

**Course: Human Nutrition**

**Field of study:** Principles of Nutrition

**Type of instruction and number of hours:** lecture 45 h, laboratory 30 h

**Number of ECTS credits:** 6

**Learning outcomes:**

Knowledge:

- Student defines basic concepts in the field of human nutrition.
- He/she has knowledge about the role of individual nutrients in food.
- He/she analyses processes related to digestion.
- He/she lists diseases caused by defective nutrition, classifies them according to the reasons for their occurrence.
- He/she knows the social and cultural determinants of lifestyle and health behaviours. He/she presents the principles of implementation and coordination of health education and health promotion programmes.

Skills:

- Student calculates the demand for energy and nutrients.
- He/she uses tables of nutritional value of products and meals.
- He/she makes a correction in the feeding method of various groups of the population.
- He/she prepares educational materials in the field of prevention of chronic non-infectious metabolic diseases. The student provides nutritional education.
- He/she plans appropriate nutritional measures to prevent diseases of chronic non-infectious metabolic diseases.

Social competences:

- Student is aware of the necessity of continuing education and professional development.

**Evaluation methods of learning outcomes:**

written test, activity during classes – solving tasks

**Subject matter of the classes:**

**Lecture:**

1. Historical outline of nutritional sciences. Nutrition and individual development.
2. Nutrients: fats, division, sources. Meaning for the body. The digestive processes. Products rich in fats (oils, margarine, butter – preparation, nutritional recommendations, free radicals, formation of the peroxidation process.
3. Carbohydrates – division, sources, digestion. Role in the body.
4. Glycemic index, carbohydrate exchanges. Dietary fibre meaning for the body, source.
5. Proteins – division, sources, digestion. Role in the body.
6. The role of water in the body.
7. Functions in the body of vitamins, sources. Antioxidants.
8. Micro- and macro-elements of the source and meaning for the body. Excess and deficiencies.
9. Energy balance of the body, sources of energy. Division of food products into groups.
10. Health pyramid, principles of rational nutrition.
11. Eating habits, nutrition mistakes. Diet-related diseases.

**Practical classes:**

1. The concept of proper nutrition and malnutrition:
  - understand the interdisciplinary nature of the nutrition science,
  - define the concepts: diet, food, food product, nutrient,
  - differentiate the nutrient.
2. Nutritional problems in Poland and in the world:
  - analyse the nutritional problems of Poland and the world,
  - list international organisations dealing with problems of feeding people,
  - define the tasks of the EEZ, SSE.
3. Principals of rational nutrition:
  - justify the importance of proper nutrition,
  - discuss the consumption model recommended by the World Health Organization,
  - explain the optimal nutrition model on the example of the health pyramid according to W. Szostak,
  - specify sample portions of products in the food pyramid,
  - arrange a daily menu using the amounts of food products recommended in rational nutrition.
4. Nutritional deficiencies and diseases caused by faulty feeding:
  - list the most common nutrition mistakes in various social groups,
  - name primary and secondary nutritional defects,
  - to classify nutritional deficiencies according to their causes,
  - calculate burden of disease due to malnutrition,
  - compare the model with the current food consumption in Poland,
  - develop corrective actions.
5. The concept of metabolic processes and energy:
  - explain the concept of metabolism,
  - explain the role of biological catalysts,
  - distinguish between anabolic and catabolic processes,
  - determine the intensity of metabolism depending on the age.
6. The concept of metabolic processes and energy, cont.:
  - discuss the method of energy expenditure measurement – direct calorimetry,
  - characterise indirect calorimetry and determine the respiratory quotient,
  - replace the energy equivalents according to Atwater,
  - compare and prove differences between physical and physiological equivalents,
  - name energy units,
  - convert energy units kcal, kJ, cal, MJ,
  - use equivalents and energy units to calculate the nutritional value.
7. The concept of metabolic processes and energy, cont.:
  - define the concept of basal metabolism and resting,
  - explain the differences between basal and resting metabolism and calculation method,
  - list the factors on which the value of PPM depends,
  - replace the elements of the extra-basal metabolism,
  - explain the concept of meal / specifically dynamic food activity,
  - differentiate and apply energy expenditures to various forms of activity,
  - calculate the total energy conversion,
  - estimate energy consumption during activities using the timing and charting method.

