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The impact of exercise and diet on body composition and biochemical parameters of blood - a case study

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Abstract

Obesity is Jena of the most common diseases of civilization twenty-first century. Affects people of all ages, it carries a number of complications, not only in terms of physical and mental health. I estimate that obese people have a greater sociological problems, and the level of self-acceptance in

these individuals is much lower. Ways to deal with the problem of obesity are many, but one of the most effective physical activity is combined with diet. Epidemiological studies confirm the beneficial effect of physical activity to reduce the risk of obesity and its impact on the comprehensive treatment. Increasing energy expenditure affects not only the reduction of body fat. Regular physical activity increases muscle tissue and bone, and a decrease in resting and exercise blood pressure, pulse. Through physical activity, we are able to influence the lipid profile and glucose tolerance. Adaptation of physical activity should be an individual, it is recommended to increase daily physical activity for 30 minutes.

The unit training should increase energy expenditure by 300 - 400kcal. Coexistence of diseases in obesity is a major limiting factor for some physical activity, however, there are forms of relieving traffic using such a resistance. Exercises in water or a bike.

Objective: Effects of exercise and diet on body weight change in the composition and the results of biochemical blood.

Methods: Case study of women - 40 years, BMI 36.06, a man - 39 years, BMI 46.69, using the same physical activity and diet throughout the year. Used in the study of body composition, performed every month, and the results of biochemical blood made prior to physical activity after switching diets, and after a year.

Case study :To describe the changes in body composition under the influence of exercise and diet used a man and woman - marriage. The study lasted one year. Physical activity in both people was the same (frequency - 5 times a week). The diet consisted of the exclusion of sugar and fruits, junk food, highly processed foods. Eating regular meals. Both individuals are working as a sales representative. A woman born in 1976, 164 cm tall, 97 kg output. The man born in 1977, 178 cm tall 148kg weight output. In women, there were no chronic diseases in the male there is asthma and hypertension.

Results: For one year body composition has changed significantly. In women reported weight loss of 33kg, U man of 51 kg. Loss of body fat in women was 35 kg and 2 kg gain muscle mass.

One man, a decrease of 63 kg body fat to 16 kg and 4 kg increase in muscle mass. Blood biochemical parameters in both cases, have changed. Total cholesterol decreased in women with 288 mg / dl to 152 mg / dl in men with 325mg / dl to 157 mg / dl. In both sexes increased level of self-acceptance, mental health and general well-being. Additionally, in men increased capacity (FVC), and the blood pressure is normalized.

Conclusions: Physical activity and diet changes the composition of body weight. The combination of exercise and diet affect the results of biochemical blood, normalization of blood pressure and asthma. Physical activity and diet is the prevention of diabetes, hypertension. The elimination of sugars and fruits is an effective method to reduce body fat. Weight loss is not linear. Physical activity affects the growth of muscle tissue.

Key words: overweight, obesity, aerobics, exercises in water

INTRODUCTION

Long-term supply of excess energy products to the body causes changes in body mass composition. Excess products are deposited in the form of adipose tissue, thus causing the occurrence of overweight, which still leads to obesity [1] [24]. Obesity is classified in the IInternational Statistical Classification of Diseases and Related Health Problems as related to the disorder of internal secretion, nutritional status and metabolic transformation. One of the methods of treatment of overweight, which in turn turns into obesity is physical activity. It is estimated that the daily energy expenditure increased by 400kcal with consumption of 2100kcal helps to prevent the formation of an energy store in the form of adipose tissue [1].

Reducing physical activity through a sedentary lifestyle is not conducive to maintaining a correct energy balance. Our ancestors in the Paleolithic era had much more physical activity. The loss of energy associated with the movement is estimated to be 1000kcal per day when providing 3000kcl with food, which resulted in a 1: 3 ratio in favor of energy from food [2].

Currently, this ratio is 1: 7. Performing aerobic physical exercises for approx. 45-60 minutes, we are able to increase the energy expenditure by about 300-400 kcal. According to Saris [1]

In the era of automation, I assume that a modern man expends 300 kcal of daily physical activity, and delivers 2100 kcal with meals.

