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ASSESSMENT OF THE DIETARY ENERGY INTAKE OF YOUNG PEOPLE WITH NORMAL WEIGHT AND OVERWEIGHT

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The problem of weight gain and obesity with the formation of energy imbalance remains relevant especially among children and young people. The paper was aimed at determining the dietary energy intake of young people with normal weight and overweight and its compliance with energy needs. The study involved 84 male and female subjects aged 18-25. Height, body weight, waist circumference, and thighs circumference, and their ratio was determined. According to the body mass index (BMI), 22 women and 22 men (BMI 18.50-24.99 kg/m²) have been assigned to the control group and the group with overweight involved 20 men and 20 women (BMI 25.00-29.99 kg/m²). Nutritional status has been studied by the method of 24-hour nutrition reproduction by making records in the food diary during a weekday and weekend day. The value of the basal metabolic rate was calculated by the Mifflin-St Jeor equation. Was determined the recommended daily energy dietary intake maintains the existing body weight. The obtained data were processed statistically. The development of energy imbalance in people with overweight of both genders, a significant increase in the energy value of the dietary intake compared to controls and in comparison with the recommended daily energy intake has been established. The increase in energy value is accompanied by the altered structure of nutrients due to increased consumption of mainly fats by male subjects with overweight and fats and carbohydrates by female subjects compared to the controls. In men of the control group, the increase in energy value of the dietary intake relative to the recommended daily energy intake is less pronounced compared to subjects with overweight. Prolonged existence of the positive energy balance is the risk factor for the development of obesity and metabolic disorders.

Keywords: body mass index, overweight, energy value of dietary intake, energy metabolism, recommended daily dietary energy intake.

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Nutrition is essential for vital activity of the human body and is considered one of the most important factors determining its health, physical and psycho-emotional state. Over the last decade, the problem of high-calorie diet has increased significantly in Ukraine and worldwide, especially among children and young people [3, 5]. Reduce in physical activity due to technical progress and automation contributes to reduce in energy consumption, which in combination with excessive food consumption, disorder of the ratio of nutrients leads to energy imbalance, resulted in excessive energy substrates in the body, accumulated in the fat depot, which in turn leads to weight gain and obesity [14].

The formation of obesity is accompanied by the accumulation and activation of macrophages in the adipose tissue. Obesity activates pro-inflammatory M1 macrophages (classically activated), which stimulate leukocyte infiltration and reduces the fraction of M2 macrophages (alternatively activated) [1]. The phenotype of adipose tissue macrophages in obesity differs from the classical phenotype M1, since, along with the synthesis of proinflammatory cytokines, the profile of the superficial receptors is characteristic of the M2 phenotype. In normal-weight people, a subpopulation of M2 macrophages predominates, which secrete anti-inflammatory cytokines and use oxidative metabolism to maintain homeostasis of the adipose tissue [10].

Weight gain and obesity leads to the development of chronic systemic inflammation of low intensity, which contributes to the violation of the mechanisms of regulation of energy homeostasis [4]. The formation of a permanent energy imbalance is an unconditional trigger factor for the emergence of dangerous diseases in young age and adulthood. Notwithstanding numerous studies, the problem of energy imbalance with weight gain and obesity remains relevant to date; in recent years, an alarming increase in this pathology, especially among children and young people, has been noted.

The purpose of the paper was to determine the dietary energy intake of young people with normal weight and overweight and its compliance with energy needs.

Materials and methods. The study involved 84 male and female subjects aged 18-25. Informed consent was signed by each subject. The study was conducted with the permission of the Commission on Bioethics of the Ukrainian Medical Stomatological Academy. The anamnestic data of the subjects were recorded into the observation sheet.

Anthropometric measurements (height, body weight, waist circumference (WC) and thighs circumference (TC) and their ratio) were made. Body mass index (BMI) was calculated according to the equation: body weight (kg)/height (m²). According to the BMI, 22 women and 22 men (BMI 18.50-24.99

kg/m²) have been assigned to control group and the group with overweight involved 20 men and 20 women (BMI 25.00-29.99 kg/m²).

