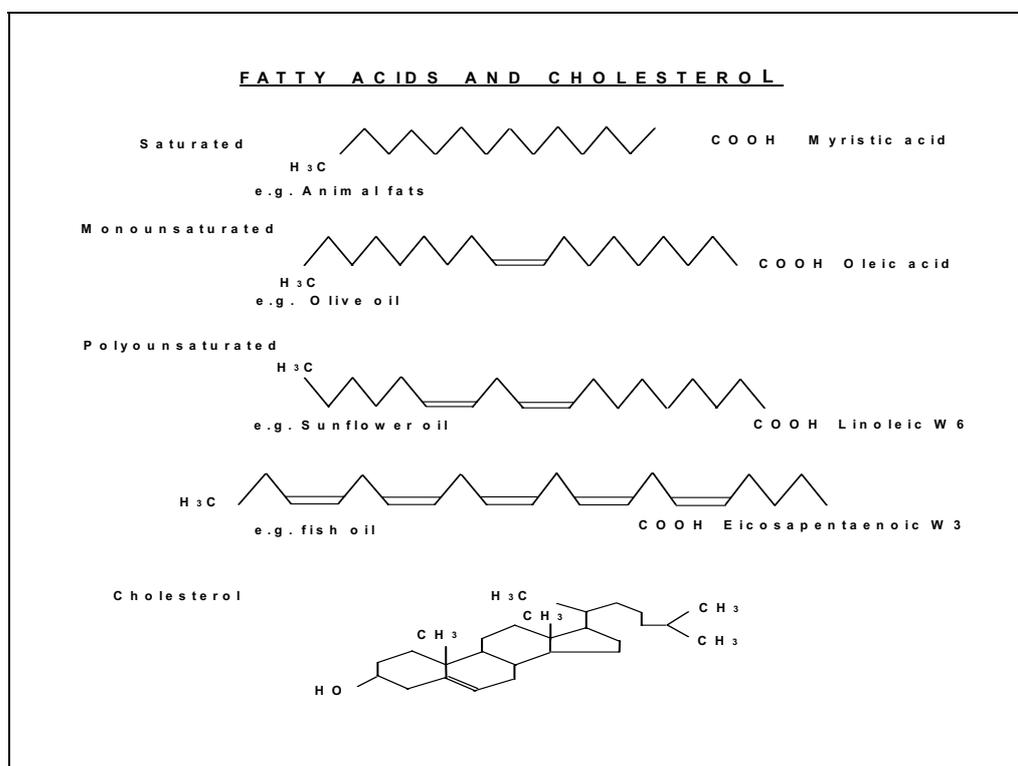
The usual recommended intake (is one gram per kilogram of body weight per day, although growing children and pregnant and lactating women have a greater requirement. People who have had severe infections or surgery may also require additional protein. A deficiency of protein in the diet can lead to muscle wasting, oedema, anaemia and, in children, a slowing or stopping of growth. High levels of protein consumption are certainly not beneficial and may in some cases be harmful. Additional calcium may possibly be required to counter-balance an excessive protein intake. This also imposes a higher load of protein breakdown products, which must be excreted by the kidneys. Moreover, many high-protein foods contain significant amounts of fat as well. In addition recent work suggest that excessive intake of animal protein may lead to high levels of a particular amino acid, homocysteine, in the blood. If homocysteine levels remain high the amino acid is converted to thiolactone which has been linked to increased levels of atherosclerosis and endothelial damage, cataracts and other tissue damage.

5. Fat

Fat, also known as lipid, is mainly present in food in a form called 'triglycerides'. Butter and margarine, for example, are almost entirely made up of these substances. Triglycerides consist of glycerol and three ('tri') fatty acids. The fatty acids can be mainly 'saturated' as in butter or mainly 'polyunsaturated' as in some margarines. There are also monounsaturated fatty acids, which occur in quantity in the triglyceride of olive oil, peanut oil and avocado.

Food may also contain other fats, such as cholesterol and phospholipids. Lecithin is a phospholipid, made up of glycerol, choline and fatty acids, which again may be mainly saturated or polyunsaturated.

Figure 3 The structures of different fats



Like the essential amino acids, some polyunsaturated fatty acids are essential for humans because they cannot be made in our bodies. One group of essential fatty acids comes from plant sources; these are found in considerable quantity in vegetable oils whilst another type comes mainly from seafood.

Different fatty acids have different biological roles and effects in the body. Of particular importance is the influence of dietary fat on the coronary heart disease (CHD) risk factors. As indicated in Table 8, saturated fat increases the amount of cholesterol in blood and increases the risk of clotting. Monounsaturated fat may reduce the blood cholesterol level slightly, while moderate amounts polyunsaturated fat decrease LDL cholesterol but in large amounts may also decrease the “good” HDL cholesterol. The desirable mix of fatty acids in the diet would include around half of this being monounsaturated fat and the rest being composed of even amounts of saturated and polyunsaturated fat.

Traditionally, fatty fish were frowned upon, but recent evidence has shown that certain fish oils have a marked impact on the risk of inappropriate clotting, a small cholesterol-lowering effect and may also be protective against heart disease in other ways.

Table 8. Dietary fats and coronary heart disease risk

Dietary Factor	Dietary Source	Effects on CHD risk
Saturated fatty acids	Butter, cheese, meat, sausages, coconut oil	A high intake of certain *SFA (especially myristic and lauric with palmitic contributing) are strongly associated with high LDL and total cholesterol. Several SFA including stearic acid also increase the risk of thrombosis.
**PUFA		
n-6	Sunflower oil, safflower oil	Reduce total and LDL cholesterol but, in large amounts, may also lower the 'protective' HDL.
n-3	Fish oils	Reduce LDL levels (but only if initial levels high) and may increase HDL. Powerful anti-thrombotic and anti-arrhythmic actions.
***MUFA	Olive oil, canola oil	Reduce LDL (perhaps an independent effect or due to displacement of SFAs). No effect on HDL.
Trans fatty acids	Hydrogenated fat in margarines, biscuits, cakes, fast foods.	Relatively new research area. Appear to raise total and LDL cholesterol, lower HDL cholesterol, and increase lipoprotein(a). Possibly worse than SFAs.
Total fat		Not strongly associated with blood cholesterol but does contribute to other risk factors such as obesity and Factor VII clotting activation. A high fat intake is often associated with a high SFA intake.
Dietary cholesterol	Eggs, meat, butter, milk	Raises blood total cholesterol, but principal effect is by amplifying impact of SFA. Less effect when diet low in fat. Individuals vary greatly in their response.

