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DIETARY FIBER AS A NATURAL SOURCE TO PRODUCE BISCUIT HYPO GLYCEMIA AND CHOLESTEROLEMIA IN RATS

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ABSTRACT

This investigation was carried out to produce biscuit consists of equal weight from different natural sources of dietary fiber. Different dietary fiber sources as defatted soybean, carrot powder and resistant starch were mixture and the chemical composition was determined in raw materials. The dietary fiber mixture were used at different levels 20, 30, 40 and 50% respectively, at preparing biscuit and the sensory evaluation was recorded and the control biscuit was made from wheat flour 72% extraction. The results showed that the defatted soybean had the highest content of fat 3.46% and protein 50.35%, whereas, the resistant starch had the highest content of total carbohydrates and total dietary fiber 98.69 and 39.56% moreover, the defatted soybean and carrot powder had the highest cellulose 14.11 and 12.01% and hemicelluloses 8.31 and 3.86%, respectively. The results of statistical analysis for sensory properties indicated that no significant difference was found between control sample and supplementation of the samples for all characteristics were evaluated of biscuits contained 20, 30 and 40% dietary fiber mixture

The biological experimental for hypercholesterolemia and glycemia rat groups were fed on diets containing different dietary fiber sources mixture at different ratios. After four weeks of feeding, serum glucose, total lipids, total cholesterol and triglycerides were determined. High and low density lipoprotein- cholesterol in serum was determined and liver function enzyme activity (ALT) alanine and asparate (AST) transaminases were measured.

At the end of experimental the results showed that increasing dietary fiber mixture in the diet had significantly decreased in levels of total cholesterol from 196.3 in control positive to 110.3 mg/dL in rats fed on 50% dietary fibers mixture. Also, triglyceride was lowered from 245.7 to 118.7 mg/dL, total lipid was decreased from 1.42 to 0.72 g/dLand glucose level was decreased from 169.3 to 120.6 mg/dL in blood serum of hypercholesterolemic rats. Meanwhile, the activities of aspartate and alanine transaminoferases were significantly reduced the actives in transaminoferases in the hypercholesterolemic rate group fed on high content of fiber mixture sources.

Therefore, it may be recommended to use these sources of dietary fiber mixture in made from biscuits up to 40% and it has improved blood lipids patterns and liver functions.

INTRODUCTION

The soybean, (*Glycine max*) a grain legume, is one of the richest and cheapest sources of plant protein that can be used to improve the diet of millions of people, especially the poor and low income earners in developing countries because it produces the greatest amount of protein used as food by man (Liu, 2000). Defatted soy flour at 2-5% improves water holding capacity and sheeting process of dough. The enhanced sheeting strength produces better layering during the fat roll in process and more tender and finished product.

Carrot (Daucus carota) is a good source of natural antioxidants, especially carotenoids and phenolic compounds (Prakash et al., 2004 and Zhang and Hamauzu, 2004). After processing, carrot residues, e.g. peels, pomace, are usually discarded or used as animal feed. However, carrot by-products still contain high contents of beneficial substances, especially bioactive compounds with antioxidant activities (Zhang and Hamauzu, 2004).

Gorecka *et al.* (2002) reported the absorption of bile acids by fiber carrots was depended on kind of plants material as well as, type of heat treatment and type of bile acids. Among all examined plant carrots fiber showed the lowest adsorption one. Dietary fiber of backed carrots adsorbed the most bile acids and the cholesterol was adsorbed in the highest degree by fibers.

Dietary fiber and whole grains contain a unique blend of bioactive components including resistant starches, vitamins, minerals, phytochemicals and antioxidants. As a result, research regarding their potential health benefits has received considerable attention in the last several decades. Epidemiological and clinical studies demonstrate that consumption of dietary fiber and whole grain intake is inversely related to obesity Tucker and Thomas (2009), type two diabetes Meyer *et al.* (2000), cancer Park *et al.* (2009) and cardiovascular disease (CVD) Streppel *et al.* (2008).