The assessment of the amount of consumed food was made using the 24-hour reproduction of nutrition with making records in the food diary during a weekday and weekend day [6]. The amount of consumed food with registration of the name of dishes and beverages, their composition, method of preparation, volume of liquid dishes was recorded. To determine the intervals between meals, the time and duration of intake, the last meal consumed before bedtime, was indicated. The volume of food was estimated using the album with photos of main dishes and beverages; the respondent chose the appropriate dishes. The nutrient content and energy value were determined using the tables.

The value of the basal metabolic rate (BMR) was calculated by the Mifflin-St Jeor equation [13]: for men: BMR = 10.0 × body weight (kg) + 6.25 × height (cm) – 5.0 × age (years) + 5; for women: BMR = 10.0 × body weight (kg) + 6.25 × height (cm) – 5.0 × age (years) – 161.

In addition, respondents answered the questions about the amount of physical activity per day, participation in sports clubs and sports activities on their own. The recommended daily energy dietary intake to maintain the existing body weight was calculated by the equation: Estimated Energy Requirement (EER) = BMR × PAC [12]; physical activity coefficient (PAC) of 1.2 corresponded to individuals leading the «sitting lifestyle».

The STATISTICA 10 software package (Stat Soft Inc, USA) was used for statistical processing of the resulting data. The arithmetic mean (M), its mean accuracy (m) was determined. Statistical significance was determined using the Student's t-test. The data was considered statistically significant at p<0.05.

Results of the study and their discussion. Anthropometric values have been determined in subjects of both groups, additionally divided by gender (table 1). Increase in the values of the body weight, BMI, WC, TC and WC/TC ratio by 26.85%, 25.13%, 17.52%, 11.65% and 5.0%, respectively, have been noted in men with overweight compared to controls (p<0.05). In women, the values of the body weight, BMI, WC and TC were by 23.53%, 25.66%, 16.67%, and 11.60%, respectively, higher compared to controls (p<0.05) (табл. 1).

Table 1

Anthropometric values of the subjects of the study groups (M±m)

Parameters	Men		Women	
	with normal body weight n=22	with overweight n=20	with normal body weight n=22	with overweight n=20
Age, years	19.50 ± 0.34	19.93 ± 0.44	19.27 ± 0.32	19.25 ± 0.34
Height, cm	1.77 ± 0.01	1.78 ± 0.01	1.69 ± 0.01	1.67 ± 0.01
Body weight, kg	68.31 ± 1.71	86.65 ± 1.24*	62.09 ± 1.00	76.70 ± 1.60*
BMI, kg/m ²	21.65 ± 0.32	27.09 ± 0.28*	21.71 ± 0.19	27.28 ± 0.23*
WC, cm	75.90 ± 1.19	89.20 ± 0.83*	69.90 ± 0.70	81.55 ± 0.93*
TC, cm	94.18 ± 0.95	105.15 ± 0.92*	96.59 ± 1.00	107.80 ± 0.97*
WC/TC ratio	0.80 ± 0.01	0.84 ± 0.01*	0.72 ± 0.01	0.75 ± 0.01

Notes herein after in tables 2-3: * – p<0.05 compared to individuals with normal body weight.

Anthropometric values in men and women with overweight were significantly higher compared to controls.

The method of 24-hour reproduction of nutrition has shown that during the weekday and weekend day the total mass of food consumed by men with overweight was significantly higher by 34.71% and 42.05%, respectively, compared to controls. On a working day and weekend day, the energy value of dietary intake of men with overweight was by 45.79% and 56.26%, respectively, higher compared to controls (p<0.05) (table 2).