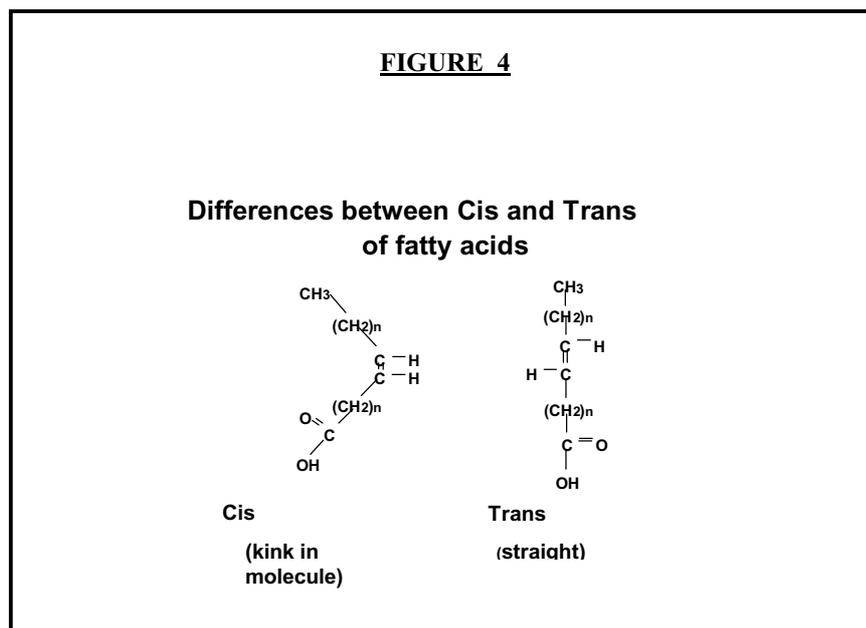
*SFA. Saturated fatty acids.

**PUFA. Polyunsaturated fatty acids.

***MUFA. Monounsaturated fatty acids.

5.1 Trans fatty acids

When liquid vegetable and fish oils are partially hydrogenated or hardened to form margarines and shortenings, an unusual form of polyunsaturated fatty acid called trans fatty acid occurs where the configuration is the opposite of that normally found in nature (see Figure 4). These fatty acids, although still unsaturated, tend to have a biological action similar to saturated fats. Although the findings on trans fatty acids are still controversial, it appears that hydrogenated oils in margarines and biscuits/cakes may raise LDL cholesterol levels and lower HDL cholesterol levels. Trans fatty acids are also found in dairy and animal fats (of ruminants) but these are slightly different compounds and do not appear to raise the risk of CHD.



The information about the effects of trans fatty acids is sparse and should be treated with caution. However, evidence is building that trans fatty acids also have detrimental effects on foetal and neonatal growth and it seems wise to limit intakes where possible.

Fat is energy-dense (37 kJ per gram). Also, it does not mix with water, so the food in which it is found tends to be more energy-dense because of the relative lack of water. If it is of plant origin, it may be associated with dietary fibre, giving bulk and reducing energy density; for example, cereal oats are relatively high in fat for a cereal, but also relatively high in dietary fibre. If the fat is from animal sources, the energy density will be rather high.

It is possible to eat very little fat and maintain good health. In some traditional dietary patterns, fat contributes as little as 10% of energy intake, while in the 'affluent' diet it may contribute up to 50%. However, the acceptable range would be about 10-35%; that is, about 30-90 g per day for a man or 20-70 g per day for a woman, at the ages of 35-55. Most nutrition programs in developed countries aim to get the proportion of energy from fat down to the 25-35% range.

Fat also confers texture and flavour on food, enhancing its palatability: many flavours are fat-soluble. Unfortunately, it is these desirable properties that encourage over-eating.

Table 9. Fat content of some common foods

Animal food sources	Grams fat	Plant food sources	Grams fat
Milk, 1 cup*	8	Peanuts, 30 g	1.5
Skim milk, 1 cup	0	Peanut butter, 1 tblspn	10
Butter/margarine, tspn	4	Oil, 1 tblspn	20
Mayonnaise, tblspn	1.5	Rice, 1 cup	0.5
Egg, 1 medium	5	Pasta, 1 cup	1
Lean meat or grilled chicken, 100 g	1.5	Bread, 2 slices	1
Poultry, fried, 100 g	20	Vegetables, 1/2 cup	0.5
Fish, steamed, 100 g	7	Fruit, 1 /2 cup	0
Hamburger, 100 g	2.1	Sugar	0
Cheese - cheddar, 30g cream, tblspn	1.0 6		
*1 cup= 240 mL			

6. Alcohol

The usual alcohol present in food and beverages, called ethanol, is made by fermentation of carbohydrate. It is virtually never found in freshly collected food. It has an energy value of 29 kJ per gram; but, with high alcohol intakes, we use proportionately less of it to produce useful energy.

When the average intake of ethanol exceeds 80 grams per day (see table10), disease of one sort or another is in due course inevitable, although even 40 g or more per day gives cause for concern. The situation is one of alcohol abuse. The adverse effects are seen on brain, liver, heart muscles, blood, gut, nerves, pancreas (leading to diabetes or pancreatitis) and nutritional status.