Consumption of foods rich in whole grains and cereal fibers has in epidemiological studies been shown to reduce the risk of chronic diseases such as diabetes, cardiovascular disease and certain cancers, as reviewed by Murtaugh et al., (2003) and shown by Larsson et al., (2005). Moreover, analogous carbohydrate was reported to be resistant for digestion and absorption in the human small intestine with complete or partial fermentation in the intestine. Dietary fiber includes polysaccharide, oligosaccharides, lignin and associated plant substances. Dietary fibers promote beneficial physiological effects including laxation and blood cholesterol attenuation (Anon, 2001). Furthermore, Harris (2000) noticed that dietary fibers may cause dietary starch to escape digestion in the small intestine and enter the large intestine. If these results from the dietary fibers reducing the gastro intestinal transit time those dietary fibers that's reduce this the most would be expected to cause the most starch to escape digestion. Resistant starch is defined as the same of starch food and products of starch degradation not absorbed in the small intestine of healthy individuals because resistance low reduce caloric content and is characterized by physiological effects that make it similar to dietary fiber .

Dietary fiber can bind carcinogens as well as bile acid. Fecal bile acids have been shown to be cytotoxic to or act as mitogens on colonic epithelial cells in animal and *in vitro* studies. The mechanism by which dietary fiber may modulate carcinogenesis involves cytokinetics of the colonic mucosa. Conversion of primary to secondary bile acids by bacterial enzymes may be prevented if the dietary fibers to which the bile acids or bile salts are bound are undegraded in the colon. Bound bile acids or bile salts pass out of the alimentary tract in the feces (Kim, 2000)

Hung *et al.* (2005) evaluated the quality of bread and formation of resistant starch in bread with high amylase wheat flour substitutions. The results showed that the amount of resistant starch in bread with high amylase wheat flout substitutions with up to 50% high amylase wheat flout did not significantly change the quality of bread.

Owing to the importance of dietary fiber for human health, the present study was aimed to produce biscuits rich in fiber. Also, a set of experiments were performed to elucidate the effect of biscuits produced using equal volume from resistant starch, carrot powder and defatted soybean to give four blends on some blood constituents such as total lipids, triglycerides, cholesterol levels and glucose level in serum of rats.

MATERIALS AND METHODS

Materials:

Defatted soybean (glycin max L) was obtained from the Soy Processing Unit, Food Technology Research Institute, Agricultural Research Center, Giza-Egypt. Wheat flour (72% extraction) was obtained from South Delta Mils Company, Giza- Egypt. Corn starch was purchased from Starch and Glucose Company, Cairo-Egypt. Meanwhile, carrot (Daucus carrot L) was brought from local market, Cairo, Egypt.

Kits for determination of serum cholesterol and other parameters were purchased from Alkan-Medical Division Biocon, Germany.

Preparation of raw materials:

Resistant starch was prepared according to the method described by Po-Ying *et al.* (1994). Corn starch weighted 200 g. into a beaker one liter and mixed with distilled water 700 ml. of suspension was autoclaved at 125°C for 1 hr. After autoclaving, the sample was cooled to room temperature and stored in a refrigerator over-night at 4°C. a product (resistant starch) was determined according to the method described by Sambucetti and Zuleta (1996). A product (resistant starch) containing approximately 30% resistant starch was obtained.

The green portion of carrots was discarded and the yellow roots were washed with tap water and cut into slices. The slices were soaked in boiled water for 5 min. and dried in an oven at 70°C for 6 hr and then the complete drying process at 40°C until the moisture content reached to 7.0%. Finely, the slices were milled using Qudrmat Lenior Laboratory Mill to a fine powder and stored in a refrigerator until use. As described by Park (1987).

Chemical analysis of raw material:

The raw materials (resistant starch, defatted soybean and carrot powder) and wheat flour (72% extraction) were analyzed for their ether extract, protein, fiber and ash contents according to the methods of AOAC (2005). Total carbohydrates content were calculated by differences. Whereas, cellulose and hemicelluloses content of raw materials were determined according to the method described by Chahal *et al.* (1979). Moreover, total dietary fiber was determined according to the method Prosky *et al.* (1988).

