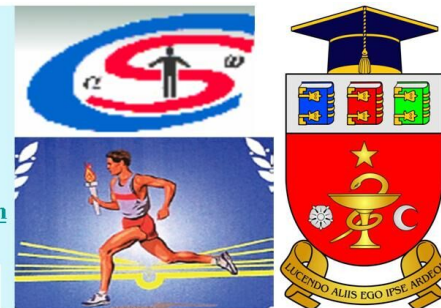


REDUCTION OF LIPOTOXIC AND CARCINOGENIC IMPACTS OF ADIPOSE TISSUE BY APPLICATION OF A COMBINED PHYSICAL TRAINING AND DIET

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INTRODUCTION: The modern lifestyle, based on a person's stay, mainly in a sitting position, while consuming hedonic food with a high carbohydrate, lipid and protein index, dramatically affects the ratio of adipose and muscle tissues in the body. Excessive reservation of adipose tissue contributes to the deepening of metabolic shifts in key organs and tissues, including adipose tissue, liver and skeletal muscle, exhibiting lipotoxicity and the effect of increasing insulin resistance of skeletal muscles. The proportion of muscle mass in healthy subjects decreases with age, which can often lead to a decrease in physical performance and a decrease in the quality of life. It is important that in individuals with sarcopenia, the concentration of anti-inflammatory adipokines decreases against the background of an increased level of pro-inflammatory adipokines. The consequences are aggravated by the fact that the accumulation of visceral and ectopic adipose tissue promotes the progression of carcinogenesis, accelerating the proliferation and increasing the aggressiveness of tumor cells through remodeling of the tumor microenvironment.

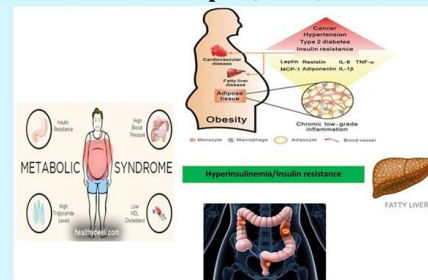
The purpose consists of experimental test of the using of combined physical training and diet for balancing energy and plastic metabolism, shifting the ratio of muscle and fat mass towards the prevalence of the latter and weakening the lipotoxicity of adipose tissue, which affects the processes of carcinogenesis.

The main objective: practically implemented The Health Creation Program based on the laboratory-monitored combination of physical training and diet in everyday life as a means of preventing lipotoxicity carcinogenesis.

MATERIALS & METHODS: The object was healthy voluntary sport students (men ages 19 to 21 YO, n = 20) in combination with an animal model (laboratory animals, male rats) exercised by swimming and treadmill running. Mature young people performed the program of aerobic exercise (5 weeks) intensity (75-80% of VO₂max), frequency (3-5 sessions/week) and duration of sessions (30-90 min) in combination with resistance training in the gym. Along with anthropometric measurements (body mass index, BMI; body circumferences: waist, hip, and limbs), body composition bioelectrical impedance analysis (BIA) and lipid profiles (TG, TC, HDL, LDL, VLDL) were carried out. The use of an animal model made it possible to carry out subcutaneously injection of B16F10 melanoma cells for the subsequent assessment of the dependence of carcinogenesis on experimental conditions. Tumor development was determined by caliperometry (longitudinal and transverse diameters, volume according to the formula of an ellipsoid of rotation, Breslow thickness) and subsequent histochemical analysis (staining with hematoxylin-eosin) in a clinical diagnostic histomorphological laboratory. Statistical analysis was performed by ANOVA using Student's t-test.

RESULTS: Experimental test of The Health Creation Program implementation revealed a statistically significant shift in the ratio of muscle and adipose mass in the examined volunteers. Adipose mass: 11.56 ± 0.98 and muscle mass: 66.75 ± 1.13 (in absolute units, kg), adipose: 14.8 ± 1.1 and muscle mass: 85.2 ± 4.3 (in relative units, %) are determined before the start of the combined Health Creation program; adipose: 10.11 ± 0.98 * and muscle mass: 68.18 ± 0.98* (kg), adipose: 12.9 ± 1.1 and muscle mass: 87.1 ± 4.3 (%) - after completion of the program. The lipid profile shows an increase in HDL concentration (from 33.4 ± 3.3 to 47.6 ± 4.8 mg/dL, P<0.05) against the background of LDL reduction of 37.6 ± 1.7 mg/dL before the program and 25.3 ± 1.3 mg/dL (P<0.001) - after its completion. Animal testing showed lower values obtained from melanoma caliperometry and Breslow thickness micrometry in animals subjected to physical training by swimming and running on a treadmill 10 and 20 days post-injection (Breslow thickness: 1.14 ± 0.09 at 10 days and 1.36 ± 0.11 on day 20 in untrained animals with a diet with a high carbohydrate, lipid and protein index; 0.83 ± 0.05 * and 0.94 ± 0.09 * in trained animals on a standard diet, respectively).

CONCLUSIONS: The Health Creation Program based on optimized Environment, Activity, and Diet: combined individualized physical aerobic, resistance training and low-glycaemic and low-fat index can underlie preventive measures aimed at reducing the degree of accumulation of fat mass, in particular visceral mass, reducing its lipotoxic effect on skeletal muscles and the impact that promotes carcinogenesis.



Rosa Divella, Antonio Mazzocca, Antonella Daniele, et al., 2019



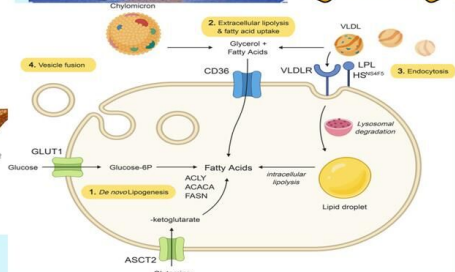
HUMAN MODEL

Program implementation

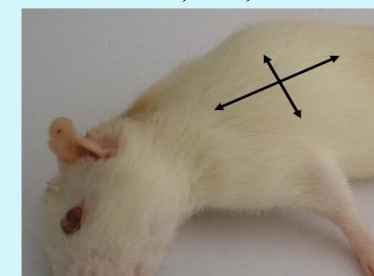
Body composition indices	The result of measuring the value of the indices of body composition (kg; %)	Body composition indices	The result of measuring the value of the indices of body composition (kg; %)
Density	1.065 ± 0.082	Density	1.069 ± 0.082
Fat mass abs. (kg)	11.56 ± 0.98	Fat mass abs. (kg)	10.11 ± 0.98*
Muscle mass abs. (kg)	66.75 ± 1.13	Muscle mass abs. (kg)	68.18 ± 0.98*
Fat mass relative (%)	14.8 ± 1.1	Fat mass relative (%)	12.9 ± 1.1
Visceral Fat mass relative (%)	9.9 ± 0.9	Visceral Fat mass relative (%)	7.3 ± 0.3*
Muscle mass relative (%)	85.2 ± 4.3	Muscle mass relative (%)	87.1 ± 4.3
Population mean	16.45 ± 1.27	Population mean	16.45
Score	61	Score	72

BEFORE

AFTER



Lisa M. Butlera, Ylenia Perone, Jonas Dehairs, et al., 2020



ANIMAL MODEL

Tumor caliperometry