The daily increase in activity by 400 kcal helps to compensate for the difference in the energy balance. 400 kcal per day, gives us 146000 kcal per year, which corresponds to 25,000 minutes (417 h) of a medium intensity run for a man weighing 80kg.

REVIEW OF THE LITERATURE

Epidemiological research NHANES-1, First National Health and Nutrition Evaluation Survey; MRFIT, Multiple Risk Factor Intervention Trial) confirm the influence of the decrease in physical activity in the development of obesity. Computerization, automation and industrial development have significantly reduced daily physical activity [3].

The obesity growth curve in 1970-1990 is parallel to the growth curve of car sales and time spent in front of the TV.[2]

Increased body mass restricts physical activity, which results in a vicious circle effect

CARDIA coronary artery risk deve lopment in young adults) shows the relationship between increased physical activity and weight loss. Wilmor, by making a meta-analysis of 53 works describing the effect of activity on body mass without changing the diet, noted that the 6-month period of increased activity causes a decrease in fat mass by about 2.6 kg and an increase in muscle mass by 1 kg [4] .

The analysis of 29 randomized trials concerning the use of diet and physical activity in the treatment of obesity, indicates that the combination of physical activity and diet are more effective than using only one of the methods of weight reduction. Noteworthy is also the fact that people who do not exercise after the finished diet do not get such good results than those exercising. It can therefore be concluded that physical activity is essential in the treatment of obesity [4].

THE INFLUENCE OF ACTIVITY ON HUMAN

Physical activity affects all systems in the human body. Increasing physical activity affects not only the body weight and its composition. Increasing energy expenditure affects all systems in the human body [2,3,4].

Under the influence of physical effort, we regulate the processes occurring in our tissues. We influence the nutrition and oxygenation of every cell in the body [5,6]

CIRCULATORY SYSTEM

The primary measurable effect of effort on the cardiovascular system is the release of resting heart rate. Research shows that an adult's heart beats at 72 beats per minute. For those who train - who engage in physical activity - the resting heart rate is below 60 beats per minute [6,7].

The ejection volume (SV) and minute capacity (CO) reflect the functional status of the heart. At rest, a person who regularly undertakes physical activity obtains better parameters. I assume that in an adult person, the ejection volume is 70-80ml, and in the athlete 100ml. During exercise, this volume increases in trained to 150ml, while in non-trained only to 100ml [8,9,10].

Another important factor is the blood pressure values. Regular decrease in systolic and diastolic pressure is seen in people regularly exercising physical activity compared to people who do not systematically engage in physical activity [7,10,11]

BONE STRUCTURE

Regular physical activity affects the functional and anatomical changes in skeletal muscles and the skeletal system. Systematic activity improves neuromuscular coordination, which affects the harmoniousness of precision and speed of movement. This results in a reduction of the energy cost of the work being done. Unfortunately, I am forced to increase physical activity to perform the same energy expenditure [12].

The effort increases the strength obtained during any muscle contraction. This is influenced by the increase in individual muscle fibers and the stimulation of more motor units. Increased muscle mass occurs in the course of protein synthesis in muscle cells[12].

In people undertaking activities, the strengthening of muscles responsible for maintaining a correct body posture is noticed, which has a positive effect on preventing the occurrence of faulty attitudes.

It is also important that under the outflow of systematic exercises, the mass of bone tissue increases and the degree of mineralization of it, which affects the prevention of osteoporosis [12,13].

RESPIRATORY SYSTEM

In persons undertaking systematic physical activity, positive changes in the respiratory system can be observed, such as:

- Increased vital capacity of the lungs (VC) - has (it is associated with greater mobility of the chest and greater strength of the respiratory muscles.)
- Functional retention space (FRC) is reduced in favor of vital capacity, so overall lung ventilation capacity (TCL) is unchanged [14,15].

Maximum lung ventilation in people regularly exercising increases during maximal efforts reaching 180l / min, while in non-active people is 100 l/m in men and 80 l/min in women. The sedentary lifestyle is not conducive to the flow through the lung segments of the lungs. Higher flow in these segments is observed in trained people, it affects the beneficial ratio of follicular ventilation to capillary blood flow through the lungs [8,9,10,15,16]. Hyperventilation occurs in people regularly exercising physical activity at higher loads, which affects the appearance of feelings of tiredness and breathlessness during day activities such as going up the stairs with shopping.

