

Effect of plant preparations on the intensity of weight gaining and lipid metabolism parameters during experimental alimentary obesity

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ABSTRACT

In contemporary literature there are data about significant role of free radical oxidation in the pathogenesis of obesity. In this relation application of endogenous as well as exogenous antioxidants for the purpose of excess weight correction has generated increasing interest in scientific circles. Numerous researches showed natural antioxidants to be effective in correction of elevated blood cholesterol, triglycerides, LDL levels. In this relation the purpose of our research was to establish effectiveness of green tea catechines and citrus extract on lipid metabolism disorder and excess body weight during experimental alimentary obesity. Experiment was conducted on rats kept on high-calorie diet for 7 weeks. Simultaneously animals from III and IV group had been administered catechines and citrus extract at the doses of 15 mg and 30 mg respectively in addition to the high-calorie diet during last 4 weeks. The experiment established corrective effect of abovementioned preparations on the parameters of lipid metabolism (blood cholesterol, triglyceride and LDL levels) and epididymal fat mass. It appeared that citrus extract is especially effective to hinder in weight gain. Obtained results are very important and may be used for the development of weight losing diets.

KEYWORDS: *alimentary obesity, diets, lipid metabolism, free radical oxidation*

At present time obesity is a special medical problem. There are many factors that may cause obesity; one of these is high-calorie food intake when diet calorie content exceeds body energetic needs (alimentary obesity). Obesity may be also caused by low activity of triacylglycerollipase that hinders in mobilization of triacylglycerides from fat depots. Low activity of this enzyme may occur at neuroendocrine diseases. In contemporary literature there are data about significant role of free radical oxidation in the pathogenesis of obesity [4,5]. In this relation application of endogenous as well as exogenous antioxidants for the purpose of excess weight correction has generated increasing interest in scientific circles. Numerous researches showed natural antioxidants to be effective in correction of elevated blood cholesterol, triglycerides, LDL levels [12,15]. In this respect, we focused our attention on citrus extract and green tea catechines. Citruses are known to be rich in ascorbic acid, carotenoides, folates, flavinoides and dietary fiber. Citrus preparations have been successfully applied for the prevention of cardiovascular diseases and cancerogenesis [15]. Catechines belong to flavinoides which green tea is abundant in [12].

The purpose of our research was to establish effectiveness of green tea catechines and citrus extract on lipid metabolism disorder and excess body weight during experimental alimentary obesity.

MATERIALS AND METHODS

Experiment was conducted on pubescent white rats of 180-200 gr. body weight. Animals of control group (I group) had been fed on Puruna Rodent Chow food for 7 weeks. In order to achieve excess weight gain rats for 7 weeks had been kept on high-calorie diet including 44% sweet condensed milk, 47% Puruna Rodent Chow food, 8% vegetable oil, and 1% vegetable starch (II group). Animals from III and IV group had been administered catechines and citrus extract at the doses of 15 mg and 30 mg respectively in addition to the high-calorie diet during last 4 weeks.

At the end of the experiment animals were weighed and killed under anesthetic by nembitane. Epididymal fat was

weighed and blood samples were taken for biochemical research. Blood total cholesterol, triglycerides and LDL levels were measured.

Obtained results were processed by student's method of variation statistics.

RESULTS AND DISCUSSION

The table shows changes in weight gain, epididymal fat mass, blood glucose, triglycerides, cholesterol and methemoglobin levels after 7 weeks of high-calorie diet and administration of antioxidant preparations.

Data presented in the table 1 show that after 7 weeks of high-calorie diet rats' weight gain in II group is by 38% higher compared to controls. At that, epididymal fat mass in these animals is 4.9% of body mass (compared to 3.6% in controls). Animals treated with citrus extract showed weight gain intensity less by 17% and 40% compared to those of controls and high-calorie diet group animals respectively. Animals treated with catechines did not show any difference in weight gain intensity compared to high-calorie diet group. Epididymal fat mass in this group is 3.2% and 3,7% of body weight respectively. There is no statistically reliable difference in blood glucose levels among experimental groups of animals.