8. Division, characteristics and nutritional importance of proteins, carbohydrates and fats:
- explain the structure,
  - divide them into groups,
  - distinguish carbohydrates by breakdown,
  - characterise individual nutrients,
  - determine the nutritional importance and consumption standards.
9. Characteristics and nutritional significance of nutrients, cont.:
- calculate the need for nutrients,
  - determine the nutrient density of the INQ product,
  - define and calculate the CS limiting amino acid index,
  - define, calculate and interpret the glycemic index (GI) and glycemic load (GL),
  - indicate sources of fatty acids and cholesterol.

## **Bibliography**

### **Basic literature**

Packenpaugh N. J., *Nutrition essentials and diet therapy*. 11<sup>th</sup> edition Elsevier, 2010.

Thompson J., Manore M., *Nutrition: An Applied Approach*. 5<sup>th</sup> edition by Jenice J. Thompson. Pearson Education, 2017.

### **Complementary literature**

Bender D. A., *Introduction to Nutrition and Metabolism*. 5<sup>th</sup> edition. CRC Press Taylor & Francis Group 2008.

Eschelmann M. M., *Introductory Nutrition and Nutrition Therapy*. Lippincott Williams & Wilkins 2000.

Giroux I., *Applications and case studies in clinical nutrition*. Lippincott Williams & Wilkins 2007.

### **Websites**

World Health Organization: <https://www.who.int>

## Lecture I

### FOOD HABITS – SOCIAL AND CULTURAL ROLE OF NUTRITION

#### 1. Influences on food habits:

*Social:*

- Social structure.

*Psychosocial:*

- Understanding diet patterns.
- Food and psychosocial development.
- Marketing and environmental influences.

*Economic:*

- Family income.

#### 2. Cultural development of food habits:

*Strength of personal culture*

- Conscious/unconscious learning of traditions.

*Foods in culture*

- Availability, wealth, personal food meaning (belief).
- What is eaten and when it is eaten.

*Traditional food patterns*

- Elderly more often follow the tradition than young people.

*Food and drink is a basic need*

#### 3. Dietary religious laws:

*Jewish:*

- Orthodox – strict adherence.
- Conservative – less strict observance.
- Reformed – less ceremonial emphasis and minimal general use.
- Kosher – “fit and proper” to eat; content ritually cleaned of the blood.

Do not mix milk and meat in one meal (separate dishes).

Influences: bagel, challah, lox, matzo, strudel.

*Muslim:*

- Based on teachings of the Koran.
- No pork; all meats are drained of blood (halal) similar to kosher meats.
- No alcohol.

Influences: bulgur, pita, pilaf, falafel, tabouli.

Ramadan – 30 days daylight fasting.

Spanish and native American influences in USA:

*Mexican:*

- Dried beans, chili peppers and corn, coffee.

*Puerto Rican:*

- Similar to Mexican; add fruits, plantains, dried codfish and rice.

*Native American:*

- Meat on a daily basis, fry bread, corn bread.
- Frying is popular.

### *SOUTHERN UNITED STATES*

#### *African American:*

- Breads – biscuits, cornmeal variations.
- Cooked cereals – grits, mush, oatmeal.
- Vegetables – black eyed peas, greens, okra, sweet potatoes.
- Meats – frying pork and chicken.

#### *American (Cajun): French*

- Seafood, spicy, strong flavours served with rice.

### *ASIAN FOOD PATTERNS*

#### *Chinese:*

- Fresh foods, quickly cooked (wok), green tea, rice in every meal, soy sauce; pickled, dried, salted foods in small quantities.

#### *Japanese:*

- Sushi, fish, vegetables steamed or pickled, fresh fruits.
- High in salt, low in milk products.

#### *Southeast Asia – Vietnam, Laos, Cambodia:*

- Nuts and legumes (primary protein source).
- Rice, fish, vegetables, fruit, little red meat.