Preparation of blends and making biscuits:

Equal weight from resistant starch, defatted soybean and carrot powder as sources of dietary fibers were maxing. The mixture was fortified wheat flour (72% extraction) at levels 20, 30, 40 and 50% to give four blends. The control sample was prepared from 100% wheat flour 72% extraction. Four blends dough and control samples were prepared separately to make biscuits. Blend (1) mad from 20% dietary fiber (resistant starch, carrot powder and wheat bran) plus 80% wheat flour 72% extraction. Blend (2) mad from 30% equal weight dietary fiber sources and 70% wheat flour 72% extraction. Blend (3) mad from 40% dietary fiber plus wheat flour 72% extraction. Blend (4) mad from 50 to 50% dietary fiber sources and wheat flour 72% extraction according to Omobuwajo (2003).The biscuits were baked at 170- 180°C for 20 min-in an electric oven and tested by ten panelists according to AACC (2002).

Nutritional experiments:

Male albino adult rats (36 rats) weight ranging 150-155g were brought from Helwan Experimental Animal, Station Ministry of Health, Egypt. Animals were housed in individual cages with screen bottoms and fed on basal diet for eight days. The basal diet consisted of corn starch 70%, casein 10% corn oil 10%, salt mixture 4%, vitamin mixture 1% and cellulose 5% according AOAC (2005).

After feeding on basal diet for eight days, rats were divided into two groups. The first group (6 rats) was fed on the basal diet for another four weeks and considered as negative control. The second group (30 rats) was fasted overnight and injected by alloxan solution (150 mg active alloxan/1Kg rat weight) according to Buko *et al.* (1996) to induce hyperglycemia and hypercholesterolemia (Arbeeny and Bergquist, 1991) then the whole rats injection were fed on basal diet for 48 hr. where hypercholesterolemia and hyperglycemia were developed. After that, the rats were divided into five sub groups. The first one (6 rats) was continued to be fed on basal diet and considered as positive control. The second , third, fourth and fifth sub group (6 rats for each) were fed on the basal diet after native the 20% dietary fiber sources mixture at different levels 20,30,40 and 50%, respectively.

The body weight and food consumption recorded every three days for four weeks. At the end of experimental period (four weeks), the blood samples were taken with drawn from the orbital plexus and centrifuged at 3000 rpm to obtain the sera. After that, the sera were kept on a deep freezer at -20^{o}C until their analyses. Serum glucose, total lipids, total cholesterol and triglycerides were determined according to knight *et al.* (1972), Allain *et al.* (1974), Fossati and Prencipe (1982) and Tietz (1986), respectively. High and low density lipoprotein- cholesterol in serum was determined according to Burstein (1970) and Fruchart (1982). Serum transaminoferase activities alanin (ALT) and asparate (AST) transaminases were measured according to the methods reported by Bergmeyer (1983).

Statistical analysis:

Statistical analysis for each of the collected data was done following the procedure outline by Gomez and Gomez (1984). The treatment means were compared using the least significant difference test (LSD) at 5% level of probability as outline by Waller and Duncan (1969).

RESULTS AND DISCUSSION

Chemical composition of raw materials:

From the results presented in Table (1) it could be noticed that the defatted soybean had the highest content of fat 3.46% and protein 50.35% followed by wheat flour 72% extraction and carrot had contained 10.68 and 6.72% protein. However, resistant starch had the highest content of total carbohydrates and total dietary fiber 98.69 and 39.56% followed by wheat flour 72% extraction had contained 87.08% in carbohydrates and defatted soybean was 10.19 in total dietary fiber. Cellulose and hemicelluloses were determined in raw materials and the results showed that the defatted soybean and carrot powder had the highest cellulose 14.11 and 12.01% and hemicelluloses 8.31 and 3.86%, respectively.

Soybean is one of the most important oil and protein crops of the world. Soybeans contain 30 to 45% protein with a good source of all indispensable amino acids (Serrem et al., 2011). The protein content of soybean is about 2 times of other pulses, 4 times of wheat, 6 times of rice grain, 4 times of egg and 12 times of milk. Soybean has 3% lecithin, which is helpful for brain development. It is also rich in calcium, phosphorous and Vitamins A, B, C and D, it has been referred to as “the protein hope of the future”. Moreover, isoflavones contained in soybeans are effective cancer-preventive agents for lowering risks of effective cancer-preventive agents for lowering risks of various cancers (El Gharras, 2009). Evidence also points to the beneficial effects of soy isoflavones in the prevention of cardiovascular disease (El Gharras, 2009).

