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ESTIMATING THE ACTUAL DIET AND FOOD STATUS OF OBSESS MEN

G.I. Shaikhova, D.Kh. Ibrokhimova, Sh.A. Zokirkhonova, D.A. Ataxanova, M.O. Zaydullaeva

1 MD, DSc, Professor, Department of Hygiene of Children, Adolescent and Nutrition of Tashkent Medical Academy, Tashkent, Uzbekistan
E-mail: guli.shayhova@gmail.com

2 Assistant, Department of Hygiene of Children, Adolescent and Nutrition of Tashkent Medical Academy, Tashkent, Uzbekistan

3 PhD, Associate Professor, "Department of Pediatric dentistry" of Tashkent State Institute of Dentistry, Tashkent, Uzbekistan
E-mail: zokirhonova@gmail.com

4 Candidate of Medical Sciences, Associate Professor, Department of Hygiene of Medical institute in Karakalpakstan

5 Assistant, Department of Hygiene of Medical institute in Karakalpakstan

ABSTRACT

Obesity is a chronic relapsing disease, today it is one of the most widespread non-communicable diseases: in 1998, there were 250 million obese patients in the world, and by 2025, according to WHO experts, their number will exceed 300 million.

The aim of this work was to study the actual nutrition and nutritional status, as well as physical activity of obese men.

Materials and methods. The study involved 250 men aged 40 to 55 years old, diagnosed with obesity of 1-11 and 111 degrees, living in the city of Tashkent and the Tashkent region. 30 men made up the control group. The study was carried out at the Levelmed clinic in Tashkent.

Results and discussion: The diet of obese men is characterized by quantitative and qualitative deficiencies: body mass index, waist and hip circumference are above normal. Violated the diet in the form of irregular food intake, food at the late hours of the day, massive consumption of high-calorie foods: saturated animal fats, salt and sugar.

Key words: obesity in men, BMI, nutritional status in obese men.

INTRODUCTION

Obesity is a chronic recurrent disease, today it is one of the most common non-communicable diseases: in 1998, 250 million obese patients were registered in the world, and by 2025, according to WHO experts, their number will exceed 300 million (1,16,17,18). Obesity is one of the most important public health problems in the twenty-first century, and therefore this problem is given great attention. It is proved that the increase in the number of diseases associated with overweight and obesity, atherosclerosis, hypertension, coronary heart disease, decreased glucose tolerance, metabolic disorders, bone and joint (osteochondrosis, deforming osteoarthritis) and endocrine systems (insulin-dependent diabetes mellitus, diabetes mellitus type-2), many forms of cancer (cancer of the rectum, breast, prostate), reproductive system, secondary immunodeficiencies are caused by several "external" factors, the leading of which is a rapid non-evolutionary change in nutrition (the ratio of the main groups of nutrients) and lifestyle (decrease in physical activity and increased stress). The fundamental reasons for this change are recognized as industrialization, urbanization and globalization of the food and services market, which have changed not only food production, but also the stereotype of food choice (9,10,11,12,20,21). Every year, diseases associated with overweight cause more than one million deaths in the Central Asian region 9).

In recent years, there has been a sharp increase in the prevalence of obesity worldwide, which stimulates interest in the consequences for the health and quality of life of this population (22,23). Persons suffering from various forms of obesity make up 20-30% of the total population. In developed countries, obesity is already considered the fifth most important risk factor and one of the leading causes of disability. (WHO.2003). In addition, obesity leads to a decrease in life expectancy and increases the risk of arterial hypertension, dyslipidemia, type 2 diabetes mellitus, coronary heart disease. Targeted studies regarding the study of actual nutrition, morbidity, the development of new food products in obese men aged 30 to 60 years in the Republic of Uzbekistan have not been conducted. The quality of life of obese patients is an important issue that needs to be considered more carefully. Unfortunately, the effect of weight loss on sexual function and quality of life is not well understood.

The aim of this work -was to study the actual nutrition and nutritional status, as well as physical activity of obese men.