### *MEDITERRANEAN INFLUENCES*

#### *Italian:*

- Bread and pasta are the basic ingredients for the most of meals. Use fish, poultry, vegetables and cheese.
- Fresh fruit is dessert or snack. Red meat once a month.

#### *Greek:*

- Bread is the core. Yogurt, feta cheese. Lamb and fish are the main meats. Rice is the main grain used.

#### *Poland:*

- The basis of the diet is meat (sausage, game meat) and potatoes/flour products (dumplings, bread).
- In the Polish cuisine, pickling is used (sauerkraut, pickled cucumbers). Personal choices.

### **Basic Determinants:**

- **Needs to be culturally sensitive and understand the factors that concern your patient**

#### Factors Influencing the Change:

- Income – allows choices in foods.
- Technology – amount and variety of choices.
- Access to food – fresh food vs fast food.
- Vision – media leads expectations and desires.

### CHANGES IN FOOD PATTERNS

- Households – no longer just nuclear family.
- Working women – the need for food items that save space, time and do not require much time for preparation.

- Family meals – less often family meals; eating quickl or eating out more often.
- Meals and snacks.
- Health and Fitness – increase of interest in healthy foods.
- Fast food – has half of all restaurant money spent.

## HEALTH PROBLEM OF THE PRESENT GENERATION

**Overweight & obesity** – has become a serious problem for a part of our population. Nowadays, more and more people, even children are becoming fat, or overweight. The reason is simple. People eat too much junk food and they do not have enough movement. It is necessary to change their lifestyle. People should go to fitness, gym, do some sport or at least go for a walk to the places of nature. Also walking to work instead of driving should be a good advice to keep fit.

## PHYSICAL ACTIVITY AND DIET

Doing 150-minute aerobic exercises each week (or equivalent) is estimated to reduce the risk of ischemic heart disease by approximately 30%, the risk of diabetes by 27%, and the risk of breast and colon cancer by 21–25%. In addition, it has positive effects on mental health by reducing stress reactions, anxiety and depression and by possibly delaying the effects of Alzheimer’s disease and other forms of dementia.

## PHYSICAL ACTIVITY AND DIET

In Europe, the estimates indicate that over one third of adults are insufficiently active. Men were more active than women, particularly in high-income countries, where nearly every second woman was insufficiently physically active. Through decisions that have influence on urban design, land use and transport, societies have become increasingly car-friendly over time, and there is a growing geographical separation of living, working, shopping and leisure activities.

As a consequence, the role of active modes of transport, such as cycling and walking as the chance for active recreation, has decreased dramatically in some countries. Recent research has also suggested that people should limit the sedentary lifestyle, such as sitting at work or watching television, since these may constitute an independent risk factor for ill health regardless of other activity levels.

## Lecture II

### Fructose as a simple carbohydrate

Fructose is a simple sugar, classified as monosaccharides.

After being absorbed in the intestines, this sugar is transported to the liver, where it is transformed into glucose and in this form it is used in the metabolism of the body.

The described process causes that after consuming fructose, the concentration of **glucose in blood does not increase** as rapidly as after consuming glucose itself, and the following response is not so rapid (slower insulin increase), it causes less strain on this organ and a lower risk of triglyceride deposition in subcutaneous adipose tissue.

This property is characterised by the glycemic index, which for fructose is around 20.

For this reason, we should use fructose to sweeten food and drinks. Fructose is called fruit sugar because it is found in fruits, plant juices and honey.

Fructose is also eaten in the form of sucrose which is created by combination of glucose and fructose.

There are also polysaccharides whose building block is fructose, these are fructans, compounds that are not broken down by digestive enzymes in our intestines. Therefore, they do not act as a nutrient, but they are part of the dietary fibre and provide food for the good bacteria.

Fructose is absorbed much more slowly by the body than sucrose and glucose.

Significant amounts of fructose can cause diarrhea and gastrointestinal pain. It also causes a significant increase in cholesterol.