Total dietary fiber (DF) is the part of plant that is resistant to intestinal digestion in human large intestine. The beneficial effects of total DF on human health and body function are well-documented, thus a high consumption of DF is associated with a reduced incidence of common disorders and diseases in developed societies such as chronic bowel disorders, obesity, diabetes, cardiovascular disease and cancer (Benítez *et al.* 2011)

Table (1): Chemical composition of raw materials as sources fiber and wheat flour on dry weight basis g/100g

Analyses	Wheat flour (72%extraction)	Defatted soybean	Carrot powder	Resistant starch
Ash	0.51	6.28	4.77	0.30
Fat	1.20	3.46	2.53	0.09
Protein	10.68	50.35	6.72	0.72
Crude fibers	0.9	8.6	4.39	0.20
Total carbohydrates	87.08	31.31	40.59	98.69
Total dietary fibers	3.71	10.19	5.21	39.56
Cellulose	0.95	14.11	12.01	-
Hemicelluloses	1.82	8.31	3.86	-

Sensory characteristics of biscuits:

Equal volume from defatted soybean, carrot powder and resistant starch were mixture and fortified with wheat flour72% extraction at level 20, 30, 40 and 50%, respectively to produce biscuits. The biscuits were evaluated for their sensory characteristics and the results are reported in Table (2). The results presented in Table (2) show the effect of addition 20, 30, 40 and 50% of the dietary fiber sources to wheat flour on biscuits properties. It could be clearly observed that there no significant difference between wheat flour biscuits (control) and samples supplemented with 20, 30, and 40% of dietary fiber mixture sources for taste, color, texture and odor. Whereas, the addition of 50% dietary fiber mixture to wheat flour 72% extraction, the biscuits product had significantly decreased than control sample and gave lower score in all sensory evaluation parameters than control sample and other additions.

The color characteristics of biscuits showed to be darker with increase in concentration of dietary fiber mixture which enhanced consumer appeal up to 40 percent of incorporation. Similar trend to that of flavor scores was observed in case of color values of incorporated biscuits.

Textural profile plays an important role in justifying the overall acceptability of biscuits, here in case of dietary fiber mixture incorporated biscuits, slight improvement in crispiness of biscuits were observed in samples up to 40 percent of DSF, hence secured better scores while in case of biscuits containing 50 percent of dietary fiber mixture, the panelists reported dryness of mouth hence secured least scores.

The results of statistical analysis indicated that no significant difference was found between control sample and supplemented samples for all evaluated characteristics of biscuits contained 20, 30 and 40% dietary fiber mixture

Table (2): Effect of fortified wheat flour using different mixture dietary fiber sources on sensory evaluation of biscuit.

Blends	Shape 20	Taste 20	Color 20	Texture 20)	Odor 20	Over all acceptability 100
Control	18.6^{ab} ±0.56	18.7^{a} ±0.13	17.45^{ab} ±0.66	18.9^{a} ±0.11	19.2^{a} ±0.80	92..85
Blend 1	18.53^{ab} ±0.60	18.4^{a} ±0.39	17.0^{ab} ±0.92	18.6^{a} ±0.78	18.7^{a} ±0.17	91.23
Blend 2	17.13^{bc} ±0.23	18.1^{a} ±0.12	17.2^{ab} ±0.28	18.2^{a} ±0.48	18.7^{a} ±0.19	89.33
Blend 3	16.67^{ab} ±0.71	17.3^{a} ±0.44	18.4^{ab} ±0.16	17.3^{a} ±0.85	17.2^{a} ±0.62	87.87
Blend 4	16.03^{a} ±1.06	16.3^{a} ±0.12	18.0^{ab} ±0.28	16.9^{a} ±0.47	16.3^{a} ±0.29	83.53
LSD at 5%	1.654	1.287	1.713	1.413	1.126	

Control made from wheat flour 72% extraction.

Blend (1) mad from 20% dietary fiber (resistant starch, carrot powder and wheat bran) plus 80% wheat flour 72% extraction.

Blend (2) mad from 30% equal weight dietary fiber sources and 70% wheat flour 72% extraction.

Blend (3) mad from 40% dietary fiber plus wheat flour 72% extraction.