Materials and methods. The study involved 250 men aged 40 to 55 years old, diagnosed with obesity of 1-11 and 111 degrees, living in the city of Tashkent and the Tashkent region. 30 men made up the control group. The study was carried out at the Levelmed clinic in Tashkent. Obese men were under outpatient control. The diagnosis was made on the basis of anamnestic, anthropometric data and the

results of examination by hygienists, endocrinologists and therapists, as well as on the basis of anamnestic, anthropometric data. During the outpatient examination, the activity and mood of the patients were assessed. Anthropometric studies included bioimpedance control of body composition with the determination of its mass, body mass index (BMI), waist and hip circumference (W/H); amount of fat mass. The measurements were carried out using a Martin anthropometer, caliper, and standard medical scales.

During the outpatient examination, the nutritional status, as well as the well-being, activity and mood of the patients were assessed. In the conducted studies, actual nutrition was studied using a questionnaire card. The collection of material was carried out under expeditionary conditions 2 times a year (winter-spring and summer-autumn periods) with registration in individual sheets of products actually eaten by men for 7 days. The content of the main nutrients and energy was calculated from the tables of the chemical composition of food products (14,15).

The results obtained were compared with the average daily rational norms of food consumption for the population of the Republic of Uzbekistan (SanPiN - 0105-01; SanPiN: Sanitary rules and regulations - 0250-08) (13).

To study the nutritional status in the clinic, a clinical and outpatient examination was conducted simultaneously, including clinical blood and urine tests, as well as a biochemical blood test with the determination of amylase, total protein, albumin, fibrinogen, bilirubin, creatinine, cholesterol in its serum. The obtained data were subjected to statistical processing on a Pentium 1V Microsofi office Excell – 2003 computer.(4,7).

Research results and discussion. When studying the quality of nutrition according to a questionnaire survey, the diets of obese men were characterized by a predominance of bakery, fatty and salty foods, low physical activity; unhealthy eating habits - systematic overeating, adherence to cheap high-calorie foods (fatty, flour, sweet, "fast food"); decreased metabolic processes of the body due to age; violations in the endocrine system; stressful and depressive states that have led to both changes in eating habits and metabolic disorders. There was a high content of saturated fats, salt and sugar in the daily diet against the background of non-compliance with nutrition standards for fresh vegetables and fruits (dietary fiber deficiency in the diet was 80%). In the main group, the content of meat and meat, fatty products (red meat, lamb meat, smoked sausages, chickens, sausages, etc.) in the diets is significantly higher than normal. It was noted that 48% of the surveyed 40-year-olds with obesity consume fatty foods (pilaf, kovurdok, kebabs), fast foods, hamburgers, hot dog, fried potatoes, Coca Cola, fanta and other soda drinks. were consumed daily during meals. One of the factors determining the

development of obesity, an important role is given to physical activity, which plays an essential role in the formation and functioning of a healthy organism. Among the surveyed 35% of men from 40 to 50 years of age are engaged in light gymnastics in the morning (10 minutes). Men from 50 to 55 years of age regularly engaged in physical exercises. 65% of men aged 40 to 50 years, 80% of men aged 45 to 55 years are around the TV after dinner and watch TV shows, movies, etc. 34% of men aged 40-50 work around a computer during the day. The analysis of the provision of men with basic foodstuffs showed that the actual nutrition of men with obesity is generally not balanced and is deficient in some foods, due to the characteristic irrational hierarchy of food sets. According to the questionnaire survey, the diets of obese men are characterized by a predominance of bakery, flour-grain and confectionery products, a high content of saturated fats, salt and sugar was noted in the daily diet against the background of non-compliance with nutrition standards for fresh vegetables and fruits (dietary fiber deficiency in the diet was 80%). The study of the provision of men with basic foodstuffs of men in the control group showed that the average daily consumption of meat and meat products is significantly higher than normal, milk and dairy products, eggs and fish, vegetables, berries and fruits, as well as vegetable oil is significantly lower than normal (Table 1).

