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Original article

THE EFFECTS OF DRIED APRICOT SUPPLEMENTATION ON DAILY FOOD INTAKE IN RATS

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Abstract

The aim of this study is to investigate the effects of sun dried organic apricot (SDOA) (Prunus armeniaca L.) *supplementation on the daily food consumption of rats. In this study, 120 male and 120 female Sprague Dawley rats were used. They were grouped as 24 rat per group of female and male rats. Group 1 (control)was fed up with standart rat chow, group 2; 1%, group 3; 2.5%, group 4; 5% and group 5 were fed up with 10% SDOA supplemented chow throughout 16 days. At the beginning of the study the body weight of the male rats was measured as 321±24.6 g (n=120), and the body weight of the female rats was 210±21.4 g (n=120). The daily avarage normal food intake of control group of male and female rats were determined as 24±1.9 g/rat/day and 16±1.1 g/rat/day respectively.*

Consequently, it can be confidently said that in the ratio of 2.5% ve 5% supplementation of SDOA food on the male rats, 10% suplementation on the female rats have a significant positive effect in their daily food consumption.

Key words: *Sun dried organic apricot, Daily food intake, Rat.*

Yemlere Kuru Kayısı İlavesinin Ratlarda Günlük Yem Tüketimine Etkisi

Bu çalışmanın amacı, yemlere farklı oranlarda gün kurusu organik kayısı (GKOK) ilavesinin dişi ve erkek ratlarda günlük yem tüketimine etkilerini incelemektir. Bu çalışmada 120 erkek ve 120 dişi Sprague Dawley rat her grupta 24 rat olacak şekilde aşağıdaki gibi gruplandırıldı; Grup 1 (kontrol) standart rat yemi, grup 2; %1, grup 3; %2.5, grup 4; %5 ve grup 5; %10 oranında GKOK ilaveli yemle beslendi. Çalışmanın başlangıcında erkek ratların canlı ağırlıkları 321±24.6 g (n=120), dişilerinki 210±21.4 g (n=120) olarak belirlendi. Ratlarda ortalama normal yem tüketimleri kontrol grubu erkekler için 24±1.9 g/rat/gün ve dişiler için 16±1.1 g/rat/gün olarak belirlendi.

Netice olarak, yemlere %2.5 ve %5 oranında GKOK ilavesi erkek ratlarda, %10 ilavesi dişi ratlarda günlük yem tüketiminde anlamlı olarak etkidiği söylenebilir.

Anahtar kelimeler: *Organik kuru kayısı, Günlük yem tüketimi, Rat.*

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INTRODUCTION

The main functions of the alimentary canal is the digestion of food, the absorption of nutrients and the propulsion of material through the digestive tract. Although in humans and rats oral (nitroglycerin) and stomach (non-ionized) are some of the absorption examples, these constitutes a very small amount, even compared to the intestines (1). Despite strong morphological similarities between humans and rats at the microscopic level, there are gross, significant anatomical differences such as the difference of the absorption rate and the amount of the absorptive substance variation at the multidimensional level. In humans, the length of small intestine is 25 cm duodonum, 260 cm jejunum and 395 cm ileum, a total of 680 cm, and in rats, duodonum is 9.5-10 cm, jejunum 90-135 cm and ileum 2.5-3.5 cm, a total of 125 cm. For humans, the large intestine is 7 cm caecum, 93 cm colon and 55 cm rectum a total 155 cm, and in rats caecum is 5-7 cm, colon 9-11 cm and rectum 8 cm, a total 25 cm. Total intestinal length is 835 cm in humans, and 150 cm in rats. According to the absolute absorption surface areas of digestive tract organs in the human stomach, the small and large intestine are 0.053, 200 and 0.35 m^2 and in rats they are 0.00062 m^2, 1 m^2 and 0,034 m^2 respectively. In addition, vascularization of the digestive tract, motility of intestines, and transit time of content, as well as the other factors such as physico-chemical structure of content and entero-hepatic circulation are also effective (1).

Some physical and physiologic factors such as the daily meal number, amount of meal, meal time, consistency and composition of chow, stress, age, gender, hormonal status, the humidity and temperature of the given room but also pharmacological or surgical applications may cause physiological/biochemical changes which will have an effect on food intake in rats (1-5).

In mammals, genetic, enviormental and behavioral factors also affect on long life as well as body weight. In this contex, there is a positive correlation between low body weigh and long life span and negative correlation between high body weight and short life span (6). Epidemiological observations suggests that, there is an increasing effect of excessive heavy body on obesity and mortality (6). In rats, the balance of food intake and energy are mainly arranged by speed of hepatic glycogen synthesis (7), and dietary dihydroxyacetone addition which increases the amount of glycogen synthesized via pyruvate, so weight gain reduces (8).