Table 2

Daily dietary intake of the subjects of study groups (M±m)

Parameters	Men		Women	
	with normal body weight, n=22	with overweight n=20	with normal body weight, n=22	with overweight n=20
Energy value, kcal, weekday	2261.62±69.82	3297.11±89.04*	1270.73±63.52	2080.34±115.28*
Proteins, g, weekday	84.17±6.97	119.53±9.95*	54.34±4.60	82.70±7.44*
Fats, g, weekday	91.67±5.13	152.07±9.06*	49.82±4.23	84.90±7.17*
Carbohydrates, g, weekday	277.64±13.34	366.26±17.70*	150.53±11.30	244.99±16.61*
Energy value, kcal, weekend day	2465.42±52.08	3852.36±139.69*	1739.51±97.89	2788.41±163.58*
Proteins, g, weekend day	88.26±4.67	124.30±10.59*	70.62±5.67	91.46±9.52*
Fats, g, weekend day	98.68±5.90	167.61±13.39*	70.28±5.46	132.82±11.56*
Carbohydrates, g, weekend day	308.84±17.47	451.00±21.28*	207.16±16.04	296.98±19.90*

Differences in nutrition pattern have been identified. It has been established that on a weekday, men with overweight consumed protein, fat and carbohydrates by 42.01%, 65.89% and 31.92%, respectively, higher compared to controls ($p<0.05$). On a weekend day, consumption of proteins, fats and carbohydrates was by 40.83%, 69.85% and 43.03%, respectively, higher compared to controls ($p<0.05$) (table 2).

On a weekday and weekend day, the total mass of food consumed by women with overweight was significantly by 25.77% and 17.10%, respectively, higher compared to controls. On a weekday and weekend day, the energy value of dietary intake of women with overweight was by 63.71% and 60.29%, respectively, higher compared to controls ($p<0.05$) (table 2).

On a weekday, women with overweight consumed protein, fat and carbohydrates by 52.19%, 70.41% and 62.75%, respectively, higher compared to controls. On a weekend day, consumption of proteins, fats and carbohydrates was by 29.51%, 30.14% and 43.35%, respectively, higher compared to controls ($p<0.05$) (table 2).

The findings of the study have shown that the rates of the energy value of daily dietary intake and consumption of essential nutrients of subjects with overweight of both genders were significantly higher compared to subjects with normal body weight.

At the next stage, the value of the basal metabolic rate and recommended daily dietary energy intake has been determined. The analysis of the data on the amount of daily physical activity has shown that almost all respondents with normal weight and overweight led a passive lifestyle and were not involved in physical activities. Therefore, the coefficient of 1.2 was used when calculating the recommended daily dietary energy intake.

The comparison of the values of the basal metabolic rate has shown that in male and female subjects with overweight it was by 10.71% and 9.46%, respectively, higher compared to controls ($p<0.05$). The similar differences have been noted in the rates of recommended daily dietary energy intake (table 3).

Table 3

The value of the basal metabolic rate and recommended daily dietary energy intake in the subjects of the study groups (M±m)

Parameters	Men	
	with normal body weight n=22	with overweight n=20
The basal metabolic rate, kcal/day	1655.63±49.31	1832.87±59.58*
Recommended daily dietary energy intake, kcal/day	1986.75±59.17	2199.45±71.50*
Parameters	Women	
	with normal body weight n=22	with overweight n=20
The basal metabolic rate, kcal/day	1421.67±17.14	1556.13±24.46*
Recommended daily dietary energy intake, kcal/day	1706.00±21.00	1867.35±29.35*

The comparison of the recommended daily dietary energy intake and its actual intake by the subjects with normal weight and overweight on a weekday and a weekend day has been made to determine the presence of the energy imbalance (table 4).

Table 4

Comparison of the energy value of daily dietary intake and recommended daily dietary energy intake in the subjects of the study groups (M±m)

Parameters	Men		Women	
	with normal body weight, n=22	with overweight n=20	with normal body weight, n=22	with overweight n=20
Recommended daily dietary energy intake, kcal/day	1986.75±59.17	2199.45±71.50	1706.00±21.00	1867.35±29.35
Energy value, kcal weekday	2261.62±69.82*	3297.11±89.04*	1270.73±63.519	2080.34±115.28*
Energy value, kcal weekend day	2465.42±52.08*	3852.36±139.69*	1739.51±97.89	2788.41±163.58*

Notes: * - $p<0.05$ – compared between the energy value and recommended daily dietary energy intake

On weekend day and weekday, the energy value of dietary intake in men with normal body weight was by 13.84% and 24.09% ($p<0.05$), respectively, higher than recommended daily dietary energy intake (coefficient of physical activity = 1.2) (table 4).

