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The problem of malnutrition in Poland and across the world

Problem niedożywienia w Polsce i na świecie

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Summary

Malnutrition occurs when the diet does not supply the body with sufficient quantity and/or quality of essential nutrients. It concerns a very large population of developing countries, but it can also be a problem in developed countries, including Poland.

Underweight indicates the risk of protein-energy malnutrition. In our country it occurs in 1% of men and more than 3% of women. It is more common in children and adolescents, concerning for about 13% of that population.

Deficiencies of certain nutrients, especially iron, vitamin A and iodine also are the problem. In Poland there is a frequent occurrence of iron deficiency among young children and pregnant women, concerning for about 1/4 of people from these groups. In recent years there has been a marked reduction in risk of iodine deficiency and in Poland its supply at a population level was considered sufficient.

Malnutrition is promoted by poverty and that cause hunger in some countries, or can negatively affect the nutritional value of diets in others. In Poland, nearly 7% of households live below the poverty line. Particularly at risk of poverty are children and adolescents.

Inappropriate diet also can lead to nutrient deficiencies. Poles' diet poses a risk of vitamin D, folate, vitamin C, calcium, iron and iodine, especially in young children, teenage girls and women.

Key words: underweight, vitamins and minerals deficiencies, living conditions, diet

Streszczenie

Niedożywienie występuje, kiedy dieta nie dostarcza organizmowi dostatecznych ilościowo i/lub jakościowo niezbędnych składników odżywczych. Dotyczy bardzo dużej części populacji krajów rozwijających się, ale może też stanowić problem w krajach rozwiniętych, w tym również w Polsce.

Na ryzyko niedożywienia energetyczno-białkowego wskazuje niedobór masy ciała. W naszym kraju występuje on u 1% mężczyzn i ponad 3% kobiet. Częściej spotykany jest u dzieci i młodzieży, gdzie dotyczy ok. 13% populacji.

Problemem są również niedobory niektórych składników odżywczych, zwłaszcza żelaza, witaminy A i jodu. W Polsce częstym zjawiskiem jest niedobór żelaza wśród małych dzieci i kobiet w ciąży, występujący u ok. 1/4 osób z tych grup. W ostatnich latach nastąpiło wyraźne zmniejszenie zagrożenia niedoborem jodu, w Polsce jego podaż na poziomie populacyjnym została uznana za wystarczającą.

Niedożywieniu sprzyja ubóstwo, w niektórych krajach będące przyczyną głodu, a w innych niekorzystnie wpływające na wartość odżywczą diety. W Polsce poniżej granicy ubóstwa żyje prawie 7% gospodarstw domowych. Szczególnie zagrożone ubóstwem są dzieci i młodzież.

Również nieprawidłowe żywienie może prowadzić do niedoborów składników odżywczych. Dieta Polaków stwarza ryzyko niedoboru witaminy D, folianów, witaminy C, wapnia, żelaza i jodu, zwłaszcza u małych dzieci, nastoletnich dziewcząt i kobiet.

Słowa kluczowe: niedobór masy ciała, niedobory witamin i składników mineralnych, warunki życia, sposób żywienia

INTRODUCTION

Nutritional status, according to international terminology, is the health condition being the result of usual food intake, nutrients absorption and utilization, as well as pathological factors which affect those processes (1).

According to this definition, in order to fully assess one's nutritional status, it is necessary to test the nutrients level in blood and other bodily fluids or tissues, to assess body condition, taking into consideration one's medical history, as well as to characterize nutritional value of one's diet for a longer period of time.

Such tests are very expensive and laborious, so in practice one's nutritional status is assessed on the basis of anthropometric measurements. Usually one's height, weight and circumferences are measured. It enables the assessment of underweight, as well as overweight and obesity (1, 2).

Underweight indicates the risk of protein-energy malnutrition. It may be accompanied by vitamins and minerals deficiencies in the body. Malnutrition occurs when the diet does not supply the body with sufficient quantity and/or quality of essential nutrients (1, 2).

Malnutrition may disturb growth and pubertal timing, and in later periods of life it may lead to fertility disorders and in extreme cases it may even lead to cachexia (3).

That is why it is important to assess one's nutritional status, including underweight and the risk of malnutrition.

