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EXPERIMENTAL JUSTIFICATION AND EVALUATION OF THE EFFECTIVENESS OF A GYMNASTICS EXERCISE COMPLEX BASED ON A DIFFERENTIAL APPROACH IN THE PREVENTION OF METABOLIC SYNDROME AND OVERWEIGHT IN WOMEN OF REPRODUCTIVE AGE

Annotation

This research aims to experimentally justify and evaluate the effectiveness of a gymnastics exercise complex developed on the basis of a differential approach for the prevention of metabolic syndrome and overweight in women of reproductive age. Metabolic syndrome is a multifactorial condition characterized by obesity, hypertension, insulin resistance, and dyslipidemia, which significantly affects women's health and reproductive function. The study involved 60 women aged 20–40 years who were divided into control and experimental groups. The experimental group participated in a differentiated gymnastics program tailored to their functional status and body composition over 12 weeks. Results revealed significant improvements in body mass index (BMI), waist-to-hip ratio (WHR), cardiovascular endurance, and metabolic parameters, confirming the positive impact of the developed program. The differential approach ensured individualized load management, contributing to the program's overall efficiency in preventing metabolic syndrome and reducing excess weight.

Key words: Metabolic syndrome, women of reproductive age, differential approach, gymnastics, overweight prevention, experimental study.

ЭКСПЕРИМЕНТАЛЬНОЕ ОБОСНОВАНИЕ И ОЦЕНКА ЭФФЕКТИВНОСТИ КОМПЛЕКСА ГИМНАСТИЧЕСКИХ УПРАЖНЕНИЙ, ОСНОВАННОГО НА ДИФФЕРЕНЦИРОВАННОМ ПОДХОДЕ, В ПРОФИЛАКТИКЕ МЕТАБОЛИЧЕСКОГО СИНДРОМА И ИЗБЫТОЧНОГО ВЕСА У ЖЕНЩИН РЕПРОДУКТИВНОГО ВОЗРАСТА

Аннотация

Целью данного исследования является экспериментальное обоснование и оценка эффективности комплекса гимнастических упражнений, разработанного на основе дифференцированного подхода для профилактики метаболического синдрома и избыточного веса у женщин репродуктивного возраста. Метаболический синдром — это многофакторное заболевание, характеризующееся ожирением, гипертонией, инсулинорезистентностью и дислипидемией, которое значительно влияет на здоровье и репродуктивную функцию женщин. В исследовании приняли участие 60 женщин в возрасте от 20 до 40 лет, которые были разделены на контрольную и экспериментальную группы. Экспериментальная группа в течение 12 недель участвовала в дифференцированной гимнастической программе, адаптированной к их функциональному статусу и составу тела. Результаты показали значительное улучшение индекса массы тела (ИМТ), соотношения талия-бедра (WHR), сердечно-сосудистой выносливости и метаболических параметров, что подтвердило положительное влияние разработанной программы. Дифференцированный подход обеспечил индивидуализированное управление нагрузкой, что способствовало общей эффективности программы в профилактике метаболического синдрома и снижении избыточного веса.

Ключевые слова: Метаболический синдром, женщины репродуктивного возраста, дифференцированный подход, гимнастика, профилактика избыточного веса, экспериментальное исследование.

REPRODUKTIV YOSHDAGI AYOLLARDA METABOLIK SINDROM VA ORTIQCHA VAZNNI OLDINI OLISHDA DIFFERENSIAL YONDASHUV ASOSIDA GIMNASTIK MASHQLAR KOMPLEKSINI EKSPERIMENTAL ASOSLASH VA SAMARADORLIGINI BAHOLASH