In the liver, fructose is converted into glucose and it is used by the body in this form. People use fructose to sweeten fruit, milk and alcoholic drinks, fresh and frozen fruit, preserves, jellies, ice cream and other desserts as well as fruit and vegetable preserves.

It is used for the production of chocolates and chocolate products, as well as sweet pastries, both for home use and for the industrial scale.

However, it should be remembered that fructose is sweeter than sugar and therefore we add it about **40% less** than sugar.

## **Exercises**

### **I. Plan a daily menu**

1. Plan a daily menu: based on the principles of rational nutrition (including the names of meals and their ingredients, without giving the normative amount so-called grammes).
2. List the diseases caused by bad nutrition.

### **II. Calculate the fibre content**

1. Using the nutritional tables, select and arrange the products according to their decreasing content of dietary fibre. Determine which are high in fibre and which are low in fibre.
2. Calculate how much you would need to eat the products categorised as sources of fibre in order to cover 20% of the recommended daily amount of this component for an adult.
3. Calculate the amount of dietary fibre in the usual diet and determine the extent to which the recommended daily amount of dietary fibre is covered. Suggest possible modifications.

### **III. The body's energy needs**

The body's energy needs

PPM (Primal Metabolic Rate) = 1 kcal x body weight [kg] x 24 [h]

PPPM (Overprimal Metabolic Rate) = work activities [kcal] + 220 kcal (women)/360 kcal (men) + 10% PPM (sdd)

CPM (total metabolic rate) = PPM + PPPM

sdd – specific dynamic action of food,

Table 1. Energy expenditure in carrying out various activities

Action	Energy kcal/kg/h
Sleep	0,94
Slow walk	4,28
Running	9,30
Swimming	7,14

According to: Ciborowski A., Ciborowska H. *Dietetyka. Żywnienie zdrowego i chorego człowieka.* PZWL Warszawa 2021

*Examples:*

1. A man weighing 83 kg, 183 cm high, doing an IT job for 8 hours a day.

– PPM:  $1 \text{ kcal} \times \text{body weight} \times 24 \text{ h}$

$$1 \text{ kcal} \times 83 \text{ kg} \times 24 \text{ h} = 1992 \text{ kcal}$$

– PPPM:  $150 \text{ kcal (light work)} \times 8 \text{ h} + 360 \text{ kcal (home and work activities)} + 199 \text{ kcal (10\% PPM)}$   
= 1759 kcal

– CPM:  $1992 \text{ kcal} + 1759 \text{ kcal} = 3751 \text{ kcal}$

2. A woman weighing 55 kg, 172 cm high, working as a librarian for 4 hours a day.

– PPM:  $1 \text{ kcal} \times 55 \text{ kg} \times 24 \text{ h} = 1320 \text{ kcal}$

– PPPM:  $150 \text{ kcal (light work)} \times 4 \text{ h} + 220 \text{ kcal (home and work activities)} + 132 \text{ kcal (10\% PPM)}$   
= 952 kcal

– CPM:  $1320 \text{ kcal} + 952 \text{ kcal} = 2272 \text{ kcal}$

3. A man weighing 78 kg, 171 cm high, doing manual labour (heavy work, 450 kcal/hour) for 8 hours a day.

Calculate PPM, PPPM, CPM.

4. A woman weighing 65 kg, height 156 cm, working as a secretary (light work, 150 kcal/hour) for 8 hours a day.

Calculate PPM, PPPM, CPM.

#### IV. Content of macronutrient in diet

A properly composed diet should provide:

– **15% energy from protein**

Not less than half of the total protein should come from animal products.

To meet this challenge, products containing animal protein should be included 3-4 meals a day.

– **30% energy from fat**

Limit the consumption of animal fats and foods high in cholesterol (2/3 of total fat should be unsaturated fats).

– **55% of energy from carbohydrates**

First of all, complex carbohydrates (70% of the total demand) contained in wholemeal cereals, breakfast cereals, whole grain and grain breads, nuts, and vegetables and fruit, sugar should be limited as it is a source of 'empty calories'.