Underweight prevalence

Underweight occurs more or less frequently in particular regions of the world. According to the data collected by the World Health Organization (WHO), in the countries of European Region this abnormality occurs in a relatively small percentage of adults, at the same time it occurs more often in women than in men (4). Depending on the country in recent years underweight has been observed in 0.5-2.0% of men and in 3.0-7.4% of women. Norway, France and Slovakia were the countries where underweight occurred most often, while the fewest cases of underweight were observed in Spain and Sweden. Changes in this field have been monitored only in some countries for more than ten years. Most often a reduction in underweight has been observed, among others in Denmark, Portugal and Estonia. However, there are countries, such as Norway, where underweight has increased in recent years.

In other developed countries outside Europe underweight does not occur very frequently. In the United States in the years 2007-2008 underweight was observed in 1.0% of men and in 2.2% of women, however it has decreased by almost 2.5 times since the beginning of the 1960s (5). Also relatively low percentages of people with this abnormality was observed in Canada (in 1.2% of men and in 4.1% of women), Mexico (1.5% and 1.4% respectively), Australia (1.3% and 2.8% respectively) or New Zealand (1.3% and 1.6% respectively) (4). It is worth noticing that the smallest number of people with underweight is reported in Kuwait: in 2009 it was observed in 0.7% of men and women. On the other hand, Japan is an interesting case. Underweight is noted there more often than in other developed countries: in 2008 it was observed in 4.3% of men and in 10.8% of women.

India and Pakistan are countries with the highest levels of underweight (4). In India in 2005 it was reported in 33.7% of men and in 35.6% of women, but only younger age groups were examined – men under 54 and women under 49 years old. In Pakistan underweight was observed in 30.8% of men and in 31.6% of women. However, this data was collected between the years of 1990 and 1994 and there is no current data in this matter.

There is also an unfavourable situation in many African countries (4). The country where underweight occurs more often is Madagascar: in 2005 underweight was reported in 19.2% of people, irrespective of sex. The situation is much better in the Republic of South Africa (in 12.5% of men and in 6.2% of women) and in Zambia (11.6% and 6.2%, respectively). Most data from Africa concerns only women aged 15-49. In this group the highest percentage of persons with underweight was observed in Ethiopia (26.5%), Burkina Faso (20.8%), Niger (19.2%), the Democratic Republic of the Congo (18.5%) and Senegal (18.2%).

The most comprehensive data concerning the occurrence of underweight in Poland comes from representative nationwide research carried out in 2000 as part of the project "Household Food Consumption and Anthropometric Survey" (HFCAS) among people aged 1-96 (6). The data can be found in the abovementioned WHO database. The results of the research show that underweight was observed in 1.0% of men and in 3.2% of women. In men the abnormality occurred in the youngest and the oldest age groups – in about 2% of men. In women underweight was the most frequently reported between the ages of 19 and 29 – it occurred in 11.0% of women. In older age groups the percentage of underweight women was much lower, in women over the age of 50 it amounted to 1%.

The occurrence of underweight in Poland was also assessed by the Central Statistical Office (CSO) (7). This is the most recent data on this problem in our country. However, it should be noticed that anthropometric measurements were not carried out there, and researchers used the information they received from respondents. It was estimated that in 2009 underweight was observed in 1.3% of men and in 4.3% of women aged 15 and above. In spite of the fact that the percentage was a bit higher than in 2000, especially among women, the prevalence of underweight does not seem to have increased among adults for the last few years. In the case of data collected by the CSO some underestimation of weight is possible, especially by women, and a real number of persons with underweight might have been a bit lower than the estimated one.

In the world the problem of underweight in children, especially under the age 5, is more often raised than the problem of underweight in adults. This concerns above all citizens of developing countries (8). Malnutrition, which includes underweight and insufficient height for age, as well as nutrients deficiency, is the main cause of mortality in under-five children in those countries, amounting to 35%.

WHO estimates that in 2010 in developing countries underweight occurred in 103 mln under-five children that is in 18% of this population (8). The worst situation was in the countries of South-central Asia (30%),

Eastern, Western and Middle Africa (21-22%) and South-Eastern Asia (17%). Moreover, in some countries underweight occurs much more often than it is shown by the data collected in a particular region. India is an example of a country where in recent years underweight has been observed in 43.5% of people, also Yemen – 43.1%, Bangladesh – 41.3% and Niger – 39.9% (9).