On weekend day and weekday, the energy value of dietary intake in men with overweight was by 49.91% and 75.15% ($p<0.05$), respectively, higher than recommended daily dietary energy intake (table 4).

On weekend day and weekday, the energy value of dietary intake in women with overweight was by 11.41% and 49.32% ($p < 0.05$), respectively, higher than recommended daily dietary energy intake (coefficient of physical activity = 1.2) (table 4).

Thus, the findings of the study have shown a significant increase in the energy value of dietary intake in the overweight subjects of both genders compared to controls and in comparison with the recommended daily energy intake. The established increase in the energy value of the dietary intake relative to the recommended daily energy intake in men of the control group was less pronounced than in overweight subjects.

Current data show that even insignificant systematic increase in energy balance by 1-2% of daily energy consumption can lead to considerable long-term changes in body weight. It is believed that only 10-20 kcal per day of excessive energy consumption is enough to gain 0.5-1 kg per year by an adult with a deficit of its use. The programs of National Health and Nutrition Examination Survey (NHANES) report about significant increase in energy consumption along with the rapid increase of obesity in people of different age-groups [11].

The assessment of the nutritional status of the adult population of Ukraine in current socio-economic conditions showed an excess of energy value of dietary intakes in 38.4% of people. The increase in body mass index of rural population by 34.5% and urban population by 42.4% is noteworthy [7].

Our studies have shown that the energy value of the actual dietary intake in overweight subjects of both genders is significantly higher compared to controls and the recommended daily energy intake.

Notably, in male subjects with normal body weight, the energy value of the dietary intake on a weekday and weekend day significantly exceeded the recommended daily energy intake. Despite the fact that their positive energy balance was much lower than in subjects with overweight (13.84% vs. 49.90% on a weekday and 24.09% vs. 75.15% on a weekend day, respectively), the resulting data are worth considering. In our opinion, first of all young people should reconsider their lifestyle. Given that the level of physical activity of the subjects is very low, the long-term existence of a positive energy balance can lead to a gradual weight gain.

The comparison of the structure of nutrients in the daily dietary intake revealed differences between the groups with normal weight and overweight. Thus, in male subjects with overweight there was an increase in consumption of mostly fats on a weekday and weekend day and in females, mostly fats and carbohydrates, compared to controls.

The studies show that a diet high in carbohydrates or an increase in the percentage of total energy intake in the form of carbohydrates significantly increases the risk of obesity. The relationship between obesity and long-term consumption of food high in unrefined carbohydrates and fat has been established [15].

The study revealed non-rationed nutrition of subjects with overweight, unusual timing of food eating, failure to keep to intervals between the last meal and sleep.

Chernova N.N., et al (2017) report that up to 80% of students consume most of their food after 18:00 or just before bedtime, when the main caloric and substantial meal is consumed in the evening. This dietary pattern can lead to weight gain and contribute to the development of diseases of the gastrointestinal tract and endocrine system. Moreover, students' dietary intake consist of mainly products rich in carbohydrates and fats of animal origin with inadequate ratio of proteins, fats and carbohydrates [8].

It has been previously found that energy imbalance in young people is the key factor for the development of excess energy with accumulation in the fat depot and weight gain due to significant prevalence of the energy value of the dietary intake over energy expenditure, as well as other factors as eating disorders, changes in quality of life, increased basal metabolism, insulin resistance, changes in markers of chronic systemic inflammation and neuropeptides [9].

Our investigations also showed the negative impact of weight gain on the quality of life of young people with overweight, in particular, a decrease in physical functioning, role physical and emotional functioning, pain, general health and mental health in male subjects, as well as lower rates physical functioning, general health, pain intensity, viability, social and role emotional functioning, mental health and mental health component in female subjects [2].