Table 1

The average daily set of basic foods in the diets of obese men aged 40 to 55 years of age

Products, g *	Norma * g	Obese men (BMI 25-29, and above)		Men without obesity (BMI 18-24, I)	
		Winter-spring period	Summer-autumn period	Winter-spring period	Summer-autumn period
Meat and meat products (calculated as meat)	150	169 (112,7)	162 (108,0)	148 (98,7)	140 (93,3)
Milk and dairy products (calculated as milk)	491	480 (97,8)	420 (85,5)	410 (83,5)	380 (77,4)
Fish and fish products	35	25 (71,4)	22 (62,9)	19 (54,3)	16 (45,7)
Eggs, pcs	1,0	0,9 (90)	0,8 (80)	0,8 (80)	0,7 (70)
Bread and bakery products (in terms of bread)	314	495 (157,6)	443 (141,1)	427 (136,0)	398 (126,8)
Potato	181	238 (131,5)	221 (122,1)	215 (118,8)	196 (108,3)

Animal fat	21	30 (142,9)	28 (133,3)	19 (90,5)	16 (76,2)
Vegetable oil	16	18 (112,5)	17 (106,3)	15 (93,8)	14 (87,5)
Vegetables and gourds	296	250 (84,5)	300 (101,4)	275 (92,9)	318 (107,4)
Fruits and berries	325	230 (70,8)	340 (104,6)	245 (75,4)	330 (101,5)
Sugar and confectionery (in terms of sugar)	67	85 (123,2)	76 (110,1)	70 (101,4)	65 (98,5)

* When compiling the table, the recommended set and the number of products for one day according to SanPiN 0105-01 and 0250-08 are taken into account

In the main group, the content of meat and meat products (sausage, sausages, etc.) in the diets is much higher than the norm. In a week without restriction, fast-foods (hamburgers, hot dogs, french fries, etc.) were consumed by obese men. Ration calculations showed that the excess consumption of meat and meat products in children over the age of 12.1% in the winter-spring period, 8% in the summer-autumn period, and in the control group there is a shortage of these products by 1.3 and 2.75%.

Among dairy products, milk, cheese and feta cheese and cottage cheese turned out to be in obvious deficit; the range of these products included mainly kefir, kurt (a product made from salted curd), kaimak, and sometimes curdled milk, especially in the winter-spring period and, accordingly, below the recommended norms, the deficit ranged from 39.2% to 45.0%, and in summer-autumn period from 29.8 to 37%., and in the control group of the above products were not found in the diet of kaymak, kurt, but milk and dairy products, however, were below the norm by 16.6 and 22.6% . The deficit of vegetable fat (mainly cottonseed) turned out to be relatively small. In some cases, there was even an excess of the norm of fats, mainly of animal origin. The largest excess of animal fat consumption was 2-4 times. Butter, lamb and beef were used as animal fat. A clear deficiency (almost 2 times less than the norm) in the consumption of vegetables, melons, fruits and berries was found in obese men and in the control groups.

Fried potatoes turned out to be a favorite dish for every third surveyed, which exceeded the norm by 30 and 22%, in the control group it also exceeded the norm by 18 and 8%. Sugar and confectionery in the main group increased by 23 and 30%, in the control group by 1.4% in the winter-spring period, and in the summer period the deficit is 1.5%.

Analysis of the collected data showed that the energy value of the diet of obese men was 27% higher than in the control group, due to the excessive

consumption of high-calorie foods: saturated fats, salt and sugar, as well as bakery products (Table 2).

The calculation of the biological value of the diets of obese men showed that the content of total protein is 1.2 and 1.4% higher than the norm. In the control group, in the winter-spring period, the protein deficiency was 4.7%, and in the summer-autumn period, 2.2%. The diet was dominated by fats of animal origin, which amounted to 66.5±1.3%, i.e. 6.7% higher than the norm in the winter-spring period, (62.7±2.1) 10.0% higher than the norm in the summer-autumn period. In the control group (51.5±1.7) by 9.6% and (50.8±1.2) 8.2% below the norm. In comparison with the data of the control group, the consumption of animal protein significantly prevailed in obese children and adolescents (P>0.001).