BLOOD BLOOD BIOCHEMISTRY

Along with the increase in training, the amount of the carrier factor for oxygen or blood increases. This increase is estimated at 15-20%.

Physical effort also affects the lipid components of the plasma:

- total cholesterol contained in the low density lipoprotein fraction (LDL) and cholesterol contained in the high density lipoprotein fraction (HDL)
- triglycerides [17,18,19]

Regular training causes an increase in cholesterol in the HDL fraction and a reduction in the LDL fraction. Under the influence of effort, the synthesis of cholesterol and triglycerides in the liver and other tissues is reduced. There is also an increase in lipoprotein lipase enzyme activity.

The growth of HDL lipoproteins protects blood vessels against the cholesterol fractions on their walls, which is beneficial for antiatherosclerotic processes, protecting against coronary heart disease [7,8,10,15,20].

ENDOCRINE SYSTEM

Regular activity decreases the stress-induced activation of the sympathetic-adrenal system, which reduces the secretion of adrenaline and norepinephrine during exercise.

The reduction in the secretion of catecholamines results in a reduction of the cardiovascular response to exercise without impairing exercise. Systematic physical effort also affects the endocrine glands. Insulin secretion is reduced by the pancreas, glucose tolerance in tissues increases. This indicates an increase in the sensitivity of the tissues of a person training for insulin, as well as increased insulin binding by insulin receptors of trained persons, and tissue sensitivity to this hormone. This effect appears in both high-speed and strength endurance efforts[6,7,20].

IMMUNOLOGICAL REACTIONS

Physical activity has a beneficial effect on the immune system. The risk of developing an infection of the upper respiratory tract has people who do not undertake physical activity[21,22,23,24].

However, overloading with training can affect the weakening of the immune system. Studies in people participating in recreational type physical activity did not show any significant changes in the white blood cell pattern [25,26,27,28]. The increase in the number of T lymphocytes, C lymphocytes and immune proteins was statistically insignificant. The results of the study confirmed the hypothesis that moderate systematic effort leads to an increase in immunity, while too intensive, and therefore not regular, may cause a decrease in immunity.

SANITY

Systemic endorphins are secreted. [29,30] The compounds produced by the pituitary stimulate the brain to feel happiness and inhibit the sensation of pain. Thanks to endorphins, we become addicted to activity. Serotonin secreted during exercise makes our sleep effective. It also has a positive effect on learning and concentration. Dopamine synthesized during you that affects the reduction of hunger [31,32].

OBJECTIVE

The aim of the study was to determine the impact of a systematic physical exercise lasting a year with a frequency of 5 times a week with the use of a diet with the restriction of polysaccharides, the elimination of simple sugars to change the composition of body weight and blood biochemical results.

MATERIAL AND METHODS

A case study of a woman and a man using the same physical activity and diet throughout the year. Bioelectric impedance, also called biomedical bioimpedance (BIA, bioelectrical impedance analysis), was used for the study. The BIA test consists in measuring the impedance (ie the type of electrical resistance consisting of the resistance and reactance) of the tissues through which the low-current (1 mA) current is passed. The phenomenon of resistance is related to the specific resistance of individual tissues, while the reactance is mainly due to the electrical capacity of cell membranes, which due to their structure act as capacitors.

The electrical properties of tissues have been known for almost a century and a half - Hermann wrote about them in 1871 [21]. In the middle of the twentieth century, Barnett [23] wrote about the relation of bioelectrical impedance measurements with total body water, followed by Thomasset [21] using two subcutaneous electrodes, and later Hoffer et al. [24] who used four electrodes placed on the surface skin. In the 1970s, Nyboer and colleagues [21] began pioneering research in the field of impedance plethysmography, in which they pointed to the relationship between changes in the impedance of the human body with changes in pulsatile blood flow in organs, arterial pulse and breathing.

The study was divided into two stages. Change of activity and diet occurred after 4 months from the beginning of the study.