However, over the last two decades a significant improvement has been observed. In 1990 the prevalence of underweight in the mentioned group of countries was estimated to be 29% (8). A significant improvement has been observed in Eastern Asia, Latin America and the Caribbean, as well as in the South-central Asia. However, in the last region the percentage is still very high.

In developed countries underweight in small children occurs much more rarely (9). In Europe in countries where research has been conducted in recent years the prevalence of underweight was estimated to fluctuate from 0.9% in Ukraine to 3.5% in Romania and Turkey. Most often, however, it did not exceed 2%. In the United States the prevalence was 1.3%.

Assessing underweight in under-five children, the World Health Organization recommends to use weight-for-age based on WHO child growth standards (9). In epidemiological study, which involves also older children, most often Body Mass Index (BMI) is used, at the same time using international standards recommended by the International Obesity Task Force (IOTF) (10). That is why the results of epidemiological study may differ from the data collected by WHO. Standards recommended by IOTF enable determining not only a serious risk of malnutrition but also moderate and small risk. The percentage of persons with underweight estimated with the use of these standards is often much higher than the percentage estimated on the basis of weight-for-age.

In Poland on the basis of the above-mentioned nationwide research, carried out as part of the HFCAS project, it was assessed that underweight occurred in 12.8% of boys and in 13.5% of girls aged 2-18 (11). The percentage of underweight boys was highest among the persons aged 2-6, among girls – the percentage was highest in girls aged 7-12. The least often the abnormality occurred in the older age group – between the ages 16 and 18 years.

The results of other research carried out at the same time in the whole Poland among children aged 11-12, and 3 years later at the age of 14-15, showed that the prevalence of underweight decreased with age: from 9.5% to 4.6.% in boys and from 17.9% to 9.1% in girls (11).

Due to the fact that underweight is much less frequently assessed than overweight and obesity, involving various age groups into research and using various standards handicaps the comparison of underweight occurrence in Poland and in other countries. When comparing particular age groups it was noted, among others, that underweight among young Poles occurs more often than among their peers in the United States, France or Serbia and it occurs almost as frequently as in Russia (11).

Nutrients deficiencies

The most common problem in the world connected with malnutrition is iron deficiency (12). It concerns a big number of people, especially children and women in developing countries, but it is also quite common in industrialized countries. It may cause anaemia, physical disorder and mental retardation, perinatal mortality in women, and in developing countries it results in the development of infectious diseases, such as malaria, HIV/AIDS and tuberculosis. This, in turn, causes serious economic consequences by reducing the work capacity of individuals and entire populations, bringing serious economic consequences and obstacles to national development.

WHO report assessing occurrence of anaemia in the world between the years 1993 and 2005 shows that anaemia occurred in 24.8% of population (13). Most often it was observed in preschool-age children – 47.4% and in pregnant women – 41.8%. The most affected regions were Africa (64.6% of preschool-age children and 55.8% of pregnant women) and Asia (47.7% and 41.6%, respectively). The highest percentage of small children with anaemia was reported in Liberia – 86.7% and the Central African Republic – 84.2%. In the case of pregnant women anaemia most often occurred in the Gambia – 75.1% and Nepal – 74.6%.

In Europe the percentages were lower. Nevertheless, they showed the significance of the problem (13). 16.7% of preschool-age children and 18.7% of pregnant women suffered from anaemia. Most often anaemia occurred in Moldova (in 40.6% of small children and 35.5% of pregnant women) and Romania (39.8% and 30.0%, respectively), and most rarely it occurred in Monaco (5.0% and 6.3%), Switzerland (6.3% and 9.7%) and Norway (6.4% and 9.3%). Poland belongs to countries where the occurrence of the problem is considered to be moderate. Anaemia in our country has been observed in 22.7% of preschool-age children and in 25.3% of pregnant women.

The most favourable situation is in the United States, where anaemia has been observed only in 3.1% of preschool-age children and in 5.7% of pregnant women (13).

Also vitamin A deficiency is a worldwide problem (14). Small children and women are most exposed to the consequences of vitamin A deficiency. In children the deficiency is the main cause of preventable blindness and increases the risk of disease and death from severe infections. In women it is additionally a risk factor associated with perinatal mortality.

WHO estimates that between the years 1995 and 2005 33.3% of preschool-age children and 15.3% of pregnant women suffered from retinol deficiency in blood. However, the assessment concerned only countries with the risk of vitamin A deficiency (15).