While in male rats the methiyonin supplementation to food was increasing 2-8 times, the density of plasma homocystein, folic acid, vitamin B_6 and vitamin B_{12} supplementation were ineffective (9), from the 8^{th} day of pregnancy till the completion of lactation, omega-3 supplementation to food have an effective on offspring locomotor activity and learning and also docosahexaenoic acid and eicosapentaenoic acid supplementation significantly improved motor coordination have reported by Coluccia et al (4). Although the effects of bran addition to diets on absorption/bioavailability of minerals in food are still debated by authorities, Callegaro et al have pointed out that, dietary fiber levels of multimixtures positively effect the apparent absorption of minerals and they suggest that low-cost supplements, especially those with high fiber levels, may be a strategy to improve the nutritional value of poor diets (5). On the other hand, epygallactocatechingallate by increasing energy demand and termogenezes caused an increase in oxidation at fat/brown fat tissue, thus preventing the increase in fat tissue and body weight gain were identified in rats, so it was emphasized by the authorities that the importance of these information might be shown in other experimental animals (10). In rats, red-wine consumption prevents body weight gain fed a hyperlipidic diet by reducing the energy ingested and maintaining the food efficiency have been reported by Bargallo et al (11), Lithium supplementation to food caused by a raise on plasma cortisone levels could be increased on appetite and food consumption and so an increase in body weight gain were reported by Levine and Saltzman (12), and also bilateral adrenalectomy by slow down the food consumption and reducing the body weight were reported by Gosselin and Cabanac (13).

It is important to point out that, in proestric (just before oestric period) female rats depending on the dose of oxytocin a reduction on food consumption was determined by Arletti et al (14),

oestrogen levels a rise in parallel to the decrease in food consumption whereas, oestrogen levels decline during metestrus and diestrus periods the opposite trend (an increase) is observed in food consumption is reported by the authorities (2). Rising the plasma oestrogen levels might be cause by thermogenesis and motor activity and it also prevented the accumulation of body weight gain and fat tissue in rats is also emphasized by the same authorities (2). Hyperinsulinemia is an important factor not only in aging but also in the development of cancer. Therefore, it is importantly stressed that in rat and human subjects, for longevity and cancer risk at young age seems important to evaluate the predictive role of serum insulin levels or better susceptibility of tissues to insulin (15). Compared to control rats in ovariectomized rats, the decrease in food intake that occurs in response to intracerebroventricular injections of leptin is reduced (16). In other studies, male rats reduced food intake in response to central injections of insulin, but not leptin, whereas female rats reduced food intake in response to central injections of leptin, but not insulin (17). These studies suggest that oestrogens decrease food intake in the female gender by increasing the sensitivity of the brain to leptin (18).

Especially in Asian diets there is a prefering consumption of soy and leguminosae and that is because of containing high amount of concentrated phytoestrogens. Similar other phytoestrogens as resveratrol, anthocyanins, flavanons are found in fruits, berries and vegetables. According to the current state of knowledge about the intake of concentrated phytoestrogens as a supplement is not supported, but the consumption of plant-foods which contain a high amount of phytoestrogens is still considered as an important individual contribution to health maintenance (19).

The bioactivity of phytoestrogens are based on their structural similarity with 17 β-oestradiol and their ability to bind to oestrogen receptors and can also act as antioxidants, therefore these compounds have received notable attention with potentially beneficial effects for a wide range of human conditions such as cancer, osteoporosis, menopausal symptoms, male infertility, obesity and type 2 diabetes (20). The main dietary sources of phytoestrogens are fruits and vegetables, the phytoestrogen content in foods depends on a large number of genetic and environmental factors such as variety, harvest and processing methods. In plants, where these compounds occur predominantly as glycosides, and also, the principal phytoestrogen-classes are isoflavones (found mainly in soybean), lignans (in some fruits and vegetables) and coumestans (in young sprouting legumes like clover) (21, 22). It is reported that 100 g wet weight of dried apricot contains 443 μg phytoestrogens, 12 μg isoflavones, 431 μg lignans, 8 μg glycitein 4 μg biochanin A and 430 μg secoisolariciresinol. Despite the large number of studies conducted, there is still no clear evidence whether phytoestrogen intake has a beneficial or detrimental effect on human health and further research has recommended by authors (21, 22).

Possible benefical effects of fruits and vegetables have been reviewed extensively and available evidence provides support for this, so such foods (like apricot) are particularly rich in vitamin C, pro vitamin A carotenoids, phenolics and a range of bioactive phytonutrients (23). In some experimental studies; hepatoprotective effects of apricot were investigated against hepatotoxicity by ethanol-induced oxidative stres (24) and carbon tetrachloride (25) protective effect of apricot against alcohol induced testicular damage (26) and detrimental effects of low-dose x-rays on testes (27), beneficial effects on myocardial ischemia-reperfusion injury (28), and potent protective effect on methotrexate-induced intestinal oxidative damage (29), fatty acid analysis of some Turkish apricot seed oils have been reported by different researchers (30).

Literature reveals no information on consumption at different rates of SDOA supplementation on food intake in rats.