Alcohol abuse can lead to deficiencies of vitamins - including vitamin B-1, vitamin B-2, niacin, vitamin B-6, folacin and vitamin C - and of minerals, including zinc and magnesium. These deficiencies will arise for various reasons such as failure to eat food containing these nutrients, decreased absorption or interference with nutrient usage. For some individuals, an average daily alcohol intake of 40 grams per day will adversely affect health. Probably the safest level of alcohol intake is one to two drinks a day, equivalent to 8 to 20 grams of ethanol, preferably with food.

Table 10. Alcohol content of beverages

Beverage	Alcohol content	standard drink		
	(% volume/ volume)	volume (m L)	alcohol (mL)	content (g)
Beer	3-8'	200	9,6	7.6
Wine	11.5	90	10.4	8.2
Fortified wine	18.5	60	11.1	8.8
Spirits	38.5	30	11.6	9.2

*Light beers have a lower alcohol content, by volume, as stated on their labels.

7. Vitamins

Vitamins are a group of chemically unrelated organic compounds that occur in minute quantities in foods, of which 13 are recognised as essential for human reproduction, growth and survival (Table 11). The 13 vitamins are classified into two groups:

- Fat-soluble - vitamins A (retinol), D (calciferol), E (tocopherol) and K (phytomenadione)
- Water-soluble - thiamin (B1), riboflavin (B2), niacin (B3), panthothenic acid (B5), pyridoxine (B6), folic acid, vitamin B12 (cyanocobalamin), biotin and vitamin C (ascorbic acid)

A varied food pattern provides all of these. Healthy people eating this way do not need vitamin supplements. However, supplements may be helpful for people who are malnourished and unable to eat an adequate diet or for people with certain diseases that lead to increased vitamin needs. If you use vitamin supplements, avoid megadoses (doses far in excess of Recommended Dietary Intakes or the amounts usually provided by food). Megadoses consumed over a prolonged period may be toxic.

As the table shows, we need such small doses that these are measured in milligrams (mg) or even micrograms (µg).

Table 11. The Vitamins

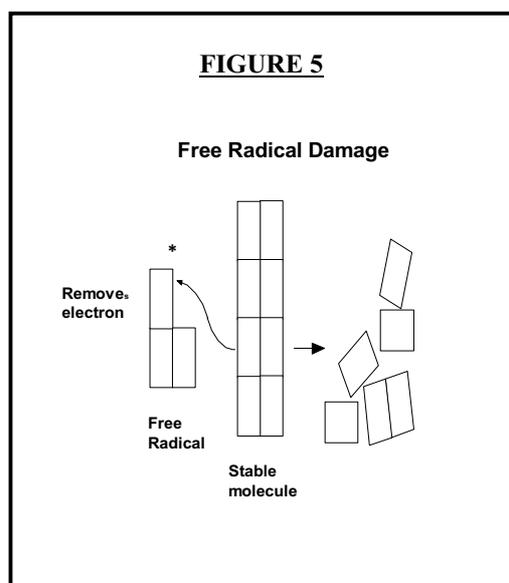
Vitamins	Important food sources	Functions	Effects of too little	Effects of too much
vitamin A (retinol)	liver, dairy products, fish oils orange and green vegetables margarines	eyesight, healthy skin and mucous linings of body organs	night blindness, rough skin, proneness to infection	alopecia nerve damage
vitamin D (cholecalciferol)	fish oils, North Sea salmon (canned), herring, liver, sunlight on skin	bone formation	rickets in children, bone softening; rare in adults	hypercalcaemia

Vitamins	Important food sources	Functions	Effects of too little	Effects of too much
vitamin E (tocopherol)	vegetable oils and seeds, wholegrain cereals, nuts	antioxidant: protects cells from oxidation damage	extremely rare	interference with absorption of vitamins A and B
vitamin K	green leafy vegetables; intestinal bacteria	blood clotting	haemorrhage with some diseases	haemolytic anaemia in infants
vitamin C (ascorbic acid)	citrus fruits, peppers, tomatoes, cabbage, etc	in formation of supporting tissues of cells f or wound healing absorption of iron	scurvy (very rare), poor wound healing, anaemia	oxaluria withdrawal scurvy iron-storage disease
vitamin B1 (thiamin)	wholegrain cereals and breads, legumes , nuts, meats	in carbohydrate utilisation; nervous system	nerve degeneration and heart failure in alcoholism	hypersensitivity reactions
vitamin B2 (riboflavin)	green leafy vegetables; meats, eggs, milk	in protein metabolism and growth	skin disease	none described
niacin nicotinic acid, or vitamin B3)	wholegrain cereals, nuts, legumes, meat, poultry, fish	in energy metabolism -	very rare in developed countries	flushes
vitamin B 12 (cyano-cobalamin)	meats, eggs, fish, poultry, milk, root/nodes of legumes; otherwise not generally present in plants	red blood cell formulation and for nervous system	pernicious anaemia and nerve degeneration	none recognised
folic acid	yeast; liver, kidneys; green leafy vegetables; orange juice	to aid in the maturation of red blood cells	megaloblastic anaemia	exacerbation of B 1 2 deficiency
pyridoxine	liver, kidneys, meat, wholegrain cereals , egg yolk	in protein metab olism and in the formation and growth of red blood cells	rare	sensory neuropathy possible withdrawal depression

7.1 Antioxidants and free radical damage

Vitamin E, vitamin C and the carotenes (especially beta-carotenes are just some of the compounds in food that have anti-oxidant properties (see table 12). This function is a

particularly important component of the bodies defence mechanism against free radical damage. Free radicals are highly reactive molecules with unpaired electrons. They are produced as the natural by-products of breathing oxygen and burning food. They are also produced in large amounts by cigarette smoke, radiation from the sun, drugs, pesticides and other pollutants.



In order to become more stable, free radicals will attempt to donate or take an electron from a stable molecule. In doing so they cause damage in the same way as removing a strategic brick from a wall would cause it to collapse. In an attempt to prevent this happening, the damaged molecule will donate an electron or grab one from another molecule, setting off a chain reaction of damage which must be stopped.