When analyzing food intake, the most negative changes, characterized by an increase in the absolute and relative fat content, were noted in obese men. The content of fats in the daily diet exceeded the physiological norms by 30.8 and 20.0%, and in the control it was below the norm by 3.7 and 2.2%. The optimal ratio of consumption of fats of vegetable and animal origin is the content of animal fat in the daily diet is less than 21%, and vegetable fat is more than 16%. The diet was dominated by fats of animal origin, which amounted to 121.6±4.2 (130.8) in the winter-spring period, 111.6±4.9 (120.0) in the summer-autumn period, with a norm of 21.

The level of consumption of animal fat significantly differed from that in the control group and was 1.2 times higher (P> 0.001.) According to Olson R.E. (2000) the excess of fat in the daily diet by more than 30-40% of energy requirements leads to obesity, and also contributes to the development of metabolic syndrome, sugar insulin and dependent diabetes.

The main sources of fat in the diet were: fatty fast food meat products (fatty pilaf, fried meat products, flour dishes with fat, smoked meat and chicken, fast foods: hot dogs, hamburger, daily scrambled eggs (breakfast), hot dishes and etc., from dairy products (kaimak, sour cream) Despite their calorie content, fast foods, hamburgers are not very nutritious, contain a large amount of animal fat and are very poor in B vitamins and dietary fiber. An excess of saturated fatty acids increases the concentration of cholesterol and the development of coronary heart disease.Dietary cholesterol also has a significant effect on blood cholesterol levels (15).

The problem of qualitative and quantitative consumption of carbohydrates deserves special attention. In the compared groups, in the diets of actual nutrition, an excess of the amount of carbohydrates was noted: in obese men by 32.5 and 25%, and in the control group by 10 and 3%. Compared to the control group,

58.9% of obese men significantly more often dominated the consumption of carbohydrates (P>0.001).

A high content of mono and disaccharides in the daily diet was revealed, apparently due to the availability of high-calorie confectionery products (cake, muffins) for obese men. The structure of consumed sugars did not meet sanitary standards and recommendations for a balanced diet: an increase in the consumption of refined products in relation to polysaccharides was revealed. The main suppliers of simple carbohydrates were sugar and sugar-containing foods. As you know, the supply of energy with these sugars is not accompanied by the supply of essential nutrients, which leads to the displacement of foods with nutritional value (polysaccharides, proteins) from the diet. When assessing micronutrients in the daily diet, the following indicators were revealed: in the main group, the calcium content was slightly higher than the norm (by 4 and 5%); (in the control group - below the norm by 28.4%), 1.1 times the recommended level of magnesium, probably due to an excess of cereals, (in the control group - below the norm by 21 and 17%); the phosphorus content corresponded to the norm (in the control it was below the norm by 17.8 and 19.8%).

When assessing micronutrients in the daily diet, iron deficiency was detected, the intake of which was 13.3±2.4 and 13.8±2.8 mg/day in obese men, 12.6±2.9 and 13.1 in the control group. ±2.1 mg/day at the required level of 16.5 mg. The content of iodine in the diet of men is below the norm, despite the use of only iodized salt in recent years. An analysis of the daily intake of vitamins in obese men revealed a reduced intake of vitamins A, E and C compared to the norm, and their combined use is known to be a powerful antioxidant factor (13). The content of vitamin A in the diets of obese men was below the norm in the winter-spring period by 53.3%, in the summer-autumn period 47.8, and in the control group 62.0 and 58.0%. The content of vitamin B1 in obese men exceeded the norm by 41.7, and in the control group by 33.3%; vitamin B2 is below the norm by 1.2-1.5 times (29%), and in the control group by 1.5 times (28.5%). The content of vitamin PP in the diets of the main group was above the norm by 10 and 5%, and in the control group below the norm by 7.6% and 4%. 2-7%.