CAUSE STUDY

To describe the change in the composition of body weight under the influence of physical effort and diet, a woman and a man were used - a couple who exercised the same physical activity with the same frequency within a year - 5 times a week. They consumed the same meals, they do the same kind of work - a sales representative.

Woman born in 1976, 164 cm. At the start of the test, the impedance measurement showed:

- weight 97 kg,
- muscle mass 28.8 kg,
- fat mass 46.2 kg

The biochemical results of the blood prior to accession were: Cholesterol total 288mg/dl.

The level of self-acceptance was measured by the scale of the SES Morale Self-esteem by Morris Rosenberg, yielding the value of 14 points where this is assessed as a lack of acceptance.

A man born in 1977, 178 cm tall.

The study of body mass composition before the study showed:

- weight 148kg,
- muscle mass 45kg,
- fat mass 63kg.

Blood chemistry results: Total cholesterol: 325 mg / dl.

The man was additionally suffering from asthma. Before the test, the results of spirometry:

FEV-3.82, 94%

FVC-4.97, 101%

PEF-578, 102%

FEV1 / FVC-77, 96%

FEF50-3,74, 72%

The level of self-acceptance according to the aforementioned scale was 18 points, which suggests the lack of self-acceptance.

In the period between September and December, physical activity was included in the relief using an aquatic environment. The water temperature used for the test was 24-28 degrees. Exercises were carried out under the control of pulse oximeters, where the exercisers were well cared for to keep the heart rate within 65-75% of the maximum heart rate during the training unit. Exercisers were used for exercises, such as abdominal belts and devices that give resistance, ie sponge dumbbells

In the first phase of the study, the diet was based on the introduction of 5 meals at regular times and the elimination of simple sugars - without fruit.

In the second stage, where a significant improvement in body weight composition results, physical activity against gravity without weight relief was included, and diet modification consisting in limiting fructose to 15 grams per day (corresponding to e.g. 150g of apple or 120 grams of banana), limiting complex carbohydrates to 100g per day (corresponding to e.g. 300 grams of pasta). The other elements of the diet have not changed from the first stage.

Attachable physical activity was of strength, speed and strength.

The frequency was 5 times a week

- Monday - training in water,
- Tuesday - strength training and water training,
- Wednesday - day of regeneration,
- Thursday - endurance workout in water,
- Friday - training in water,
- Saturday day of regeneration,
- Sunday - speed training and training in water.

Intermediate heart rate measurement using the heart rate monitor was further used. However, they were already working on the thresholds of aerobic and anaerobic muscle work. HR <75% and >75% max. Exercise load was selected individually depending on the heart rate.

RESULTS

After a year, the composition of body mass changed significantly. In the woman there was a weight loss of 33 kg, a man by 51 kg.

Month	Wight	Muscular mass	Fat mass	WHR
September	148	43	63	1,1
Nowember	135,5	44,8	52,2	1,08
November	120,9	44,4	43,1	1,03
December	113,6	43,1	38,3	1,02
Januar	110,5	43,2	33,2	1,02
February	106,8	43,8	30,5	0,98
March	106	43,8	29,8	0,97
April	105,5	43,7	29,2	0,97
May	99,3	44,5	23,6	0,97
June	93,7	45,2	17,2	0,95
July	93,5	46,2	17,1	0,95
August	93,5	47	16,4	0,94

Table. 1: Changes in the body mass composition in individual months with the WHR index (waist-hip).

According to the results of body composition, the loss of fat in a woman was 35 kg and the increase in muscle tissue by 2 kg.

In men, there was a decrease from 63 kg of adipose tissue to 16 kg and an increase of 4 kg in muscle mass. The biochemical parameters of the blood in both cases have changed significantly. The total cholesterol in a woman decreased from 288 mg/dl, to 152 mg/dl, in a man from 325mg/dl to 157 mg/dl.

	28 AGUST 2015	13 MAY 2016
FEV	3,82, 94%	4,39, 109%
FVC	4,97, 101%	5,59, 114%
PEF	578, 102%	602, 107%
FEV1/FVC	77, 96%	79, 98 %
FEF50	3,74, 72%	4,42, 85 %

Table. 2: Changes in spirometric parameters of men's months.