Oxygen generates very powerful free radical which are capable of attacking DNA strands which may pre-dispose cells to cancer. Free radicals can also readily attack (peroxidise) the hydrocarbons in lipids (especially unsaturated fats) leading to damaged cell wall membranes. When LDL cholesterol is peroxidised by free radicals it leads to increased LDL uptake and stimulating the development of atherosclerosis.

Antioxidants from food interfere with an oxidation chain once it has started by trapping free radicals and terminating the reaction. The antioxidant nutrients tend to work together. As vitamin E is fat soluble, it is able to sit within membranes and protect polyunsaturated fatty acids. Vitamin C is water soluble and able to move more freely around the body where it is believed to reconvert spent vitamin E into a useful form.

Table 12. Sources of some of the principal dietary antioxidants

Antioxidant	Sources
Vitamin E (tocopherols, tocotrienol)	Vegetable oils, nuts, whole grains, other seeds, sweet potatoes, margarine, liver, egg yolk, dark green vegetables
Carotenes (>600 compounds)	Yellow and orange fruit, green vegetables, e.g. carrots, apricots, spinach, watercress, broccoli, green beans, peas, peppers.
Vitamin C	Fruit and vegetables, particularly kiwi fruit, blackcurrants, strawberries, green peppers, bean sprouts, new potatoes
Flavonoids (>3000 compounds)	Coloured fruit and vegetable skins, apples, onions, potatoes, tea, red wine.
Ubiquinone-10 (ubiquinol/ubiquinone)	Soyabean oil, sardines, mackerel, nuts, wheat germ, beans, garlic, spinach and other vegetables.
Selenium	Grains, fish, liver, pork, cheese, eggs, walnuts and brazil nuts

7.2 Folic acid

Folic acid has many functions within the body particularly with vitamin B12 in rapidly growing cells. Recent research has indicated that women who have consumed high doses of folate acid immediately prior to and in the early stages of pregnancy have a reduced risk of babies being born with a neural tube defect such as spina bifida. although the original studies were completed on women who had had a previous NTD birth and involved a dose of 4.0mg of folate each day, further assessments have recommended that all women can reduce the risk by consuming an additional 400µg each day as a supplement in addition to consuming extra folate rich foods.

8. Minerals

At least 15 different minerals are needed in our diet - some in comparatively large amounts and some in very small amounts. For example we need calcium and phosphorus in comparatively large amounts for bone formation (bone is mostly calcium phosphate); we need iron in smaller amounts, particularly as a component of haemoglobin, the red substance in blood, which carries to the tissues the oxygen we breathe in, and without which tissues die and life ceases. Copper, zinc, manganese and several other minerals are needed in very small amounts, but they play vital roles in the chemical processes leading to energy release or protein synthesis in tissues.

The minerals so far shown to be essential for life are listed in the Table 13. The last five minerals in that list have been proved so far to be essential for life to rats and chicks only. However, we have included them here because there is some debate about their role in the human diet. Cobalt is also essential, but only as a constituent of vitamin B12'

Table 13. Essential Minerals

Sodium	Iron
Potassium	Manganese
Chlorine	Molybdenum
Calcium	Selenium
Magnesium	Zinc
Phosphorus	Flouride
Sulphur	Nickel
Chromium	Silicon
Copper	Tin
Iodine	Vanadium

Simple dietary deficiencies of sodium, potassium, chlorine, magnesium, phosphorus, sulphur, manganese and molybdenum are unknown in man, although the deficiencies can sometimes occur because of increased loss from the body. Copper deficiency can occur in premature infants, but has not been reported in adults. Iodine deficiency is still a problem in many parts of the world but can be readily prevented by the use of iodised salt. Nowadays, because of concern about too much salt (sodium) in the diet, iodine supplements should take other forms. The situation with chromium is still uncertain; chromium administration may sometimes improve the control of diabetics, but diabetes is not due to chromium deficiency.

Table 14. Minerals - main functions and food sources

Mineral	Important food sources	Functions	Effects of too little	Effects of too much
Iron	<u>animal</u> : liver, organ meats, other meats; poultry, egg yolk, sardines, mackerel: <u>plant</u> : wholegrain cereals and breads legumes, spinach	-in red blood cell pigment, which carries oxygen to the tissues -in muscle pigment which uses oxygenin -energy release	failure to thrive in infancy; anaemia	rare; haemochromatosis
calcium	<u>animal</u> : milk, cheese, ice cream, shrimp, salmon, sardines, herring;; <u>plant</u> green leafy vegetables	growth of bones and teeth; contraction of muscles and nerve transmission	failure to thrive in infancy; fragile bones and rickets	
zinc	meats, fish, eggs, cereals, legumes	growth, reproduction, wound healing	impaired growth, impaired reproduction, and less wound healing	
iodine	iodised salt; seafood; animal and plant foods grown in non-goitrogenic coastal areas	forms thyroid hormone thyroxine, which controls metabolism	cretinism (in infants) goitre	
Fluorine	fluoridated water, , tea, seafood, infants foods made with bone meal	to harden teeth and bones	dental disease	
magnesium	roasted peanuts, dry beans, raw spinach and other greens	nerve and muscle activity important for many enzyme reactions	anorexia, nausea mental changes	

Sodium plays an important role in maintaining the pressure of body fluids, and the acid-base (pH) balance. If the amount of sodium rises or falls, so does the amount of body fluid, and this can cause changes, often undesirable, in blood pressure. The intake of sodium salt (also known as common salt or table salt) is regulated more by custom, taste and habit than by bodily needs. The body needs less than 1.0 g daily, whereas the intake of many European countries can exceed 12g.

Foods such as olives, soy sauce, salted nuts and potato chips have very high salt levels. Nutritionists advise a reduction in salt intake, as a preventative measure against heart disease.

8.1 Iron

Iron is a mineral of particular nutritional concern because it is one of the few nutrients where intake amongst women and children in developed countries (as well as developing countries) may fall below requirement. More than half of the iron within the body is found within circulating blood cells as the body has limited stores (mostly within the liver) and only a small amount is present in other tissues such as muscle protein myoglobin. Therefore iron balance is a direct relationship between the intake of iron and body losses.