Blend (4) mad from 50 to 50% dietary fiber sources and wheat flour 72% extraction.

Biological evaluation:

At the end of experimental period the results are recorded in Table (3) and the data showed that loss in final weight of the hypercholesterolemia rats (positive control) the loss reached 42.5% than control negative. As well as the rats hypercholesterolemia fed on 20, 30, 40 and 50% of different dietary fiber sources mixture lost from its initial weight 11.4, 16.5, 21.2 and 25.3%., respectively . The results are in agreement with Holm et al (1995) mentioned that the addition of bile salts to the diet of experimental rat caused inhibition absorption of foods and led to decrement of body weight gain and feed efficiency ratio. Also, at the end of experimental period, the decrease in total food intake may be due to decrease of rate appetite or to the swelling of fiber which caused a feeling of satiety. These results are agreed with Higgins (2004) who reported that resistant starch ingestion increase satiety so it is possible that this effect could aid the success of weight loss and maintenance diets. In addition, it is well known that high fiber content leads to a low caloric intake.

Table (3): Mean of body weight of cholestremic rats fed different dietary fiber mixture sources diets.

Groups	Body weight			
	Initial (g)	Finial (g)	Gain (g)	Daily gain(g)
Control negative	155.0 ± 2.70[a]	312.0 ± 1.58[a]	156.6 ± 2.70[a]	5.22 ± 0.05[a]
Control positive	153.2 ± 2.58[a]	279.2 ± 4.43[a]	126.0 ± 2.44[b]	4.20 ± 0.04[b]
Blend 1	156.23±2.34[a]	276.53±3.51 [a]	120.3±1.954[b]	4.01±0.04[b]
Blend 2	154.98±2.13[a]	260.48±2.05[ab]	105.5±1.213[ab]	3.52±0.08[ab]
Blend 3	153.8 ± 3.49[a]	245.8 ± 1.92[b]	91.8 ± 5.10[b]	3.06 ± 0.08[c]
Blend 4	155.4 ± 2.6[a]	233.0 ± 2.34[c]	77.6 ± 4.04[c]	2.59 ± 0.07[d]
LSD at 5%	3.851	3.756	4.998	0.0825

Total lipid, triglycerides and total cholesterol were determined in blood serum experimental rats to evaluate the effect of hypercholesterolemia diet containing 20, 30, 40 and 50% dietary fiber mixture from defatted soybean, carrot powder and resistant starch. The obtained data are given in Table (4). Diets reach in dietary fiber, it could be noticed that there was significant decreased total cholesterol, cholesterol fractions (LDL and HDL), triglycerides, total lipid and blood glucose in rats fed on biscuits contained different levels of dietary fiber mixture. These results mean when dietary fiber mixture increased in biscuits the total lipid parameter, total cholesterol pattern and glucose levels were decreased in rats fed on biscuits made from 20, 30, 40 and 50% dietary fiber mixture. Similar results were obtained by Cheng and Lai (2000) who reported that serum cholesterol and triglyceride concentrations were clearly lower in rats fed diet containing amount of corn resistant starch. Also, Flores *et al.* (2004) mentioned that response in hamsters on serum lipidemic when fed on diets containing 2% cholesterol and different dietary fiber sources. Whilst, Gorecka et al (2002) reported that the cholesterol was absorbed in the highest degree by fiber and the absorption of bile acid by fiber.

However, more recent studies found interesting data illustrating that for every 10 g of additional fiber added to a diet the mortality risk of CHD decreased by 17–35% Streppel *et al.* (2008). Risk factors for CHD include hypercholesterolemia, hypertension, obesity and diabetes type two. It is speculated that the control and treatment of these risk factors underlie the mechanisms behind DF and CHD prevention. First, soluble fibers have been shown to increase the rate of bile excretion therefore reducing serum total and LDL cholesterol Story *et al.* (1997). Second, short chain fatty acid production, specifically propionate, has been shown to inhibit cholesterol synthesis Amaral *et al.* (1992). Third, dietary fiber demonstrates the ability to regulate energy intake thus enhancing weight loss or maintenance of a healthier body weight. Fourth, either through glycemic control or reduced energy intake, dietary fiber has been shown to lower the risk for diabetes type two. Fifth, DF has been shown to decrease pro-inflammatory cytokines such as interleukin-18 which may have an effect on plaque stability Esposito *et al.* (2003). Sixth, increasing DF intake has been show to decrease circulating levels of C-Reactive protein (CRP), a marker of inflammation and a predictor for CHD Ma *et al.* (2006).