Month	Wight	Muscular mass	Fat mass	WHR
September	97	28,8	46,2	1,1
Nowember	90,7	29,1	39,2	1,08
November	81,9	29	29,9	1,03
December	76,7	28,3	26,1	1,02
Januar	74,2	28,5	23,1	1,02
February	72,5	28,7	21	0,98
March	71,9	29,5	18,2	0,97
April	71,6	30,2	17,8	0,97
May	68,4	30,1	14,8	0,97
June	66,1	30,4	12	0,95
July	65,5	30,8	10,7	9,95
August	64,7	30,8	10,2	0,94

Table 3: Changes in the composition of body mass in individual months in a woman with the WHR index (waist-hip).

In both sexes there was an improvement in mental health. Using the same scale, a woman scored 39 points out of 12 points. The man has an increase to 40 points from 18 points. Which means full self-acceptance in both cases. In addition, men increased spit capacity (increased vital capacity -FVC), and arterial blood pressure normalized.

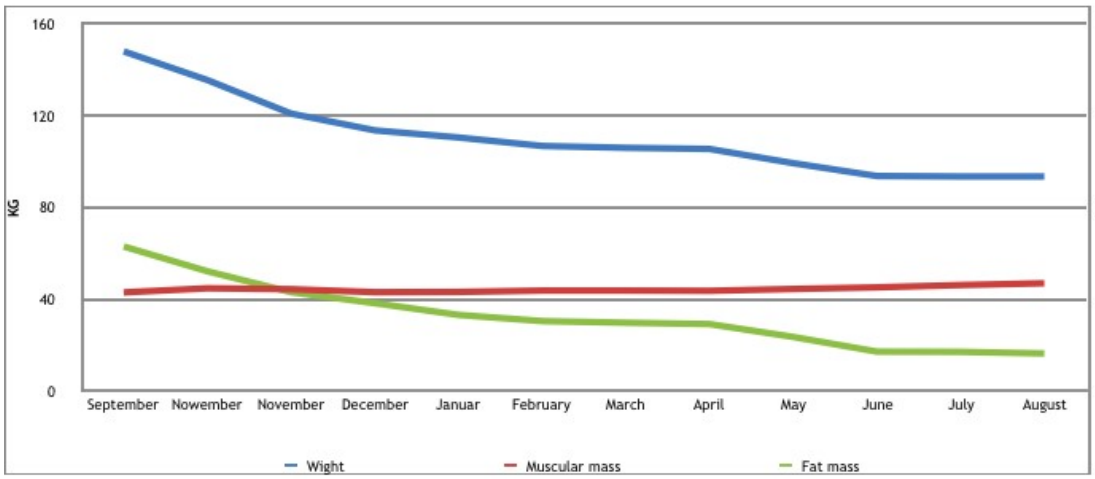

Diagram 1. Changes in weight composition during the year in a man.