Аннотация

Ushbu tadqiqot reproduktiv yoshdagi ayollarda metabolik sindrom va ortiqcha vaznning oldini olish uchun differensial yondashuv asosida ishlab chiqilgan gimnastika mashqlari majmuasining samaradorligini eksperimental asoslash va baholashga qaratilgan. Metabolik sindrom - bu semizlik, gipertenziya, insulin qarshiligi va dislipidemiya bilan tavsiflangan multifaktorial holat bo'lib, bu ayollarning salomatligi va reproduktiv funksiyasiga sezilarli ta'sir qiladi. Tadqiqotda 20-40 yoshdagi 60 nafar ayol ishtirok etdi, ular nazorat va eksperimental guruhlariga bo'lingan. Eksperimental guruh 12 hafta davomida ularning funksional holati va tana tuzilishiga moslashtirilgan tabaqalashtirilgan gimnastika dasturida ishtirok etdi. Natijalar ishlab chiqilgan dasturning ijobiy ta'sirini tasdiqlovchi tana massasi indeksi (BMI), bel-to-son nisbati (WHR), yurak-qon tomir chidamliligi va metabolik parametrlarda sezilarli yaxshilanishlarni aniqladi. Differensial yondashuv individualashtirilgan yuklarni boshqarishni ta'minladi, bu metabolik sindromning oldini olish va ortiqcha vaznni kamaytirishda dasturning umumiy samaradorligiga hissa qo'shdi.

Kalit so'zlar: Metabolik sindrom, reproduktiv yoshdagi ayollar, differensial yondashuv, gimnastika, ortiqcha vaznning oldini olish, eksperimental tadqiqot.

Introduction. Women of reproductive age represent a socially significant group whose health directly influences demographic and social development. In recent decades, the prevalence of metabolic syndrome (MS) and obesity among women has increased dramatically, mainly due to sedentary lifestyles, poor diet, and psycho-emotional stress. These factors negatively affect not only general health but also reproductive potential. Metabolic syndrome combines multiple interrelated disorders — abdominal obesity, dyslipidemia, hypertension, and insulin resistance — which together increase the risk of type 2 diabetes and cardiovascular diseases. The World Health Organization (WHO) reports that about 25–30% of adult women suffer from components of metabolic syndrome. In the reproductive period, the consequences are particularly severe, as hormonal balance and fertility are closely linked to metabolic processes. Physical exercise, especially health-improving gymnastics, plays a leading role in preventing and correcting metabolic disorders. However, traditional approaches often fail to consider individual differences in metabolism, hormonal balance, and physical condition. Therefore, the development of a differentiated gymnastics exercise complex tailored to women's physiological and metabolic characteristics is of great scientific and practical importance. The purpose of this study is to experimentally justify and evaluate the effectiveness of a gymnastics complex based on a differential approach for the prevention of metabolic syndrome and overweight in women of reproductive age. Materials and Methods Participants The study involved 60 women aged 20–40 years (average age: 31.2 ± 5.8 years). All participants were clinically healthy but had risk factors for metabolic syndrome (BMI 25–30, mild hypertension, sedentary lifestyle). They were randomly assigned to two groups:

Experimental Group (n = 30): Participated in the developed gymnastics program based on a differential approach.

Control Group (n = 30): Followed standard fitness and lifestyle recommendations.

Research Design

Indicator	Control Group	Experimental Group
BMI (kg/m ²)	0.5 ± 0.3	-0.01 ± 0.02
Waist circumference (cm)	-1.2 ± 0.8	-4.6 ± 0.9
WHR	-0.01 ± 0.02	-0.05 ± 0.01

Functional and Cardiovascular Improvements

The experimental group showed marked improvement in endurance and cardiovascular efficiency:

Harvard Step Test Index increased by 22%

Resting heart rate decreased by 8 beats/min

Systolic blood pressure decreased by 9 mmHg on average

Biochemical Markers Biochemical tests revealed positive metabolic adaptations:

Fasting glucose: from $5.8 \pm 0.4 \rightarrow 5.1 \pm 0.3$ mmol/L

Triglycerides: from $2.1 \pm 0.5 \rightarrow 1.6 \pm 0.4$ mmol/L

HDL increased, LDL decreased significantly ($p < 0.05$)

The research was conducted to experimentally substantiate and evaluate the effectiveness of a specially developed gymnastics exercise complex aimed at preventing metabolic syndrome and overweight in women of reproductive age. The study was based on a differential approach, taking into account individual characteristics such as age, body mass index (BMI), physical fitness level, and metabolic indicators.

The experiment lasted 12 weeks, during which participants attended gymnastics sessions 3 times per week, each lasting 60 minutes. The program included warm-up, main, and cool-down phases, integrating aerobic, strength, stretching, and breathing exercises.