MATERIAL AND METHOD

The study protocol was approved by the Ethic Commitee, Faculty of Medicine University of Inönü (2009/13). Animals were hold the Experimental Animal Research and Production Center

of Inonu University. Guidelines the Care and Use of Laboratory Animals were considered. The rats were housed in cages, in every cages they were 4 rats and they were maintained at 21±2 C^0 and humidity 53±3% in an animal room with a 12 h-light/dark cycle. They had free access to chow and tap water throughout 16 days study period and there were not any side effects and death observed. The female rats were housed in seperation room from the male rats. Daily food consumption procedure was done at $09:^{00}$-$11:^{00}$ a.m. every day.

Animals; In this study, 120 male and 120 female rats were used and daily food consumption procedure were maintained approximetly 16 days. At the beginning of the study the average body weight of male and female rats were determined as 321±24.6 and 210±21.4 g respectively. The rats were randomly divided into five groups (n=24 per group of male and female) as follows; group 1; (control) was fed with standard rat chow, group 2; 1%, group 3; 2.5%, group 4; 5% and group 5 was fed 10% SDOA supplemented chow.

Diet; In the present study, the standard rat chow were purchased from Korkutelim (Antalya, Turkey) and Kabaaşı variety of SDOA which was provided from local market in Malatya Province (having organic certificate) was used as a supplemented diet. The average nutrient and mineral content of rat chow and Kabaaşı variety of SDOA which were used in the present study are given in Table 1. The composition of SDOA were taken from Kan's study (31), and the composition of rat chow were analysed in Department of Animal Feeding, Faculty of Veterinary Medicine, University of Fırat, Elazığ, Turkey. Except control, the animals were fed with pelleted which SDOA supplemented pellets were prepared as a 10 kg per package manually.

Table 1. Compositions of rat chow (%) and Kabaaşı variety of SDOA (mg/100g).

Nutrient	Chow	SDOA	Minerals	Chow	SDOA
Water	10.5±0.5	25.3±0.6	Na	320±2.3	16±0.4
Protein	24.3±1.2	5.4±0.3	K	620±7.6	1470±8.8
Fat	7.5±0.6	0.5±0.1	Cl	280±4.5	23±0.5
Carbohydrate	44.8±0.4	62.1±0.6	Ca	1400±9.8	97±5.4
Fiber	4.3±0.2	5.6±0.2	Fe	8.5±0.4	5,5±0.3
Ash	8.6±0.3	1.1±0.2	Mg	250±6.3	123±4.3
Energy(Kcal/g)	2.56±0.06	2.62±0.06	P	910±6.5	108±2.4

Statistical Analyses; All data expressed as mean± SD. Datas were analyzed with Willcoxon sign test for comparisons. *P*-value less than 0.05 was considered significant.

RESULTS

The effects of four different (1; 2.5; 5 and 10%) proportions of SDOA supplementation to diets after 16 days periods in female and male rats are presented in Table 2. According to Table 2, in female rats the lowest food intake is 15.3 g/rat/day on the group 1%, and the highest is 16.6 g/rat/day in the group 10%. In male rats, the lowest food intake is 23.3 g/rat/day in the group 2.5%, and the highest is 24.3 g/rat/day in the control and 10% group. The effects of different rate of SDOA supplementation to diets caused an increase in food consumption than the control group in female rats, and in male rats significant reduction in food consumption than the control group was observed.

Table 2. Daily food intake amounts of female and male rats (g/rat/day ±SD) (n=24 for per group).

	control	1%	2.5%	5%	10%
Female	15.8±1.1	15.3±1.6	16.1±1.0	15.9±1.2	16.6±0.8[a]
Male	24.3±1.9	23.6±1.5	23.3±1.3[a]	23.4±0.8[a]	24.3±1.8

a = different than the control group ($p<0.05$).

DISCUSSION

Although there are strong morphological similarities between humans and rats at the microscopic level, there are also gross anatomical differences not only in terms of absorption rate, but also amount and size of absorptive substances vary multi-dimension significantly (1). In rats, daily food consumption were affected by gender, age, ambient temperature, stress, given the amount of food per day, meal time, number of feeding and macro components of food, administered surgical procedures and pharmacological/toxicological compount(s), some kind of supplementations (3, 12, 14-16).

In the present study, the same strain rats were used the others studies (32-35), and the avarage body weights and daily food intake rates of female rats were approximate to Boza et al (32). In this study, the daily food intake of male rats were the same to Trigazis et al (36) and relatively approximate to Taboada et al (4, 33, 34) and very approximate to Obeid et al (7). When, there are not any information about consumption of the different rates of SDOA supplementation on daily food intake in rats, so, the present study was performed at four different rates of supplementation on daily food intake rates in rats during 16 days periodical time.

Consequently; we have determined that statistical significant increasement in average daily chow consumption of an additional 10% SDOA than the control group of the female rats, it may be due to phytoestrogens (isoflavones) which is a content of apricot and that can be pointed out as a result of the existing different hormone which is originated from the oestrogenic effect which could cause an increase on appetite. The same active group (phytoestrogens) may have statistically significant decrease effect on appetite and daily food consumption of male rats at 2.5% and 5% rates of SDOA indirectly. But also, we can conclude that, the analysis of serum testosterone and oestrogen levels may contribute to this matter quite differently which study design use metabolic cages for each gender and groups.

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