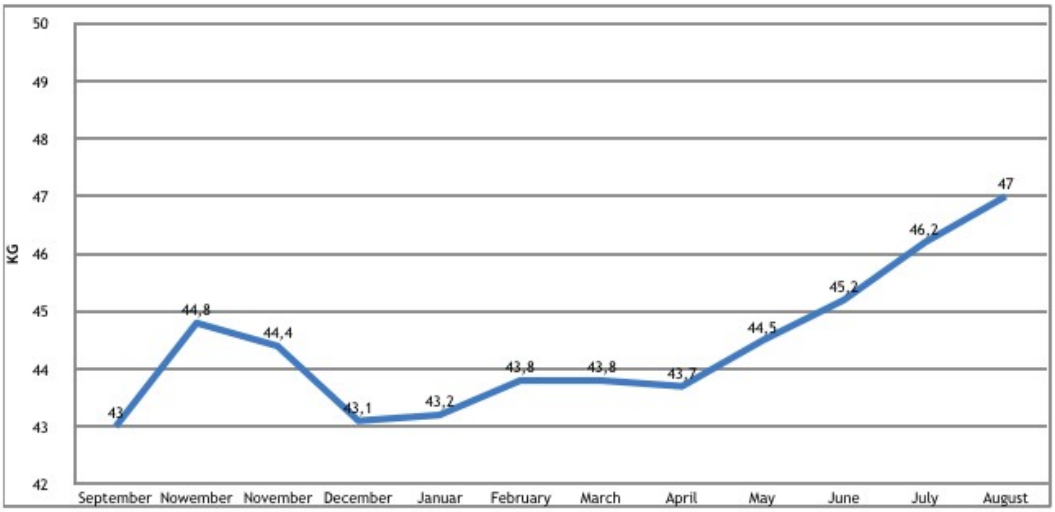

Diagram. 2: Changes in the value of muscle tissue in a man during the year.

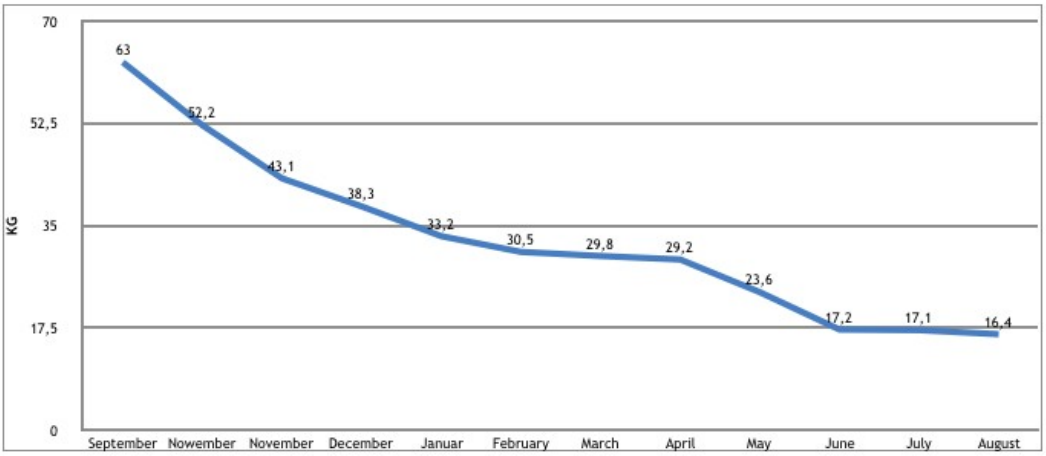

Diagram. 3: Changes in the value of adipose tissue in a man during the year.

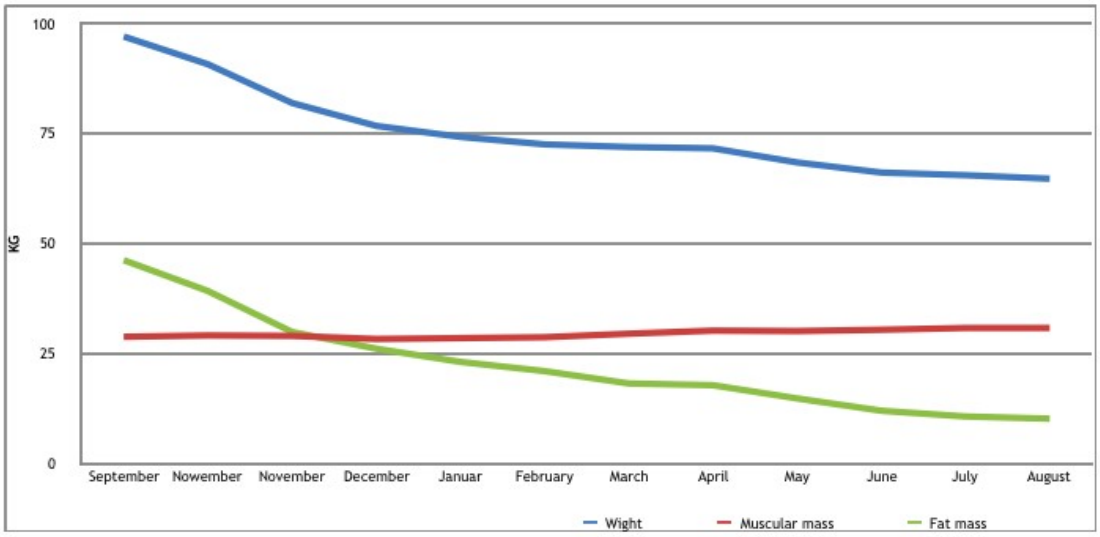

Diagram 4:Changes in weight composition during the year in a woman.