Generally, feeding the rats diet containing 20, 30, 40 and 50% dietary fiber sources mixture as defatted soybean, carrot powder and resistant starch led to lower the level of serum cholesterol, triglycerides and total lipids.

Table (4): Means of serum cholesterol, triglyceride, total lipids and total sugar in rats fed on different sources of dietary fiber mixture.

Groups	Total Lipid (g/dl)	Triglyceride (mg/dl)	Total cholesterol (mg/dl)	HDL (mg/dl)	LDL (mg/dl)	Blood sugar (mg/dl)
Control negative	0.65 $\pm0.03^{d}$	112.3 $\pm6.1^{b}$	86.3 $\pm1.1^{d}$	83.7 $\pm10.0^{a}$	25.0 $\pm5.56^{d}$	115.3 $\pm5.7^{d}$
Control positive	1.42 $\pm0.17^{a}$	245.7 $\pm27.9^{a}$	196.3 $\pm6.5^{b}$	47.3 $\pm7.2^{d}$	131.7 $\pm20.2^{a}$	169.3 $\pm3.8^{a}$
Blend 1	1.12 $\pm0.59^{a}$	190.4 $\pm15.3^{b}$	150.2 $\pm3.4^{a}$	60.1 $\pm5.2^{c}$	85.4 $\pm12.3^{b}$	140.2 $\pm3.5^{b}$
Blend 2	0.97 $\pm1.02^{b}$	170.5 $\pm10.5^{b}$	140.6 $\pm4.1^{a}$	67.5 $\pm3.1^{c}$	77.3 $\pm9.8^{b}$	130.1 $\pm2.3^{b}$
Blend 3	0.78 $\pm0.13^{c}$	141.0 $\pm30.0^{b}$	127.0 $\pm7.0^{c}$	74.0 $\pm5.3^{b}$	49.67 $\pm10.0^{c}$	125.3 $\pm1.2^{c}$
Blend 4	0.73 $\pm 0.06^{c}$	118.7 $\pm9.07^{c}$	110.3 $\pm 3.5^{d}$	72.0 $\pm3.0^{b}$	50.3 $\pm 6.03^{c}$	120.6 $\pm1.2^{c}$
LSD at 5%	0.2120	40.272	14.152	1.956	22.594	6.6123

Effect of different diet composition on serum transamino-ferases:

Table (5) showed the mean values of SAST and SALT as a factor affecting liver function. The basal diet (negative control) showed SAST value 33.15 μ / L. The hypercholesterolemia rats (positive control), resulted an increase in SAST amounts by about 1.53 fold as that of negative control. Whereas, feeding 20, 30 and 40% different dietary fiber sources mixture, resulted was significant decreased in SAST by about 0.81, 0.41 and 0.21 fold as negative control. Mean while, 50% dietary fiber fed on hypercholesterolemia rats was equal resulted for negative control fed on basal diet. Also, the serum ALT activity on hypercholesterolemia rats fed on different dietary fiber sources mixture, the results showed that significant increased in positive control than negative control. Whereas, the rats fed on different blends fiber showed significant decreased than positive control till equal volume of negative control in blend 50% different fiber sources mixture.

Form the afore mentioned results, it can be suggested that the addition of different dietary fiber sources mixture at 20, 30, 40 and 50% levels to wheat flour 72% extraction to produce biscuits had significant acceptability and better sensory evaluation. Also, it can be recommended that the different dietary fiber sources mixture occurred reduction the serum lipid pattern and improvement liver lipids in hypercholesterolemia rats by using biscuits contained 40 and 50% dietary fiber.

Table (5): Serum AST (μ / L) and ALT (μ / L) activities in hypercholesterolemia rats fed on different dietary fiber sources mixture.