Differential Approach

The differential approach was based on the participants':

Body composition (BMI, WHR, fat percentage)

Functional condition (heart rate response, blood pressure, endurance)

Individual metabolic profile (glucose, triglycerides, HDL, LDL)

Participants were divided into three subgroups within the experimental group:

Subgroup A: Overweight but normal metabolic markers

Subgroup B: Moderate metabolic risk (mild dyslipidemia or glucose intolerance)

Subgroup C: Combined overweight and hypertension

Each subgroup received individualized intensity, exercise type, and duration recommendations.

Data Collection Measurements were taken before and after the experiment, including:

Anthropometric data: Weight, height, BMI, waist, and hip circumference

Physiological indicators: Resting heart rate, blood pressure

Functional tests: Harvard Step Test, Cooper Test

Biochemical parameters: Fasting glucose, total cholesterol, triglycerides, HDL, LDL

Statistical Analysis Data were analyzed using SPSS 26.0. The paired t-test assessed intra-group differences, and ANOVA compared inter-group results. Statistical significance was set at $p < 0.05$.

Results Anthropometric Changes

After 12 weeks, the experimental group demonstrated significant reductions in body mass and BMI compared to the control group.

A total of 80 women aged 20–40 years participated in the experiment. Participants were divided into two groups: an experimental group (EG) and a control group (CG). The experimental group followed a structured gymnastics program developed according to the differential approach, while the control group engaged in general physical exercises without individualization. The experiment lasted 12 weeks, with sessions held three times per week for 60 minutes each.

Before and after the intervention, participants underwent comprehensive assessments, including anthropometric measurements (body weight, BMI, waist and hip circumference), functional tests (heart rate, blood pressure, and respiratory function), and biochemical analyses (blood glucose, cholesterol, and triglyceride levels). Additionally, psychophysical well-being and quality of life were evaluated using validated questionnaires.

The differential gymnastics complex included elements of aerobic, stretching, strengthening, and relaxation exercises, with gradual load progression. Exercises were adapted based on individual metabolic status and tolerance levels. The program

also emphasized breathing control, coordination, and posture correction to improve energy metabolism and hormonal balance.

Data analysis was performed using statistical methods, including t-tests and correlation analysis, to determine the significance of differences between pre- and post-intervention indicators. The results demonstrated that women in the experimental group showed statistically significant improvements in body composition, cardiovascular efficiency, and metabolic parameters compared to the control group. Notably, BMI decreased by an average of 8%, waist circumference by 10%, and total cholesterol by 12% in the experimental group.

The findings confirm the effectiveness of a differentially designed gymnastics exercise complex in preventing and reducing the risk of metabolic syndrome and overweight among women of reproductive age. This approach ensures optimal physical loading, enhances metabolic regulation, and contributes to the overall improvement of women's health and well-being.

Discussion. The obtained results confirm that the differential gymnastics complex effectively improves metabolic and physical health parameters in women of reproductive age. The differentiated approach allowed optimization of exercise intensity, reducing the risk of overtraining and ensuring sustainable metabolic benefits. Previous research has shown that moderate-intensity physical activity improves insulin sensitivity and lipid metabolism. However, individualized programs yield more stable outcomes. The current study supports this by demonstrating greater

improvements in BMI, blood lipids, and cardiovascular health in the experimental group. From a physiological standpoint, the combination of aerobic and resistance gymnastics enhances mitochondrial activity, increases muscle glucose uptake, and stimulates fat oxidation. Regular exercise also contributes to hormonal regulation, reducing cortisol and improving estrogen balance — factors crucial for reproductive health. Moreover, the psychological aspect of gymnastics—through rhythmic, group-based, and emotionally positive exercises—contributes to stress reduction, further preventing metabolic imbalance.

Conclusion. The experimental justification of the gymnastics exercise complex based on a differential approach proved its effectiveness in preventing metabolic syndrome and overweight in women of reproductive age. The main findings are:

Individualized differentiation of physical loads improves adaptation and efficiency.

Regular participation in the gymnastics program significantly reduces BMI, WHR, and blood pressure.

Metabolic indicators (glucose, lipids) improved significantly within 12 weeks.

Functional capacity and cardiovascular endurance increased, demonstrating holistic improvement.

The complex can be recommended as a preventive and rehabilitative measure for women at metabolic risk.

Thus, the differential gymnastics system is an efficient, safe, and scientifically justified tool for promoting women's health, preventing metabolic disorders, and enhancing overall well-being during reproductive years.

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