Reduced levels of vitamin C content in the diet were established. Our studies showed that the deficiency of vitamin C- (ascorbic acid) in the body of obese men ranged from 20 to 22.5%, and in the control group up to 20.0%. (Table 2.).

Table 2

The average daily content of the main nutrients in the diets of obese men (45-55 years old) (M ± m), abs. (% of the norm).

Nutrients	^ Norm	Obese men, BMI 25-29.9 and above (% of normal)		Non-obese men, BMI 18-24 (% of normal)	
		Winter-spring period	Summer-autumn period	Winter-spring period	Summer-autumn period
Proteins, g	93	100±3,8 (107,5)	95±3,2 (102,2)	90,0±3,5* (96,8)	88±3,1* (94,6)
including animal	57	68,5±3,3 (120,2)	66,7±2,7 (117,0)	50,0±2,6 *** (88,7)	48,0±2,1*** (84,2)
Fats, g	93	131,1±4,4 (141,0)	120,6±3,7 (129,8)	99,0±3,2*** (106,5)	90,0±2,8* (96,8)
Carbohydrates, g	395	600,0±18,6 (151,9)	580,7±16,7 (147,0)	412,8±11,6*** (104,5)	405,4±10,7*** (102,6)
Calorie content, kcal	2787	3770,0±33,2 (135,3)	3600,0±29,8 (129,2)	2800,5±22,7*** (100,5)	2787,7±25,1*** (100)
Vit A, mg	0,9	0,54±0,03 (60,0)	0,55± 0,04 (61,1)	0,45±0,02* (50,0)	0,40±0,03** (44,4)
Vit C, mg	70	57,7±3,4 (82,4)	60,6±3,1 (86,6)	54,8±2,9 (78,3)	55,5±2,8 (79,3)
Vit B1, mg	1,4	1,9±0,05 (135,7)	1,8±0,06 (128,6)	1,7±0,05** (121,4)	1,6± 0,04** (114,3)
Vit B2, mg	1,6	1,5±0,04 (93,8)	1,8±0,03 (112,5)	1,6± 0,03* (100,0)	1,8±0,05 (112,5)
Vit PP, mg	25	30,8±2,5 (123,2)	28,3± 2,2 (113,2)	26,0±2,4 (104,0)	28,0±2,4 (1121,0)
Calcium, mg	1200	1300,0±20,6 (108,3)	1250,0±19,7 (104,2)	961,0±18,5*** (80,1)	988,0±19,4*** (82,3)
Magnesium, mg	300	320,0±8,8 (106,7)	330,0±9,1 (110,0)	240,0±7,3*** (80,0)	251,0±7,6*** (83,7)
Phosphorus, mg	1800	1880,0±22,6 (104,4)	1899,0±23,8 (105,5)	1668,0±19,4*** (92,7)	1647,0±18,3*** (91,5)
Iron, mg	16,5	18,3±1,6 (110,9)	17,8±1,7 (107,9)	16,0±1,4 (97,0)	17,0±1,6 (103,0)

Note: ^ - when compiling the table, the recommended set and the number of products for one day according to SanPiN 0105-01 and 0250-08 were taken into account;
* - compared with the nutrition of children of the main group (* - P<0.05, ** - P<0.01, *** - P<0.001)

The low content of vitamins A and C in the diet of the examined children correlates with the proportion of vegetables, fruits, and berries.

The main indicator that is used to diagnose and assess the severity of obesity is the body mass index - the ratio of body weight in kilograms to the square of height in meters. Normally, it ranges from 18.5 to 25.0. Criteria for the diagnosis of overweight and obesity are body mass index values of 25.0-29.9.0 and > 30.0, respectively (16). When assessing the nutritional status, it was found that among the surveyed main group, 25 surveyed men had obesity of the 2nd degree, in 10 patients of the 3rd degree, in the rest of the 1st degree. BMI was 32.2+1.10.