Most often the deficiency occurred in Africa (in 41.6% of children and in 14.3% of pregnant women) and in Asia (33.5% and 18.4%, respectively). Among children the worst situation was observed on the islands of São Tomé and Príncipe (95.6%) and in Kenya (84.4%), among pregnant women in the Gambia (34.0%) and in Nepal (31.5%).

In the case of Western Europe and Scandinavia vitamin A deficiency does not pose a public health problem (15). In other European countries retinol deficiency in blood was observed in 14.9% of preschool-age children and in 2.2% of pregnant women. In Poland the percentages were 9.3% and 2.2%, respectively. On their basis the problem was considered to be minor.

Iodine is a nutrient whose deficiency is a serious problem. WHO in 2004 in the report on iodine deficiency estimated that insufficient iodine intake determined on the basis of the urinary iodine concentration may concern 35.2% of general population, including 53.1% of school-age children (16). The occurrence of goitre, which is one of the results of iodine deficiency, was in general population 15.8%. A low level of iodine in urine was observed, above all, in Europe. It concerned 52.7% of general population and 53.1% of school-age children. However, goitre most often occurred in Africa (26.8%), although its prevalence in Europe was also high (16.3%), especially in East Europe (27.2%). Poland, on the basis of the urinary iodine concentration in children and the youth tested in 1999, was considered to be a country with mild iodine deficiency.

In 2011 an improvement in the situation described in the above-mentioned report was noted (17). The number of countries where iodine deficiency was a public health problem decreased from 54 in 2003 to 32 in 2011. The occurrence of iodine deficiency in school-age children significantly decreased; in 2011 it was 29.8%, and in Europe there was a marked fall in iodine deficiency – by 43.9%.

In Poland general obligatory table salt iodization, implemented in 1997 within the programme of prevention of iodine deficiency, significantly improved an unfavourable situation (18). Thanks to that Poland found itself in a group of European countries (about 34% of European population) with a sufficient iodine supply at the population level. Also a decrease in goitre prevalence was noted in children aged 6-9, as well as in pregnant women (from 80% in the years 1991/1992 to 19% in 2003). However still, a worrying situation is observed in the group of pregnant women, out of whom over 40% have not taken recommended iodine doses, which are essential for correct prenatal development.

It is best to assess nutrients deficiencies in an examined person or a group of people on the base of biochemical tests, among others tests for concentration of nutrients in bodily fluids or in tissues (1). In Poland such assessment was carried out among patients taken to hospitals between the years 1999-2000 (19). The deficiencies of some vitamins were assessed. It turned out that the most serious danger is connected with vitamin C deficiency, its insufficient concentration was noted in 51.8% of patients. Also, folic acid concentrations were often inadequate – in 32.0% of patients. Less often vitamin E deficiency (in 10.0%) and vitamin B_{12} deficiency (6.8%) was observed. On the other hand, a favourable situation was observed in the case of vitamin A, whose deficiency was noted only in 1.4% of patients.

Living conditions leading to malnutrition

Protein-energy malnutrition connected with the insufficient energy intake compared to recommendations, as well as with the insufficient levels of protein in one's diet in many countries is the result of insufficient food consumption.

According to the assessment of FAO in 2010 there were 925 mln hungry people in the world that is 13.1% of world population (20). The biggest number of people lived in East Asia and Pacific (578 mln), and a significant number of people came from Sub-Saharan Africa (238 mln). In developed countries the number reached 19 mln.

The number of hungry people has been increasing since 1995-1997 (20, 21). The increase is caused by three main factors: neglect of agriculture relevant to very poor people by governments and international agencies, the current economic crisis in the world, and the significant increase of food prices in the last several years which has been devastating to the poorest members of society.

Poverty is the main cause of hunger (21). The World Bank estimated that in 2008 the number of people living on $1.25 a day or less was 1,345 mln (22). The biggest percentage of people on such a low income lived in Sub-Saharan Africa (50.9%) and South Asia (40.4%). In Europe and Central Asia the percentage was only 0.04%. Hunger, which affects people's health, including their nutritional status, may lead to greater poverty, and may reduce people's ability to work and learn (21).

Harmful economic systems military conflicts and climate change are other causes of hunger (21).

In Poland poverty is not necessary connected with hunger, however it cannot be denied that some people have problems with buying a sufficient amount of food and, as a result, go hungry. There is, however, a high probability that poor people, who buy and eat cheaper products of worse quality, are more prone to nutritional deficiencies.

