

THE INFLUENCE OF KIDNEY BEANS (*PHASEOLUS VULGARIS*) PODS EXTRACT ON OBESITY DEVELOPMENT

The influence of kidney beans pods extract on obesity development was investigated. It was found that administration of *P. vulgaris* pods extract led to decrease of body weight and body mass index of the animals which were on high-calorie diet. Found changes could be result of decrease of food intake by rats treated with extract in compare with rats in high-calorie diet group.

Key words: obesity, kidney beans pods extract, high-calorie diet.

Introduction. In our modern world with increasingly cheap, high calorie food, prepared foods that are high in things like salt, sugars or fat, combined with our increasingly sedentary lifestyles, increasing urbanization and changing modes of transportation, it is no wonder that obesity has rapidly increased in the last few decades, around the world. Obesity can be the basis for the development of related diseases and complications that are often the cause of early death and disablement, including diabetes, hypertension, coronary heart disease, cancer, etc. [1]. That is why the search for new treatment approaches of this disease remains an urgent medical problem, because of number of patients continues to grow steadily.

In recent years, worldwide scientific interest focuses on the study of the properties of plant extracts due to the multifactorial nature of their therapeutic effects on the obesity and its concomitant diseases. Plant extracts unlike synthetic drugs practically non-available toxic effects [2]. Available raw for the drugs development is kidney beans (*Phaseolus vulgaris*). Kidney bean pods are believed to be helpful in obesity and weight loss programs, as well as obesity-related diseases, such as diabetes mellitus type 2 and heart disease [4]. Bean pods may lower blood sugar level. Kidney bean pods extract naturally blocks the absorption and expulsion of the carbohydrates eaten as part of a daily diet. Bean pods have been proposed as an effective agent in the fight against weight gain and obesity [5].

For today, the complex investigation about effects of *P. vulgaris* extract on obesity development is absent, so the aim of this study was to investigate the influence of kidney bean pods on the development of obesity in rats which were on high-calorie diet.

Materials and Methods. Experiments were carried out on white nonlinear male rats with initial weighing of 135-160 g. All animals were at room temperature 19-24 °C, humidity of less than 50%, natural light mode "day-night" in plastic cages during the experiment.

During first seven days, all rats received standard food "Purina rodent chow" and water ad libitum. On the 8th day the animals were randomly divided into 3 groups. Animal of the first group ("Control") have been fed with a standard food and water during the experiment. Animals of the second group ("HCD") were on a high-calorie diet which consisted of a standard meal (60%), pork fat (10%), eggs (10%), sugar (9%), peanuts (5%), dry milk (5%), and sunflower oil (1%) [6], and drank water ad libitum. Animal of the third group ("HCD+Ex") were also on high-calorie diet and water ad libitum. After 4 weeks of experiment they started to receive the extract of *P. vulgaris* (200 mg / kg). One day all rats of this group have received the extract and another day they drank water.

Body weights were recorded once a week and feed intake was recorded daily in all animal groups. Body mass index (BMI) (body weight (g) /nose-to-anus length² (cm²)) and Lee index (cube root of body weight (g) /nose-to-anus length (cm)) were calculate at the end of experiment [7].

Statistical analysis was performed using statistical analysis applications of Microsoft® Excel. To assess inter-group differences the parametric Student test was used. The difference between the parameters was considered statistically significant at p<0,05.

Results and Discussion. As the result of our experiment it was shown a significant increase in body weight of rats which received a high-calorie food compared with a control group of animals that were on standard diet. Also, it was found that the dynamic of body weight increase of animals that received the *P. vulgaris* pods extract simultaneously with high-calorie food was not very different from that of the control rats (Fig.1).

After 10 weeks of experiment body weight of rats in the control group increased by 110% from an initial value. It was shown that the body weight of rats in the "HCD" group was increased by 161% that was significantly higher compared with the "Control". Our results revealed that body weight in the "HCD+Ex" group was not different from the control and increased by 113% from the initial value.