Hip circumference 109.8±0.66 cm; waist circumference 107.3±0.89cm, fat mass 89.1±1.06%. In the control group, overweight and obesity were not detected. The physical performance of the surveyed compared with the men of the control group was reduced. In the study of total protein and albumin in the blood, slight changes were revealed, that they corresponded to the norm, indicators of nitrogen metabolism (blood urea) were also normal. Indices of blood glucose, taken on an empty stomach in the morning, exceeded the permissible level by 2% -3% (in 13 men with grade 11 obesity).

The analysis of the diet revealed a number of features. So, on average, 68% of obese men violate the diet: four meals with a long interval (5-6 hours), high energy value of food taken in the evening up to 45-58% (of the total daily calorie content). 42% of the surveyed take food 1-2 hours before going to bed. Revealed low physical activity, prevailing food intake at night, the predominant carbohydrate nature of nutrition. In the control group, the diet is more established. Both the assortment list of products and the structure of nutrition had a fundamental difference on weekdays and weekends.

It should be noted that only 10 to 15% in both groups, 45% of men have an idea about rational nutrition. Wives are sources of information about healthy eating (in 52% of cases). Only 10-15% have sources such as the media and medical personnel. Only 22% of men (control group) could independently and objectively assess their diet.

One of the factors determining the development of obesity is physical activity, which plays a significant role in the formation and functioning of a healthy body. Among the surveyed, 35% of men from 40 to 50 years of age do light gymnastics in the morning (10 minutes). Men between 50 and 55 years of age did not exercise regularly. 65% of men aged 40 to 50 years of age, 80% of men aged 50 to 60 years of age after dinner are near the TV and watch television programs, movies, etc. 34% of men aged 40-50 during the day work about computer.

Thus, the analysis of the nutrition of obese men showed not only quantitative and qualitative inferiority, but also non-compliance with hygiene standards in almost all respects. A more pronounced imbalance of nutrients in their diet is a

significant risk factor for the development of functional disorders in men and requires mandatory correction.

CONCLUSIONS:

1. The diet of obese men is characterized by quantitative and qualitative inferiority. Actual nutrition is inadequate to energy costs in the direction of their excess, is characterized by a high level of consumption of animal fats and carbohydrates and is not fully adequate in terms of the content of vegetable fats, polysaccharides, fiber, a number of vitamins (A, E and C) and minerals.

2. The nutritional status of obese men is inadequate for age and gender norms: body mass index, waist and hip circumference are above normal.

3. The diet is disturbed in the form of irregular meals, eating late in the day, massive consumption of high-calorie foods: saturated animal fats, salt and sugar.

REFERENCES

1. Global strategy on diet, physical activity and health. Report of the WHO Expert Committee.- T., 2012.S.12-44.

2. Gardner D., Shobek D. Basic and clinical endocrinology. Book. 1. M: Binom 2010.

3. Goncharov N.P., Katsia G.V., Chagina N.A. Obesity and metabolic syndrome in middle-aged men: a comparative analysis of androgenic status, anthropometric parameters, lipid spectrum, carbohydrate metabolism parameters. Androl and genital hir 2007; 1:6-13.

4. Iskandarov T.I., Mamatkulov B.M. Sanitation-statistician ijtimoiy hygiene tadkikotlar uslublari. - Tashkent., 1994.-S.201-205.

5. Lyudinina A.Yu., Boyko E.R. Functional role of monounsaturated fatty acids. Advances in Physical Sciences 2013; 44:4:49-61.

6. Mamatkulov B. Basics of medical statistics (biostatistics). - Tashkent, - 2005.-143 pages

7. Norms of physiological needs of nutrients and energy for various groups of the population of Uzbekistan: SanPiN No. 0250-08. - T., 2008. - 38 p.