According to CSO in 2011 the percentage of persons living in households below the poverty line (that is, households living below the minimum existence level) was 6.7% (23). The percentage increased between the years 2000 and 2005 reaching the level of 12.3%. Then it decreased, however in 2011 it was 1% higher than in 2010.

Children and adolescents are at the greatest risk of poverty (23). Households living below the minimum existence level included over 9% of children under 18. This means that persons that age made about 31% of population at risk of extreme poverty.

Among older people the range of poverty incidence was smaller (23). About 4% of people aged over 65 lived in households considered to be extremely poor. Those persons made about 7.5% of all people being at risk of extreme poverty.

It is mainly large families that are at risk of poverty (24% of persons in households with 4 or more children) (23). There is an unfavourable situation among the unemployed and their families (12.5%). Poverty is also the result of living on a low income (almost 9% of people). Also such factors as disabled people in the family (9.2%) increase the risk of poverty. On the other hand, higher levels of education among the heads of households practically eliminate the household from population living in extreme poverty (less than 1% of people).

The level of poverty is significantly higher in the countryside (10.9%) than in cities (4.2%) (23). The citizens of Warmian-Masurian, Podlaskie, Lublin and Świętokrzyskie province are at the biggest risk of suffering poverty (from 10% to over 11%). The lowest percentage of people living in households at risk of extreme poverty noted in provinces of southern Poland: Lower Silesian, Opolskie, Silesian and Lesser Poland, as well as in Masovian and Lubusz province (from over 3 to almost 5%).

Inappropriate diet connected with malnutrition risk

In industrialized countries a much more serious problem than insufficient food consumption is food overconsumption. In such a situation people's dietary habits are most often connected with excessive amounts of energy and macronutrients in diet, which can, however, be accompanied by deficiencies of certain nutrients.

In the United States dietary deficiencies of macronutrients, such as protein and carbohydrates, have been observed very rarely (24). However, data collected between the years 2001-2002 shows that a high percentage of people consumed insufficient amount of certain vitamins and minerals. The American diet above all was defficient in vitamin E, whose intake lower than recommended was observed in 93% of the people examined, most often in older children, teenagers and women. Also vitamin A and vitamin C intake was lower than recommended in a big group of people (vitamin A – in 44% of people and vitamin C – in 31% of people). Among minerals magnesium intake was most often lower than recommended (in 56% of people) and in some people (12%) also zinc intake was too low. A relatively small percentage of people whose folate (8%) and iron (5%) intake was not sufficient.

Research conducted in 2004 in Canada showed that the percentage of people whose vitamin D intake was lower than recommended was very high (86-93% in small children, about 80-90% in men and 90% in women) (25, 26, 27). Apart from small children, a big percentage of population consumed insufficient amount of vitamin A. In older children and teenagers the percentage was from 11.6% to 42.2%, in men – 44.3% and in women – 35.8%. Moreover, there were a relatively high percentage of adults whose vitamin C intake was not higher than recommended (22.5% of men and 16.7% of women). Insufficient folate intake was noted above all in women (from 20% to almost 50%) and older men (over 20%). In the case of minerals, the diets of Canadians were most often low in calcium (23.3% of children aged 4-8, from 26.5% to 80.1% of men and from 47.5% to 86.9% of women, depending on their age), and the diets of adults were also low in magnesium (from 35% to 65% of men and from 35% to 50% of women). Insufficient iron intake was noted mainly in women aged 19-50 (in 16-19%).

The analysis of nutritional value of diets in various European countries presented in the report from 2009 shows that the intake of certain nutrients was lower than recommended, which posed a risk of deficiency (28).

In many countries there was very low vitamin D intake (28). The best situation was in Scandinavian countries, where most age groups consumed appropriate amount of vitamin D. **In Poland the biggest risk of vitamin D deficiency was observed in preschool-age children, whose diet contained 2.5 times less of vitamin D than recommended. Also older children, young girls, women and elderly people were at risk of vitamin D deficiency.**

A big problem in all countries was insufficient folate intake (28). In Poland among women it exceeded 60% of the recommended value, posing a risk of complications in the case of getting pregnant. The folate intake was also lower than recommended in children, teenage girls and elderly people.

In certain countries, also in Poland, insufficient vitamin C intake was observed (28). In our country only young men the intake of this vitamin was appropriate (6, 28). Moreover, vitamin C intake varied very much and it was very low in a big group of people.