The factors affecting iron requirement are shown in Table 15. Certain sub-groups of the population are at greater risk of failing to meet iron balance because of increased losses (menstruation), increased needs for iron (growth), particular dietary choices (vegetarians) or a combination of these (athletes). If iron intake is insufficient to meet body losses then iron stores are depleted.

Table 15. Factors influencing Iron requirements

			Iron Loss mg/day
Basal Losses	males	70Kg	1.0
	females	55	0.8
Growth		0.25-1 year	0.56
		1-2	0.24
		2-6	0.22
		6-12	0.38
		12-16	0.36
	female	12-16	0.36
	male	12-16	0.66
menstrual losses	averaged over 28 days	median	0.48
		95 percentile	1.90
pregnancy and lactation	pregnancy	last six weeks only	10.0
	lactation		0.3

Western mixed diets contain 1-1.4 mg iron per 1000 kj and thus most adults will ingest greater than 10mg iron per day. This might be expected to meet the needs of all population groups. The real problem is that only a small and variable proportion (5-20%) of dietary iron is absorbed. The extent to which iron is absorbed from depends on whether it is in the organic haem form or non-haem iron. Haem iron, which is in the form occurring in red pigments of meat and offal, is relatively well (20-30%) absorbed. The non-haem iron occurring in cereals, pulses, vegetables, fruits, eggs and dairy products is generally less well absorbed, but absorption increases when body stores are depleted or when need are greatest. Its absorption is also depends on other factors in the diet; it is increased by the presence of vitamin C animal protein and certain organic acids and decreased by phytates, calcium and soy protein and iron binding phenolic compounds.

8.2 Calcium

The skeleton contains 99% of the calcium in the body but it also performs other essential functions including muscle contraction, nerve functioning, clotting and contributes to certain enzyme systems. In the face of negative calcium balance, where losses of calcium in the urine, faces and skin are greater than the amount of calcium absorbed from the diet, skeletal reserves will be called upon to maintain serum calcium levels. Thus the hormonal mechanisms which precisely regulate serum calcium levels through bone resorption sometimes achieve that regulation at the cost of bone mass loss which in the long term may lead to osteoporosis in older adults or stunted growth in young children.

Rickets and Osteomalacia differ from Osteoporosis in that they are primarily the result of a vitamin D deficiency which prevents the absorption of sufficient calcium. It occurs among the young in some races and among the elderly where there is insufficient exposure to sunlight to stimulate development of vitamin D from its precursors in the skin. The causes of the progressive loss of bone mass in osteoporosis are still unknown although factors associated with bone loss have been identified (see Table 16). Bone mass loss occurs almost universally after the peak mass is reached in the early 30s and appears to accelerate in post-menopausal women. However it is clear that people who have attained a high peak bone mass early in life are less likely to suffer the consequences of inadequate bone strength in later life.

Table 16. Factors that influence the rate of age-related bone loss

Increase loss	Decrease loss
immobility	physical activity
low sex hormones (especially females)	hormone replacement therapy
thinness	obesity
cigarette smoking	pregnancy and lactation
excess alcohol	dietary calcium supplements ???
intestinal malabsorption	
certain diseases	

8.3 Water

Water is perhaps the most essential of nutrients, since we can do without it for only a short time - days at the outside. This is because, without an adequate flow of urine, waste products would build up in the body; moreover, with the absence of moisture loss it would be impossible to regulate body temperature. We can obtain water from beverages and food, and we also produce it in our body cells following the metabolism (chemical breakdown) of fat, alcohol, protein and carbohydrate. Food usually provides more than half our daily water requirement, as the diagram suggests. The more water a food contains, the less energy-dense it is; that is, water rich foods have fewer kilojoules per 100 grams.

The need for water is influenced by environmental conditions. For example, in a hot climate we lose a great deal of water, not only as sweat but also in expired air.

Making water supplies hygienic has contributed greatly to human health. More recently, the addition of fluoride to water supplies deficient in it has reduced dental decay. Nutritionists are

encouraging people to drink water in preference to other beverages and to drink it in adequate amounts in dry conditions and with increased physical activity. With a sensible water intake you'll be less thirsty for alcohol, coffee and other beverages and probably eat less food. Fluoride intake will be improved for many. Urine flow will increase and the risk of kidney stones decrease.

It is a most unusual event to be able to overload the body with water by drinking too much. The body compensates by increasing urine output. However, body water can accumulate in certain disease states. Occasionally, for psychological reasons, over-consumption of water does occur.

Table 17. The nutrition of water

Food sources	Functions	Effects of too little
All beverages and liquid foods; fruits and vegetables	As a solvent for many essential substances (e.g., sodium, glucose); as a vehicle to carry substances around the body (e.g., blood cells oxygen); as a site for metabolic activities	Thirst in the short term; prolonged deficiency dehydrates tissues and can cause death; if sweetened or alcoholic drinks are consumed in preference to water alone, excess energy intake may occur, as well as dehydration

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HEALTHY FOOD AND NUTRITION FOR WOMEN AND THEIR FAMILIES

Training Course for
Health Professionals

**Part 3: Healthy Eating
during Pregnancy and
Breastfeeding**

Booklet for mothers

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Introduction

Perhaps you just learned that you are pregnant? Your baby may not even seem real yet. However the choices you make and what you eat now and every day you are pregnant or breastfeeding can affect your health and the health of your baby.

It is your choice:

- what you eat
- whether you drink alcohol and/or smoke
- how much your weight may change
- how often you see your doctor

Pregnancy is a very important period. It is a time to think about your lifestyle, habits and diet and how they affect you and your future child. It is a time to consider if you wish to adopt healthy habits that will be beneficial to you and your baby both now and in the future.

It is never too late to make the right choices.