Generally, the relationship between the accumulation of excess energy in the form of adipose tissue and low-intensity chronic inflammation can lead to the development of chronic diseases, accompanied by metabolic disorders, cardiovascular and endocrine disorders. Lifestyle changes, sufficient physical activity, correction of behavioral factors can reduce the level of chronic systemic inflammation, which is of great clinical importance [4].

Conclusion

The development of energy imbalance in people with overweight of both genders, a significant increase in the energy value of the dietary intake compared to controls and in comparison with the recommended daily energy intake has been established. The increase in energy value is accompanied by the altered structure of nutrients due to increased consumption of mainly fats by male subjects with overweight and fats and carbohydrates by female subjects compared to the controls. In men of the control group, the increase in energy value of the dietary intake relative to the recommended daily energy intake is less pronounced compared to subjects with overweight. Prolonged existence of the positive energy balance is the risk factor for the development of obesity and metabolic disorders.

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Реферат

**ОЦІНКА ЕНЕРГЕТИЧНОЇ ЦІННОСТІ
ХАРЧОВОГО РАЦІОНУ У ОСІБ МОЛОДОГО
ВІКУ З НОРМАЛЬНОЮ І ПІДВИЩЕНОЮ
МАСОЮ ТІЛА**

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Проблема підвищення маси тіла і ожиріння з формуванням енергетичного дисбалансу залишається актуальною особливо серед дітей і людей молодого віку. Метою нашого дослідження стало визначення енергетичної цінності харчового раціону у осіб молодого віку з нормальною і підвищеною масою тіла та її відповідності енергетичним потребам. Обстежено 84 особи обох статей віком від 18 до 25 років. Визначена маса тіла, зріст, обхват талії, стегон, їх співвідношення. За індексом маси тіла (ІМТ) сформовані групи: контрольна по 22 особи (ІМТ 18.50-24.99 кг/м²) і група з підвищеною масою по 20 осіб обох статей (ІМТ 25.00-29.99 кг/м²). Харчовий статус досліджували методом 24-годинного відтворення харчування із заповненням харчового щоденника за робочий і вихідний дні. Розраховували величину основного обміну енергії за формулою Міффіліна-Сан-Джеора та рекомендоване добове споживання енергії для підтримки існуючої маси тіла. Отримані дані оброблені статистично. Визначено достовірне підвищення енергетичної цінності харчового раціону у осіб обох статей з підвищеною масою тіла у

**ОЦЕНКА ЭНЕРГЕТИЧЕСКОЙ ЦЕННОСТИ
ПИЩЕВОГО РАЦИОНА У ЛИЦ МОЛОДОГО
ВОЗРАСТА С НОРМАЛЬНОЙ И ПОВЫШЕННОЙ
МАССОЙ ТЕЛА**

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Проблема повышения массы тела и ожирения с формированием энергетического дисбаланса остается актуальной особенно среди детей и людей молодого возраста. Целью нашего исследования стало определение энергетической ценности пищевого рациона у лиц молодого возраста с нормальной и повышенной массой тела и ее соответствия энергетическим потребностям. Обследовано 84 человека обоих полов в возрасте от 18 до 25 лет. Определена масса тела, рост, обхват талии, бедер, их соотношение. По индексу массы тела (ИМТ) сформированы группы: контрольная по 22 человека (ИМТ 18.50-24.99 кг/м²) и группа с повышенной массой по 20 человек обоих полов (ИМТ 25.00-29.99 кг/м²). Пищевой статус исследовали методом 24-часового воспроизведения питания с заполнением пищевого дневника за рабочий и выходной дни. Рассчитывали величину основного обмена энергии по формуле Миффлина-Сан-Джеора и рекомендованное суточное потребление энергии для поддержания существующей массы тела. Полученные данные обработаны статистически. Определено достоверное повышение энергетической ценности пищевого рациона у лиц обоего пола с повышенной массой тела по сравнению с

порівнянні з контрольною групою та при порівнянні з рекомендованим добовим споживанням енергії. Підвищення енергетичної цінності супроводжується зміною структури нутрієнтів за рахунок підвищеного споживання переважно жирів особами чоловічої статі з підвищеною масою тіла та жирів і вуглеводів особами жіночої статі у порівнянні з контрольною групою. У чоловіків контрольної групи підвищення енергетичної цінності харчового раціону відносно рекомендованого добового споживання енергії менш виражене, ніж у осіб з підвищеною масою тіла. Тривале існування позитивного енергетичного балансу є фактором ризику розвитку ожиріння і метаболічних порушень.