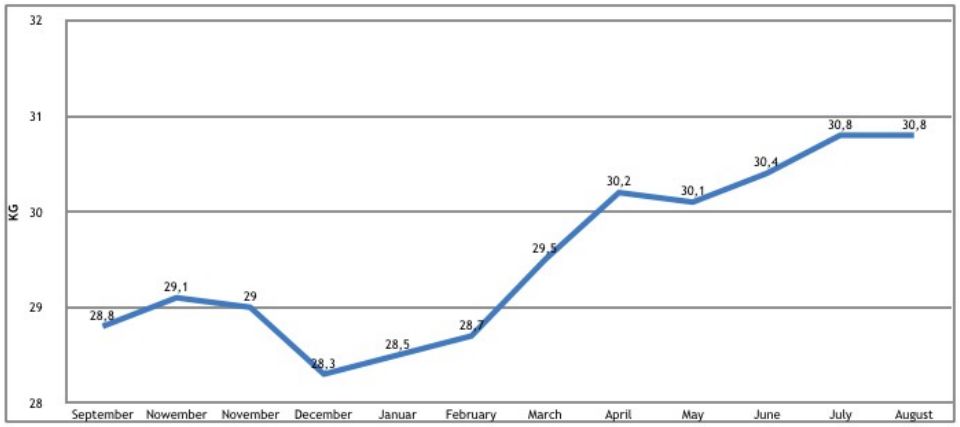

Diagram 5: Changes in the value of muscle tissue in a woman during the year.

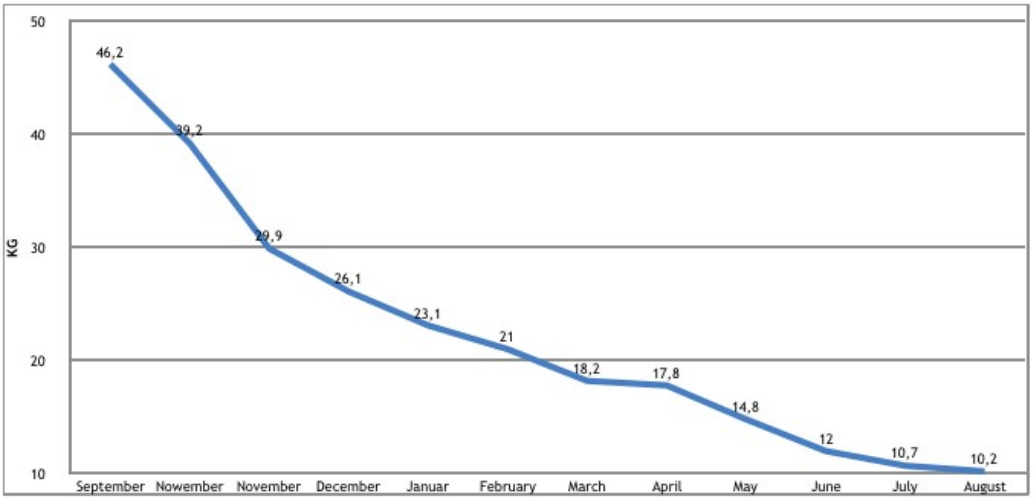

Diagram. 6: Changes in the value of adipose tissue in a woman during the year.

CONCLUSIONS:

Physical activity and diet affect the composition of body mass The combination of physical exercise and diet affects blood biochemistry, normalizing blood pressure and increasing spit vital capacity. Physical activity and diet is the prevention of diabetes, hypertension. The elimination of simple sugars in this fruit is an effective method in reducing body fat. Weight loss is not linear and depends on the initial amount of fat and sex. The decrease in weight and fat mass is convergent.

Physical activity affects the growth of muscle tissue.

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