When you are expecting a baby or breastfeeding a baby, nutritious food is very important for both of you:

For You: pregnancy and lactation place extra demands on your body. To meet these demands you need to think about what is best to eat and drink. Good nutrition in pregnancy helps you to stay healthy and energetic and to prepare yourself for taking care of you, your new baby and the rest of the family.

For Your Baby: through your milk your baby eats everything you eat. Thus, the best way of giving your baby a healthy diet is for you to eat a healthy diet.

The Placenta - carries life to your baby:

The placenta brings important things, such as oxygen and nutrients, to your baby and it removes the waste products that your baby produces while in your womb.

However the placenta cannot stop harmful substances such as alcohol and nicotine, from smoking, crossing from you to your baby

Healthy diet - what does it mean?

Contrary to a sometimes often quoted saying, you do not have to “eat for two” - or double the amount of food you normally eat.

From about the 3rd month of pregnancy you need ONLY an extra 200-300 kcal per day in addition to the diet you ate before you became pregnant. This small extra amount can be achieved, by eating for example 2-3 slices of bread extra (or 1 glass of milk and 1-2 slices of bread extra) per day.

A healthy diet is one that is based mainly on plant foods. Therefore it is important to eat lots of vegetables, fruits, bread, potatoes, pasta, cereals, beans and lentils accompanied by only relatively small amounts of: low fat milk, cheeses, kefir and yogurts; fish, lean red meats, and poultry. Whenever possible try to get locally grown vegetables and fruits, especially when they are in season. These can be less expensive, more nutrient dense, fresh and safe from contamination.

The following explanation highlights the relative importance of different foods by placing them into 5 food groups.

Food Groups

1. Bread, cereals, pasta, rice and potato group - aim to eat 6-11 portions per day

What counts as one portion?

- 1 large slice of bread (about 30-40 g)
- 3 small crackers or sooshka
- 1/2 cup cooked pasta (macaroni, spaghetti etc.)
- 1/2 cup cooked cereal (rice, buckwheat or oatmeal)
- 3/4 cup (about 30g) ready-to eat dry cereal
- 1 medium potato (100g)

Foods from this group provide you with your main source of energy. They also contain many other important nutrients, such as calcium, iron, zinc and B vitamins. Potatoes are also a good source of vitamin C.

Unrefined cereals and wholemeal bread are good sources of fiber which prevents constipation which you may experience more of during pregnancy.

Some breakfast cereals may be fortified with vitamins such as folic acid - check the label.

Try to eat a variety of foods from this group, including wholemeal and rye breads, macaroni, spaghetti, rice, buckwheat, oatmeal or your traditional cereal and potatoes.

2. Vegetables and fruits group - aim to eat at least 5 portions per day (more than 400g)

What counts as one portion?

- 1/2 cup (about 100 g) of vegetables (for example: carrots, onions, beets, leeks, turnip etc. – including that eaten in soups and stews)
- 1 cup of green leafy vegetables (cabbage, lettuce, spinach, broccoli, etc.)
- 1 medium tomato
- 1/2 cup of sprouted beans
- 1 medium piece of fruit (1 apple or 1 pear or 2 small plums)
- 1/2 cup (about 100 g) of fresh, preserved, or cooked berries
- 160 ml fruit or vegetable juice (pure 100% juice - try fresh carrot and orange squeezed and mixed)

Vegetables and fruits provide the best source of many vitamins and minerals, including folate and iron, which are important to prevent you becoming anaemic during pregnancy. Remember, vitamins such as vitamin C are needed both by you and your baby and cannot be stored in your body. Thus, it is important to eat plenty of vegetables and fruits every day, especially those that are locally grown.

Each of the following will give you enough vitamin C every day:

- 1 large pepper or 3 medium potatoes or 160 g of cabbage.

In addition vegetables contain many protective components which help keep us healthy: fibre, flavonoids and many more substances which we have not even discovered yet! This is one reason why vitamin and mineral tablets cannot replace the vegetables we eat.

Fresh vegetables and fruits may sometimes be difficult to find. Out of season, when fresh produce may not be available, don't forget about frozen, home-preserved, tinned, pickled and dried varieties - they also contain essential nutrients. You might like to try "sprouting" beans when no other sources of vitamin C are available.

The following fresh weight of sprouted beans will provide 10 mg vitamin C:

Black-eyed beans	50 g
Fenugreek, Mung beans, green lentils	70 g
Haricot, Alfalfa	90 g

Remember, that vitamin C is lost during storage and preparation. Therefore it is important to cook vegetables in a minimum amount of boiling water for only 5 to 10 minutes. Try steaming, baking or microwaving instead of boiling. Try to eat raw fresh or lightly cooked vegetables every day and try not to add excess fats, oils and salt.

3. Milk and dairy products group - aim to eat 3 portions a day

What counts as one portion?

- 1 cup (about 200 ml) of yogurt/kefir
- 45 g of hard cheese (the size of matchbox)
- 1,5 cup (about 250 g) of cottage cheese
- 1 glass (300 ml) of milk

Dairy products are one of the richest sources of calcium in your diet. Calcium is essential for the development of healthy bones and teeth of your baby; in lactation it is important for the formation of your own breast milk. However if you do not eat calcium containing foods your baby will not suffer since calcium will be taken from your body stores. But for your own health it is important that you replace your stores of calcium.

Dairy products are also a good source of protein and other minerals and vitamins, such as some B vitamins, vitamin A and sometimes iodine depending on whether or not the cows are fed iodine fortified fodder.

Contrary to the beliefs of some people, creamy, high-fat milk and dairy products are not healthier than low-fat alternatives. Where possible choose low-fat milk, kefir and low-fat milk products - they contain more calcium and protein and have a lower fat content, so are good for all of the family.

Remember, that neither butter (made from the cream of milk) nor cream contribute calcium or protein to your diet, only fat.

4. Fish, poultry, meat and bean group - aim to eat 2 portions a day

What counts as one portion?