1. Distribute the energy requirement for 2500 kcal over 5 meals.
2. In the 2500 kcal diet, calculate the amount:
  - total protein and animal protein,
  - total fat and PUFAs,
  - total carbohydrates and complex carbohydrates.
3. Using the Nutritional Tables, list the amount of products covering the needs of protein, fat and total carbohydrates in a 2500 kcal diet, respectively.

#### V. Questions

- What do you know about human nutrition?
- What changes in nutrition occur in modern society?
- Which of the presented nutritional cultures meets the principles of healthy eating?
- Obesity as the most important public health problem – make the characteristic.

#### VI. Match true (T) or false (F)

1. Experts have developed a variety of definitions of what a functional food is. The most common definition of a functional food is that it is a food that provides a health benefit beyond basic nutrition. Nutraceuticals are the chemical components of functional foods that provide the particular health benefit. (T/F)
2. Nutraceuticals cannot be of plant, animal, or microbial origin. Oftentimes, a particular nutraceutical cannot be found in a variety of different foods. (T/F)
3. Nutraceuticals classified on the basis of mechanism of action are sometimes grouped as follows: anticancer, positive blood profile indicators, antioxidants, anti-inflammatories, and osteogenic protective properties. (T/F)
4. Probiotics are a class of microbial nutraceuticals that have received a great attention in recent years. Probiotic bacteria include *Lactobacillus acidophilus*, *Bifidobacterium bifidum*, and *Streptococcus salivarius* subspecies *thermophilus*. (T/F)

#### VII. Water and Electrolytes – Fill in the blank spaces with appropriate words

- a. .... (1 word) dissociate into negatively and positively charged ions when dissolved in .... (1 word).
- b. The total amount of body water remains relatively constant due to the homeostatic regulation of the .... (2 words), .... (1 word), and .... (1 word).
- c. Human body is made up of over .... percent (1 word) of water.
- d. Each day, people need enough amount of water to supplement daily losses from .... (1 word), .... (1 word), and .... (1 word). Sources of water include water itself, beverages, and foods containing water.

### IX. Study the following case and answer the question that follow

The objective of this case study is for you to apply the knowledge you have gained on dietary constituents and apply it in a practical life situation, using your analytical and critical thinking skills.

#### Description:

Miss Eleonore Blunt is a 19-year-old university student. Physically, she is very active, and she is in the normal weight range for her age and sex. She says that she does not have time to eat lunch but most days she seems to meet her daily energy and protein requirements.

Miss E.B.'s mother is convinced that her daughter is overworked and needs to slow down, but E.B. herself does not understand what is happening to her; she just feels like she is 'progressively losing all her energy.' Miss E.B. tells her that her diet is very repetitive and mainly composed of the following:

Breakfast:	orange, 1 cup milk 1,5% fat, black coffee 1 cup
Morning snack:	chocolate milk candy bar, medium cola
Lunch:	banana 200 g, mozzarella cheese 1-inch cube 28 g
Dinner:	spaghetti noodles 2 cup with tomato sauce with onion
Late night snack:	mixed salad greens 2 cups with balsamic vinegar dressing 3 tablespoon
Bedtime snack:	vanilla ice cream 160 mL, tea 250 mL with honey 50 g and lemon 10 g

#### Questions:

1. What is the EAR, RDA or AI for that nutrient appropriate for a 19-year-old woman?
2. Is Eleonore Blunt meeting the RDA or AI for her age and sex?
3. What foods could E.B. add to her diet to increase her dietary intake of that nutrient?
4. Give some specific examples of how E.B. could modify her menu to include sources of this nutrient, taking into consideration that she does not like eating organ meats.
5. Is the RDA or AI for that nutrient the same for a man of the same age? If so, please explain why.
6. Which nutrient deficiency is most commonly found in the world today?
7. What vitamin could help increase the absorption of that nutrient?
8. What is the RDA or AI for that vitamin for E.B.'s age and sex?
9. Is Eleonore Blunt meeting her requirements in that vitamin?
10. What are sources of that vitamin?
11. Is Eleonore Blunt including some sources of that vitamin in her present diet?

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