Ключові слова: індекс маси тіла, підвищена маса тіла, енергетична цінність харчового раціону, енергетичний обмін, рекомендоване добове споживання енергії.

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контрольної групою і при порівнянні з рекомендованим добовим споживанням енергії. Підвищення енергетичної цінності супроводжується зміною структури нутрієнтів за рахунок підвищеного споживання переважно жирів особами чоловічої статі з підвищеною масою тіла та жирів і вуглеводів особами жіночої статі у порівнянні з контрольною групою. У чоловіків контрольної групи підвищення енергетичної цінності харчового раціону відносно рекомендованого добового споживання енергії менш виражене, ніж у осіб з підвищеною масою тіла. Тривале існування позитивного енергетичного балансу є фактором ризику розвитку ожиріння і метаболічних порушень.

Ключевые слова: индекс массы тела, повышенная масса тела, энергетическая ценность пищевого рациона, энергетический обмен, рекомендованное суточное потребление энергии.

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MORBIDITY AND PREVALENCE OF THE NERVOUS SYSTEM DISEASES IN CHILDREN OF UKRAINE

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The article presents clinical and epidemiological data on the prevalence and incidence of the nervous system diseases (hereinafter – NSD) in all regions of Ukraine from 1993 to 2019. The incidence rates of NSD in children from regions with radiological control areas were higher than the nation-wide ones and the incidence rates in children from other regions by 15.9%. The incidence of NSD in children affected by the Chernobyl accident was higher than the nation-wide by 44.5%, which does not permit to exclude the direct and indirect effects of radiation. The results of our observations on the incidence of the NSD in children of Ukraine indicate that children suffered prolonged exposure to ecotoxic factors, including radiation, have higher levels of prevalence and morbidity of the NSD, which requires specialists' attention and effective medical and diagnostic measures.

Key words: children, disability, nervous system diseases, Chernobyl disaster.

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The problem of morbidity and prevalence of the NSD in children remains relevant worldwide due to the annual increase in disability due to this pathology and the social significance of this issue [4, 7, 10]. Significant advances in the diagnostics and treatment of the NSD, including those in the spheres of neurogenetics, neuropharmacology, neuroimmunology, molecular biology, studies of nervous system's metabolism, have significantly changed the views of scientists and practitioners about the effects of environmental factors on the development and functioning of nervous system. It has also led to a better understanding of the neurobiological basis for developmental delay, cerebral palsy (hereinafter – CP), autism and demyelinating diseases [11, 13, 14].

Thus, Yevtushenko SK. (2016) note that the detection of cerebrovascular pathology is spreading every year, including in children, which is associated with abnormalities and diseases of the cardiovascular system, diabetes, vasculitis and complications due to infectious diseases [3]. This thesis sounds more relevant than ever due to the rapid spread of COVID-19 in the world.

In Ukraine, over the past 25 years, the situation with the general morbidity of children, including NSD, has changed significantly due to the influence of a number of social and environmental factors [2, 8]. One reason of this kind was the accident at the Chernobyl nuclear power plant in 1986, which led to direct and indirect radiation exposure of more than 4 million people [8]. The extent of its environmental, medical and social impact on the health of the population and the life quality of victims and those living in contaminated areas is difficult to determine today [1, 6].

The WHO emphasizes that the quality of the environment is a direct and indirect factor that determines the level of human health, and the deterioration of the environment leads to a decrease in health and quality of life. It can also lead to more than 80 diseases and types of injuries [10, 12]. Research works