- 1 cup (about 150-200 g) of cooked beans
- 2 eggs
- 70-80 g of cooked lean fish, poultry or meat

This group includes beans and lentils, fish, meat, poultry, eggs and nuts, which are all rich in protein. Try to eat a wide variety, especially beans, lentils, nuts and fish, these are especially healthy for you and your family. Meat, especially organ meats (such as liver and kidney), provide some of the best sources of iron. Iron from meat is absorbed better than iron from plant sources. However, liver should be taken in moderation to avoid excess intake of vitamin A.

Choose lean varieties of meat or cut the fat off when possible, think about limiting the amount of smoked and salt-cured sausages if you eat these often because it is better not to eat too much salt and fat.

5. Lard, butter, margarine, oils, sugar, sweets and salt group - use sparingly

This group includes butter, margarine, oils, lard, sugars, candies, sweet desserts, pastry, sweetened drinks: in other words foods that have a high fat, salt and/or sugar content.

These foods are dense in calories but provide little in the way of other nutrients. Therefore it is better not to indulge in these products at the expense of more nutritious foods from the other food groups.

Try to use oils (such as olive, canola or rapeseed oil) instead of animal fats as much as possible, but if this is not possible then just try to reduce the total amount of fat you eat.

Remember, eating a diet low in fat and, especially low in animal fat, reduces your and your family's risk of getting certain cancers and cardiovascular disease - the two major "killers" of the population in Europe .

Consume salt in moderation (up to 6 g per day in total): try to use less salt at the table and in cooking, eat less salty or pickled foods. This will decrease your risk of high blood pressure and related health problems.

Try whenever possible to get salt which is iodized to ensure that you and especially your baby get enough iodine during pregnancy and breastfeeding.

Remember these important nutrients

1. Folic acid

This vitamin is extremely important during pregnancy, especially in the early period and even before conception.

A good intake of folate greatly increases the chance of your baby being born without any abnormalities, thus, all women thinking about becoming pregnant, and throughout the first 3 months of pregnancy, should eat food sources rich in folate. Eat plenty of folate-rich foods such as spinach, lettuce, cabbage, green beans, cauliflower and fortified cereals.

Some women who are at particularly high risk of folate deficiency may be advised to take a daily supplement of 400 mcg (0,4 mg) of folic acid but you should talk to your doctor about this.

2. Iron

You need iron to form the red blood cells for you and your baby. Iron helps to carry oxygen in your blood from the lungs to the tissues. Your baby's brain and body need iron and oxygen to grow.

Too little iron leads to anaemia, in which case your baby may not be getting enough oxygen for normal growth and development. Fortunately your ability to absorb iron increases during pregnancy and while you are breastfeeding.

The best sources of iron are lean meats, especially liver and kidney. Some vegetables (e.g. green leafy vegetables, cooked beans and peas) are also a good sources of iron. To absorb more iron from vegetables (especially beans and peas), eat foods rich in vitamin C or acidic foods at the same time (e.g. fruits, juice, bell peppers, tomatoes, kefir, fermented foods). Tea and coffee reduce your ability to absorb iron, so try to drink them between meals rather than when eating iron rich foods.

In case of extreme tiredness you may be suffering from iron deficiency anemia. Discuss this with you doctor who may wish to prescribe iron supplements for you. Do not take iron supplements unless advised by the doctor. They can cause constipation and may

interfere with the absorption of other nutrients.

3. Calcium

Calcium is important for the healthy bones and teeth of both you and your baby. The best sources of calcium are milk, dairy products and some cereals. Try to choose low fat milk, kefir cheese and yogurt, they provide more calcium than full fat varieties.

4. Vitamin D

Vitamin D is very important both to prevent rickets in your newborn baby and to keep your teeth and bones healthy.

Try to spend as much time as you can outdoors, especially in sunny weather: vitamin D is produced in your skin when you are exposed to sunlight.

Vitamin D is found also in foods, such as oily fish, eggs, butter, and fortified margarine. In the Northern parts of Europe with low amounts of sunlight you may be prescribed supplements by your doctor, especially during the winter months.

What about multivitamin supplements?

Do not take vitamin or mineral supplements unless prescribed by your doctor. Besides being an unnecessary expense, an excessive intake of these supplements can cause toxic effects or interfere with the absorption of other nutrients.

What about fluids?

Drink plenty water - 6 to 8 glasses a day. Women who are breastfeeding should drink the amount needed to satisfy their thirst. Water, milk products and unsweetened juices are the best choices.

Limit tea and coffee to in-between meals in order not to interfere too much with iron absorption. Try to avoid excessive amounts of lemonade or drinks with a high sugar content, especially if you are gaining too much weight.

Some substances may harm your baby

1. Alcohol

Try not to drink alcohol during pregnancy. An occasional glass of wine at special events is OK.

Alcohol crosses placenta and can lead to physical, growth and mental problems in some babies. It is especially important not to drink alcohol at the time of conception and during the first 3 months of pregnancy when the embryo is most vulnerable to the toxic effects of alcohol.

2. Smoking

Try not to smoke during pregnancy or at least try to reduce smoking substantially. Mothers who are heavy smokers are at much higher risk of having low birth weight babies. Smoking can also be a cause of premature birth, miscarriage and stillbirth and may impair your child's growth and development.

Remember: it is never too late to stop or at least reduce smoking or drinking. Your baby will benefit from each alcoholic drink or cigarette you give up!

3. Caffeine

Effects of caffeine on the foetus are not well established yet. Tea, cocoa and cola-type drinks contain about the same amount of caffeine while coffee contains about twice as much caffeine. Try to limit your

coffee intake to 3-4 cups a day.

Remember also, that tea and coffee tend to impair your ability to absorb iron from foods, such as beans and cereals, and iron supplements.

4. Medications

Many medications can adversely affect your baby and are contraindicated for pregnant women or women who are breastfeeding. Consult your doctor before taking any medications, including aspirin and vitamin supplements.

How much weight do you gain during pregnancy?

On average you should expect to gain 10-12,5 kg by the end of your pregnancy.