8. Osadchuk L.V., Gutorova N.V., Lyudinina A.Yu., Potolitsyna N.N., Boyko E.R. Changes in hormonal and metabolic status in men of the Komi ethnic group with overweight and obesity. Obesity and Metabolism 2013; 2:28-32.

9. Osadchuk L.V., Popova A.V., Tumanik O.V., Subotyalov M.A., Aizman R.I. Androgen deficiency in overweight and obese men. Probl repro 2012; 18:4:76-79.

10. Pankov Yu.A. Mutations in the genes of leptin and its mediators: induction of obesity in combination with various pathologies. Probl Endocrinol

2013; 2:49-59. Problems of human adaptation to the environmental and social conditions of the North. Ed. E.R. Boyko. St. Petersburg: Politekhnika-service 2009.

11. Average daily rational norms of food consumption by sex and age, professional groups of the population of Uzbekistan: Sanpin No. 0105-01. -T., 2001.-25s.

12. Chemical composition of food products: Handbook / Ed. Corresponding member MAI, prof. I. M. Skurikhina and acad. RAMN, prof. V. A. Tutelyan. - M.: Delhi print, 2002. - 236 p.

13. Chemical composition of food products. Book. 2. Reference tables. / under. ed. I. M. Skurikhina, M. N. Volgareva. - 2nd ed. – M.: Agropromizdat. 1987. - 360 p.

14. Shaykhova G.I., Rakhimov B.B. Improving the prevention of obesity in children and adolescents. // Monograph. // Lambert Academic Publishing RU-2017 .P.26-30.

15. Shaykhova G.I. Healthy nutrition as the most important component of a healthy lifestyle // Organization and management of health care. - 2013. - No. 12. - S. 42-47. Shaykhova G.I., Odilova B.T. What is a healthy diet and how to return to it // Organization and management of health care. - 2019. - No. 12. - S. 42-48.

16. Brand J. S., van der Tweel I., Grobbee D. E., Emmelot-Vonk M.H., van der Schouw Y. T. Testosterone, sex hormone-binding globulin and the metabolic syndrome: a systematic review and meta-analysis of observational studies. Int J Epidemiol 2011; 40; 189-207.

17. Cabler S., Agarwal A., Flint M., Du Plessis S.S. Obesity: modern man's fertility nemesis. Asian J Androl 2010; 12: 480-489.

18. Cunningham M.J., Clifton D.K., Steiner R.A. Leptin's actions on the reproductive axis: perspectives and mechanisms. Biol Reprod 1999; 60: 216-222.

19. Hakonsen L.B., Thulstrup A.M., Aggerholm A.S., Olsen J., Bonde J.P., Andersen C.Y., Bungum M., Ernst E.H., Hansen M.L., Ernst E.H., Ramlau-Hansen C.H. Does weight loss improve semen quality and reproductive hormones? Results from a cohort of severely obese men. Reprod Health 2011; 8: 24.

20. Klein-Platat C., Drai J., Oujaa M., Schlienger J.-L., Simon C. Plasma fatty acid composition is associated with the metabolic syndrome and low-grade inflammation in overweight adolescents. Am J Clin Nutr 2005; 82: 1178-1184.

21. Kupelian V., Hayes F.J., Link C.L., Rosen R., McKinlay J.B. Inverse association of testosterone and the metabolic syndrome in men is consistent across race and ethnic groups. J Clin Endocrinol Metabol 2008; 93: 3403-3410.

22. Meachem S.J., Nieschlag E., Simoni M. Inhibin B in male reproduction: pathophysiology and clinical relevance. Eur J Endocrinol 2001; 145: 561-571.

23. Palmer N.O., Bakos H.W., Fullston T., Lane M. Impact of obesity on male fertility, sperm function and molecular composition. Spermatogenesis 2012; 2: 4: 1-11.

24. Tchernof A., Després J.P. Pathophysiology of human visceral obesity: an update. Physiol Rev 2013; 93: 359-404.

25. Toth M.J., Tchernof A. Lipid metabolism in the elderly. Eur J Clin Nutr 2000; 54: 121-125.