Groups	$_S$AST (SGOT) Activity	$_S$ALT (SGPT) Activity	$_S$AST / $_S$ALT ratio
Control negative	33.15[d] ± 3.91	25.43[c] ± 3.43	130.35
Control positive	83.92[a] ± 6.0	42.63[a] ± 7.1	196.86
Blend 1	60.02[b] ± 2.28	35.91[b] ± 4.91	167.14
Blend 2	49.54[c] ± 3.46	30.31[b] ± 2.89	163.44
Blend 3	40.26[c] ± 4.47	25.39[c] ± 2.28	158.57
Blend 4	34.50[d] ± 3.41	24.60[c] ± 2.36	140.24

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الألياف الغذائية كمصدر طبيعى لأنتاج بسكويت خافض لسكر وكوليسترول الدم فى الفئران

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تمت هذة الدراسة لانتاج بسكويت معد من وزن متساوى من مصادر طبيعية مختلفة للألياف الغذائية. هذة المصادر الغذائية تتكون من فول الصويا منزوع الدسم ومطحون الجزر والنشا المقاوم وتم تقدير التركيب الكيماوى لهذة المواد الخام. مخلوط الألياف الغذائية تم أستخدامة فى صناعة وإعداد البسكويت مع دقيق القمح (أستخلاص ٧٢%) على نسب ٢٠ و ٣٠ و ٤٠ و ٥٠% على التوالى وتم تسجيل التقييم الحسى . النتائج أوضحت أن فول الصويا منزوع الدهن مرتفع فى محتوى الدهون ٣.٤٦% والبروتين ٥٠.٣٥% كما أن النشا المقاوم غنى بالكربوهيدرات الكلية والألياف الغذائية الكلية ٩٨.٦٩ و ٣٩.٥٦% كما وجد أن فول الصويا منزوع الدهن ومطحون الجزر يحتوى على نسبة مرتفعة من السليلوز ١٤.١١ و ١٢.٠١% والهميسليلوز ٨.٣١ و ٣.٨٦% على التوالى. التحليل الأحصائى للصفات الحسية لخلطاط البسكويت. النتائج أوضحت عدم وجود أختلاف بين العينة القياسية وعينات البسكويت المعدة من الألياف الغذائية حتى ٤٠%.

الألياف الغذائية تعمل على خفض الكولسترول وسكر الدم لذلك تم إجراء تجربة بيولوجية على الفئران بحيث تم رفع نسبة الكولسترول وسكر الدم لمجاميع الفئران التى سوف تتغذى على البسكويت المعد من مخلوط الألياف الغذائية وتم تقدير كل من سكر الدم والكولسترول الكلى والجلسريدات الثلاثية والليبيدات الكلية والبروتين الدهنى عالى ومنخفض الكثافة و نشاط الإنزيمات الناقلة لمجموعة الأمين. أوضحت النتائج فى نهاية التجربة كلما زادت نسبة الألياف الغذائية المختلفة فى البسكويت كلما انخفض كل من الكولسترول الكلى ١٩٦.٣ مليجرام / ديسيليتر فى المجموعة القياسية الموجبة التى تغذت على الوجبة القياسية الى ١١٠.٣ مليجرام / ديسيليتر فى المجموعة التى تغذت على الوجبة القياسية المحتوية على ٢٠% من البسكويت المصنع من ٥٠% ألياف غذائية وكذلك بالمثل الجليسريدات الثلاثية من ٢٤٥.٧ الى ١١٨.٧ مليجرام / ديسيليتر واللبيدات الكلية من ١.٤٢ الى ٠.٧٣ جرام / ديسيليتر وسكر الدم من ١٦٩.٣ الى ١٢٠.٦ مليجرام / ديسيليتر أيضا كلما زادت نسبة مخلوط الألياف الغذائية المختلفة فى تغذية فئران التجارب المصابة بارتفاع الكولسترول وتأثيرها على نشاط الإنزيمات الناقلة لمجموعة الأمين وأوضحت النتائج إن الألياف الغذائية عملت على إعادة ضبط نشاط الإنزيمات الناقلة لمجموعة الأمين حول معدلها فى الفئران المصابة بارتفاع الكولسترول وسكر الدم لذلك يمكن أن نوصى باستخدام هذه المصادر المختلفة للألياف الغذائية فى تصنيع البسكويت وأيضا تحسين وظائف الدم والكبد فى الفئران المصابة بارتفاع فى نسبة الكولسترول وسكر الدم .