Starting with the 4th month of your pregnancy you will probably gain around 1,5-2 kg per month. Check your weight periodically and consult the doctor if you notice you are gaining less than 1 kg or more than 3 kg per month.

Both too little and too much weight gain can adversely affect the health of you and your baby. Thus, make sure that you and your baby get enough calories, but do not overeat (especially sweets and fatty foods). Remember, “eating for two” does not mean “twice as much”. Just follow your appetite and the healthy eating advice in this booklet. Avoid excess under- or overeating.

If your weight before pregnancy was substantially lower or higher than normal, ask your doctor for specialized advice on diet and weight gain.

Remember, during your pregnancy is **not** a good time to go on a diet

in an attempt to lose weight!

How to cope with the food-related problems during pregnancy

1. Morning sickness

About 70% of women suffer from sickness, usually in early pregnancy - around week 9-10. Later, by the end of the 4th month of pregnancy, symptoms usually disappear or become much milder. To relieve the symptoms of sickness, try to:

- eat small but frequent meals (with about 2 hr intervals)
- avoid smells and foods that make your sickness worse
- eat more nutritious carbohydrate foods: try dry toasts or crackers, breakfast cereals, fruits and vegetable salads at any time during the day
- eat less fatty and sugary foods

2. Constipation

35-40% of pregnant women suffer from constipation during pregnancy.

How to deal with the problem:

- drink plenty of fluid such as plain water (6-8 cups a day)
- increase intake of foods rich in fiber (wholemeal bread, brown rice, wholegrain cereals, fresh and dried vegetables and fruits, especially prunes and figs)

Remember, iron supplements can sometimes cause or aggravate the symptoms of constipation. If you are taking iron supplements and notice that the symptoms of constipation progress, consult your doctor.

3. Heartburn

May occur anytime during pregnancy, but symptoms usually get worse at the end of pregnancy. Also a common problem - about 30-50% of pregnant women suffer from heartburn.

Some suggestions on how to deal with the problem:

- avoid chocolate, fatty foods, alcohol and mint, especially before bedtime - they tend to relax oesophageal muscle so that acid from the stomach regurgitates up into the oesophagus more easily
- avoid acidic and spicy foods that may irritate mucosa (tomato, citrus fruits and juices, vinegar, hot pepper, etc.)
- milk and dairy products can temporarily relieve the symptoms of heartburn
- eat slowly, drink fluids between meals rather than with meals
- eat small frequent meals, do not eat large meals before bedtime
- sleep well propped up, not lying flat

Remember to consult your doctor before taking antacid medications. Some antacids can bind iron in foods and make iron unavailable for you to absorb.

Guidelines for successful breastfeeding

Breastfeeding can be a wonderful experience both for you and your baby.

Remember:

- breast milk is by far the best food for your newborn baby; no commercial-made baby formula as well as any other food or drink can match breast milk;
- breastfeeding (as compared to artificial feeding) protects against common infections, especially diarrhoeal and respiratory diseases as well as urinary tract and ear infections;
- breastfeed as often as baby wants, do not restrict frequency of feeding according to a timetable;
- let the baby come off the breast spontaneously, do not take baby off the breast before the baby is finished;
- try to breastfeed exclusively for 6 months and then continue for as long and often as possible (*exclusively means giving your baby only breastmilk for 6 months – no other fluids, including water, tea or glucose!*);
- anaemia is not a contra-indication to breastfeeding and even if you are anaemic you should continue to breast feed;
- weight loss is not a contra-indication to breastfeeding and even if you have lost weight you should continue to breast feed;
- you should not stop breastfeeding even if you are smoking or occasionally consume alcohol – your milk is still the best food for your baby.

You can get more information on breastfeeding from a WHO booklet for mothers on infant feeding (available on internet: <http://www.who.dk/Nutrition/main.htm>).

Healthy eating for women who are breastfeeding

After birth you will probably be about 3-4 kg over your pre-pregnant weight. Don't try to lose weight immediately – since these stores are used to make breast milk. Breast milk production itself demands a lot of energy - so breastfeeding will help you to get back to a normal weight.

The principles of healthy nutrition recommended for pregnancy apply also during breastfeeding.

Remember:

- alcohol can pass into the breast milk, so do not drink or at least restrict alcohol intake during lactation;
- there is no evidence of any beneficial effect of alcohol on breast milk production;
- smoking may decrease your ability to produce breast milk and thus affect the growth of your baby, smoking also decreases the vitamin C content in breast milk;
- try not to harm the lungs of your newborn child - never smoke in baby's room;
- caffeine can pass into the breast milk and cause hyperactivity and sleeping problems in your baby - try not to drink too much coffee, tea and cola drinks (recommendations are the same as for pregnancy);
- many medications can also pass into breast milk - check with your doctor before taking any (however, taking most medications is not a contraindication to a breastfeeding)

Tips on food safety and preparation

During pregnancy and breastfeeding you should be particularly careful about not getting an infection from contaminated food products.

Some bacteria and parasites can be harmful to your unborn baby.

- do not eat raw or undercooked eggs: eggs must be well cooked so that both white and yolk are hard;
- avoid home-made pates or pates that are not canned;
- avoid unpasteurized ice creams and unpasteurized (or unboiled) milk;
- thoroughly cook meat and poultry; make sure the frozen meats are defrosted properly before cooking;
- thoroughly re-heat ready-to-eat meals and leftovers before serving;
- store raw meat in the refrigerator so that it does not drip and contaminate other foods; wash your hands and kitchen surfaces after handling meat;
- thoroughly wash all fruits and vegetables;
- to preserve vitamins boil vegetables in a minimum amount of water, do not overcook; try cooking over steam or microwaving (if you have a microwave);
- if you use microwave, follow manufacturer's instructions and make sure that food is cooked right through to the centre;
- check the use-by date on the food package;
- wear gloves when gardening and wash hands afterwards;
- avoid contact with cats, use gloves when handling cat excrements: cats can be the source of Toxoplasmosis - serious infection that can cause blindness, mental retardation or even intrauterine death of the foetus.