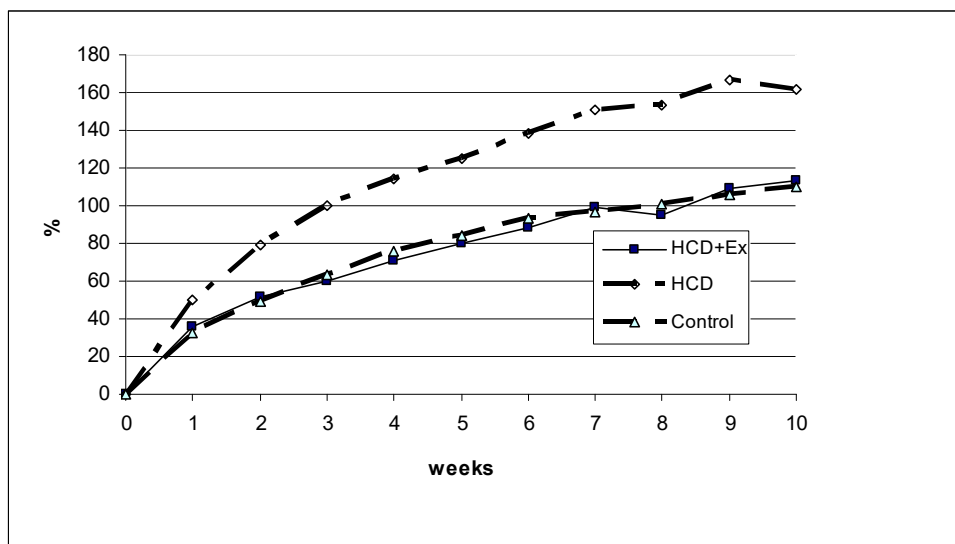


Fig.1. The dynamics of body weight increase of rats in the "Control", "HCD" and "HCD+Ex" groups (M ± m; n = 10)

During 10 weeks of study daily food consumption by rats of the control group was unchanged and was $28 \pm 1,4$ g per day (Fig. 2). The rats that were on high-calorie diet ate an average of $30,6 \pm 1,5$ g of high-calorie food per one animal.

But the quantity of daily food that consumed rats of the "HCD+Ex" group was even lower compared with the control group of animals and composed $24,6 \pm 1,2$ g per one rat.

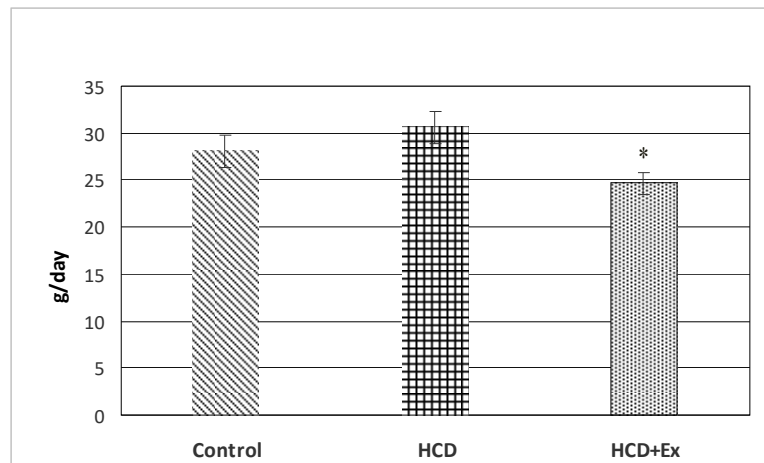


Fig.2. Food consumption by rats in "Control", "HCD" and "HCD+Ex" groups ($M \pm m$; $n = 10$)

Note: * – $p < 0.05$ differences credible with respect to the control

Also, our studies showed the higher liquid consumption in group of the control rats compared with rats that were on high-calorie diet and rats that received the *P. vulgaris* pods

extract (Fig. 3). Liquid consumption was in average $38 \pm 1,9$ ml, $32,5 \pm 1,6$ ml and $28,7 \pm 1,4$ ml for the control animals, "HCD" and "HCD+Ex" groups, respectively.

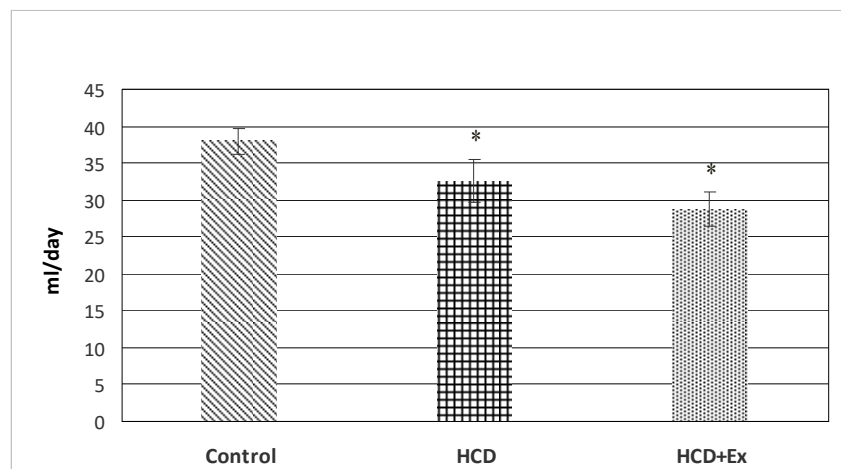


Fig.3. Liquid consumption by rats in "Control", "HCD" and "HCD+Ex" groups ($M \pm m$; $n = 10$)