Calcium is one of the minerals whose insufficient intake is observed in the diet of Europeans (28). The most favourable situation was reported in Scandinavian countries. In Poland, unfortunately, calcium intake was one of lowest in Europe (6, 28). In every age group there was a risk of calcium deficiency. Most calcium, compared to the recommended value, was found in the diet of preschool-age children – over 85%. At the biggest risk of calcium deficiency were girls and women whose diet contained 50-60% of the recommended value.

Teenage girls and women, excluding the older age group, are at the biggest risk of iron deficiency (28). In most countries iron intake in those groups was much lower than recommended. In the diets of Polish women the amount of iron made about 70% of the recommended intake (6, 28).

Not enough iodine intake was most often observed in preschool-age children and younger school-age children (28). That concerned above all Central

European countries. In Poland in those groups iodine intake was at the level of 65-70% of the recommended value. Also teenage girls and elderly women were at risk of iodine deficiency.

CONCLUSIONS

The problem of malnutrition in the world concerns, above all, developing countries. A big part of population of those countries is at risk of protein-energy malnutrition, as well as vitamin and mineral deficiency. The worst situation is in South-Eastern Asia, as well as in Africa. Small children and women of child-bearing age, especially pregnant ones, are at the biggest risk of malnutrition and vitamin deficiencies. Widespread malnutrition in those groups increases the incidence of infectious diseases and mortality rate due to them, as well as perinatal mortality rate among women.

Malnutrition among citizens of developing countries is, above all, the result of insufficient amount of food they consume. This, in turn, is caused by poverty, which is most often the result of the economic and social situation which has worsened since the economic crisis began a few years ago. In some countries people are hungry due to military conflicts or climatic changes.

In developed countries the risk of protein-energy malnutrition usually does not concern a big group of people. In Poland underweight, which might indicate a risk of malnutrition, is observed more often in children and adolescents than in adults. This may be partly connected with the unfavourable economic situation of families, because the biggest risk of poverty concerns namely children and teenagers. Children from large families and children whose parents are unemployed are in the worst situation.

In spite of a small risk of protein-energy malnutrition, the diets of the citizens of developed countries pose a risk of deficiencies of certain vitamins and minerals.

A big problem in Europe is iodine deficiency. However, in recent years there has been a significant improvement in this matter. Poland belongs to countries where this situation is much more favourable than it used to be some years ago. Iodine intake in our country is considered to be sufficient as far as whole population is concerned. However, in some groups, especially among pregnant women, there is still a risk of iodine deficiency.

Moreover, the diet of Europeans very often contains insufficient amounts of vitamin D, folate, vitamin C, calcium and iron. In the United States there is not such a big risk of folate and iron deficiency, however a risk of vitamin E, vitamin A and magnesium deficiencies is quite big. In Canada most common are vitamin D, vitamin A and calcium deficiencies, and among adults also vitamin C and magnesium deficiencies.

Also the diet in Poland is connected with a risk of deficiencies of certain vitamins and minerals. The Poles consume lower levels of calcium than recommended, and in some age groups also vitamin D, folate, vitamin C, iron and iodine. Blood tests for vitamins, carried out among patients taken to hospital, confirm the risk of vitamin C and folate deficiencies.

Small children, teenage girls and women are at the biggest risk of nutritional and vitamin deficiencies.