The research showed that in animals on high-calorie diet blood total cholesterol, triglyceride and LDL levels are increased by 71%, 62% and 33% respectively compared to those of controls. In animals treated with citrus extract blood total cholesterol, triglyceride and LDL levels are decreased by 14%, 23% and 50% respectively compared to those of high-calorie diet group. In animals treated by catechines these parameters are decreased more significantly - by 48%, 47% and 47% respectively and reach control levels.

As we have mentioned before, citruses are abundant in ascorbic acid, carotenoides, folates, flavinoides and dietary fiber. Ascorbic acid and flavinoides, as well as green tea catechines have distinct hypolipidemic effect. Vit C catalyzes conversion of cholesterol into bile acid. Flavinoïdes contained in citruses facilitate inhibition of cholesterol biosynthesis and esterification in body [1],

amplify fecal excretion of sterols and decrease activity of hepatocyte microsomal enzyme phosphotidat dosphohydrolase restricting triglyceride synthesis, that eventually results in lowered total cholesterol and triglyceride levels in blood [2,3,8,14]. Enhanced fecal excretion of neutral sterols is caused by lowered activity of 3-hydroxy-3-methylglutaryl-CoA (HMG-CoA) reductase and acyl CoA-cholesterol O-acyltransferase (ACAT). Thus, hypocholesterolemic effect of citrus flavinoides is based on a decrease in hepatic HMG-CoA reductase and ACAT activity [6,10,11], inactivation of microsomal triglyceride transport protein (MPT), increased expression of LDL-receptors [16] and significantly

decreased acetyl-CoA carboxylase mRNA levels in adipose tissue [9].

Hypolipidemic action of green tea catechines is manifested by decreased epididymal adipose tissue mass, lowered total cholesterol and LDL levels in blood, elevated HDL [7]. Supposedly, this effect of green tea catechines is based on activation of lipid β -oxidation and raising of fatty acid translocase/CD36 mRNA levels which in its turn facilitates lipid utilization in energogenerating processes [13].

In conclusion, citrus extract and tea catechines exert significant effect on lipid metabolism and thereby hinder fat tissue accumulation and intensive body weight gain.

	weight gain	glucose	fat mass	cholesterol	triglycerides	LDL
Controls	42±2,1	74,0±8,0	3,6± %	106,5±0,5	121,0±1,0	120±4,5
High-cal. diet	58±3,0	83,3±5,1	4,9± %	181,5±3,5	196,5±4,5	160±4,0
High-cal. diet + citrus extract	35±3,5	72,8±10,3	3,2± %	155,0±5,0	152,5±10,5	80±3,0
High cal. diet + catechine	55±2,0	65,5±14,1	3,7± %	93,5±1,5	104,5±3.5	100±3,5

Tab.1 Effect of plant preparations on weight gain and lipid metabolism parameters in rats on high-calorie diet.

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Влияние препаратов растительного происхождения на интенсивность прибавления в весе и параметры липидного метаболизма при алиментарном ожирении

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Р Е З Ю М Е

Существуют многочисленные данные о важной роли процессов свободнорадикального окисления в патогенезе ожирения. В связи с этим возрос интерес к возможности использования антиоксидантов с целью коррекции избыточного веса. Многочисленные исследования свидетельствуют об эффективности растительных антиоксидантов в нормализации уровня общего холестерина, триглицеридов и липопротеинов низкой плотности (LDL) в плазме крови. Целью исследования являлось изучение эффективности влияния катехинов чая и экстракта цитрусов на параметры липидного обмена при алиментарном ожирении в эксперименте. Эксперименты проводились на крысах, находящих в течение 7 недель на высококалорийной диете. Одновременно отдельным группам животных в течение последних трех недель эксперимента проводились инъекции цитрусового экстракта и катехинов. Выявлено корректирующее действие использованных препаратов на параметры липидного обмена (уровень общего холестерина, триглицеридов и LDL в плазме крови) и массу эпидидимального жира. Оказалось, что цитрусовый экстракт особенно эффективно препятствует прибавлению в весе. Эти данные имеют могут быть использованы при разработке диет, способствующих снижению веса.

Ключевые слова: алиментарное ожирение, диета, липидный метаболизм, свободнорадикальное окисление