Note: * – $p < 0.05$ differences credible with respect to the control

Table 1 represented data that summarized the daily food intake, liquid intake and changes in body weight of animals in the "Control", "HCD" and "HCD+Ex" groups. Also, Table 1 showed the body mass index (BMI) as a body weight (g) /nose-to-anus length² (cm²) and Lee index as cube root of body weight (g) /nose-to-anus length (cm) of the control, "HCD" and "HCD+Ex" groups. It was found

an increase of BMI in "HCD" group on almost 0,07 points and decrease of BMI in "HCD+Ex" group on 0,05 points compared to the control after 10 weeks of experiment. The Lee index in "HCD" and "HCD+Ex" groups of animals was increased on 0,07 and 0,05 points, respectively, compared with "Control" group.

Table 1. General characteristics of the rats that were on a high-calorie diet ("HCD") and animals that received the *P. vulgaris* pods extract simultaneously with high-calorie food ("HCD+Ex")

	Food intake (g/day)	Liquid intake (ml/day)	Initial body weight (g)	Final body weight (g)	BMI (g/cm ²)	Lee index
Control	28,1±1,4	38±1,9	183±9,1	393±19,6	0,71	2,58
HCD	30,6±1,5	32,5±1,6*	171±8,5	443±22,1	0,78	2,65
HCD+Ex	24,6±1,2*	28,7±1,4*	186±9,3	396±19,8	0,66	2,63

* $p < 0.05$ significantly different from the control group

The main result of current study was the detection the fact that animals that received the *P. vulgaris* pods extract and were on high-calorie diet not gaining weight compared with rats that consumed only a high-calorie diet. Such result partly could be explained from the position of kidney beans pods extract influence on digestion of carbohydrates in the gastrointestinal tract. Also, our results confirmed the development of obesity in group of animals that were on high-calorie diet. Excessive body weight of these rats was probably associated with the accumulation of adipose tissue. This accumulation may be the result of an imbalance between the amount of energy consumed by rats and the amount of energy spent, because alongside with the increasing amount of consumed feed by the animals. The amount of energy received was increased either due to high caloric content of food. It may be due to high caloric content of food which in turn may be the result of accumulation of adipose tissue because of an imbalance between the amount of energy consumed by rats and the amount of energy spent.

Conclusion. Thus, our results demonstrated the ability of the *P. vulgaris* pods extract to influence the development of obesity, in particular, to reduce the amount of consumed food, which were accompanied by decrease of body mass index and body weight in compare with those for animals, which were only on high-calorie diet. Noted effects suggested that this extract may be used as functional ingredient in addition to regular therapy of obesity and its related complications.

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А. Юрченко, асп., Н. Ракша, канд. біол. наук, О. Савчук, д-р біол. наук
Київський національний університет імені Тараса Шевченка, Київ, Україна

ВПЛИВ ЕКСТРАКТУ ЛУШПИННЯ КВАСОЛІ ЗВИЧАЙНОЇ (PHASEOLUS VULGARIS) НА РОЗВИТОК ОЖИРІННЯ

Досліджено вплив екстракту лушпиння квасолі звичайної на розвиток ожиріння. Встановлено, що введення екстракту стручків *P. Vulgaris* призводить до зниження маси тіла та індексу маси тіла тварин, які споживали висококалорійну їжу. Виявлені зміни можуть бути результатом зниження споживання їжі щурами, які отримували екстракт в порівнянні з щурами, що перебували на калорійній дієті.

Ключові слова: ожиріння, екстракт лушпиння квасолі звичайної, висококалорійна дієта.

А. Юрченко, асп., Н. Ракша, канд. биол. наук, О. Савчук, д-р биол. наук
Київський национальний университет имени Тараса Шевченка, Киев, Украина

ВЛИЯНИЕ ЭКСТРАКТА СТВОРОК ФАСОЛИ ОБЫКНОВЕННОЙ (PHASEOLUS VULGARIS) НА РАЗВИТИЕ ОЖИРЕНИЯ

Исследовано влияние экстракта шелухи фасоли обыкновенной на развитие ожирения. Установлено, что введение экстракта стручков *P. Vulgaris* приводит к снижению массы тела и индекса массы тела животных, которые потребляли высококалорийную пищу. Данные изменения могут быть результатом снижения потребления пищи крысами, которые получали экстракт по сравнению с крысами, которые находились на калорийной диете.

Ключевые слова: ожирение, экстракт створок фасоли обыкновенной, высококалорийная диета.

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