BIBLIOGRAPHY

1. Charzewska J: Ocena stanu odżywienia. [In:] Gawęcki J, editor. Żywienie człowieka. Podstawy nauki o żywieniu. T. 1. 3rd ed. Warszawa, Wydawnictwo Naukowe PWN 2010; 529-548.
2. Physical status: The use and interpretation of anthropometry; Report of a WHO Expert Committee. Geneva, World Health Organization 1995; 1-452.
3. Szponar L, Respondek W, Ołtarzewski M: Choroby pierwotne na tle niedoborów żywieniowych. [In:] Grzymisławski M, Gawęcki J (ed.): Żywienie człowieka zdrowego i chorego. T. 2. 2nd ed. Warszawa, Wydawnictwo Naukowe PWN 2010; 123-145.
4. Global Database on Body Mass Index. World Health Organization 2012, http://apps.who.int/bmi/index.jsp?introPage=intro_3.html
5. Fryar CD, Ogden CL: Prevalence of Underweight Among Adults Aged 20 Years and Over: United States, 2007-2008. CDC/National Center for Health Statistics 2010, http://www.cdc.gov/nchs/data/hestat/underweight_adult_07_08/underweight_adult_07_08.htm
6. Szponar L, Sekuła W, Rychlik E et al.: Badania indywidualnego spożycia żywności i stanu odżywienia w gospodarstwach domowych. Warszawa, Instytut Żywności i Żywienia 2003; 1-900.
7. Stan zdrowia ludności Polski w 2009 r. Warszawa, Główny Urząd Statystyczny 2011; 1-596.
8. Underweight in children. World Health Organization 2012, http://www.who.int/gho/mdg/poverty_hunger/underweight_text/en/index.html
9. WHO Global Database on Child Growth and Malnutrition. World Health Organization 2012, http://www.who.int/nutgrowthdb/en/
10. Cole TJ, Flegal KM, Nicholls D et al.: Body mass index cut offs to define thinness in children and adolescents: international survey. BMJ 2007; 335: 194.
11. Jarosz M, Rychlik E: Diagnosis of underweight occurrence in children and adolescents in Poland in 1983-2004. Pol J Environ Stud 2008; 17(4A): 172-177.
12. Micronutrient deficiencies. Iron deficiency anaemia. World Health Organization 2012, http://www.who.int/nutrition/topics/ida/en/
13. Worldwide prevalence of anaemia 1993-2005. WHO Global Database on Anaemia. Geneva, World Health Organization 2008; 1-41.
14. Micronutrient deficiencies. Vitamin A deficiency. World Health Organization 2012, http://www.who.int/nutrition/topics/vad/en/
15. Global prevalence of vitamin A deficiency in populations at risk 1995-2005. WHO Global Database on Vitamin A Deficiency. Geneva, World Health Organization 2009; 1-55.
16. Iodine status worldwide WHO Global Database on Iodine Deficiency. Geneva, World Health Organization 2004; 1-48.
17. Andersson M, Karumbunathan V, Zimmermann MB: Global iodine status in 2011 and trends over the past decade. J Nut 2012; 142: 744-750.
18. Szybiński Z: Niedobór jodu w ciąży – nadal aktualny problem zdrowia publicznego. Endokrynol Pol 2005; 56: 65-71.

19. Jarosz M, Dzieniszewski J, Rychlik E: Stan odżywienia chorych przyjmowanych do i wypisywanych ze szpitali w Polsce. [In:] Jarosz M (ed.): Zasady prawidłowego żywienia chorych w szpitalach. Warszawa, Instytut Żywności i Żywienia 2011; 15-25.
20. The State of Food Insecurity in the World 2011. Food and Agriculture Organization 2011, http://www.fao.org/docrep/013/i1683e/i1683e.pdf
21. 2012 World Hunger and Poverty Facts and Statistics. World Hunger Education Service 2012, http://www.worldhunger.org/articles/Learn/world%20hunger%20facts%202002.htm
22. Poverty. The World Bank 2012, http://www.worldbank.org/en/topic/poverty
23. Ubóstwo w Polsce w 2011 r. (na podstawie badań budżetów gospodarstw domowych). Warszawa, Główny Urząd Statystyczny 2012. http://www.stat.gov.pl/gus/5840_8292_PLK_HTML.htm
24. Moshfegh A, Goldman J, Cleveland L: What we eat in America – NANHES 2001-2002: usual nutrient intakes from food compared to dietary references intake. Washington, US Department of Agriculture, Agricultural Research Service 2005. http://www.ars.usda.gov/SP2UserFiles/Place/12355000/pdf/0102/usualintaketables2001-02.pdf
25. Canadian Community Health Survey – cycle 2.2, nutrition (2004): nutrient intakes from food – provincial, regional and national data. Ottawa, Health Canada 2009; 1-207.
26. Do Canadian Children Meet Their Nutrient Requirements Through Food Intake Alone? Health Canada 2012, http://www.hc-sc.gc.ca/fn-an/surveill/nutrition/commun/art-nutr-child-enf-eng.php#a331
27. Do Canadian Adults Meet Their Nutrient Requirements Through Food Intake Alone? Health Canada 2012, http://www.hc-sc.gc.ca/fn-an/surveill/nutrition/commun/art-nutr-adult-eng.php#a6
28. European Nutrition and Health Report 2009. Elmadfa I, editor. Basel, Karger 2009; 1-412.

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