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Hypocholesterolemic Properties Of Some Bakery Products Supplemented With Orange, Tomato And Carrot Fibers

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Abstract

The main objectives of this study were the utilization of some fruits and vegetable waste including orange pulp, tomato pomace and carrot pulp as different source of dietary fiber. Dietary fiber of experimental fruits and vegetable wastes were used in preparation of high fiber pies and Balady bread at levels (5, 7.5 and 10 %) dietary fiber. Thirty adult male rats, weighting 85 ± 3g, rats were classified into control group fed basal diet and four groups fed basal diet with 0.25 cholesterol for 5 weeks to induce hypercholesterolemia then the diet was administered with the best dietary fiber Balady bread 7.5 % dietary fiber of orange pulp, tomato pomace and carrot pulp for another 5 weeks.

The results showed the rheological properties of dough pies substituted with different levels of dietary fibers increased the water absorption, arrival time and development time compared to the control. Sensory characteristics of pies were improved as a result of using the dried carrot and orange pulps at 7.5% level. Rheological properties of dough produced by wheat flour 82% and that substituted with dietary fibers in producing Balady bread showed that water absorption, arrival time, dough, development time, dough stability, resistance to extension and proportional number increased with the increase in the level of dietary fibers. The results of Balady bread produced showed that the loaf height and volume decrement were according to the levels of dietary fibers added. Sensory evaluation indicated that addition of these wastes with percentages 5% or 7.5% was the best. The results indicated that rats fed on diets containing 7.5% of dried orange pulp, tomato pomace and carrot pulp decreased the body weight gain and reduced serum

cholesterol, low density lipoprotein cholesterol, total lipids, triglycerides andsodium and copper elements in rats.
In conclusion, the diet supplemented with dietary fiber from orange pulp, tomato pomace and carrot pulp have hypocholestermic effects, improved liver function and decreaseserum sodium and copper.
Key words: Hypercholesterolemia, Fiber, Orange, Tomato, Carrot, Bakery products, Baladybread.

Introduction

The major components of dietary fibers are cellulose, hemicellulose, pectin, hydrocolloids and lignin. The diets rich in fiber such as cereals, nuts, fruits and vegetables have a positive effect on health since their consumption has been related to decreased incidence of several diseases. Dietary fiber can be used in various functional foods like bakery, drinks, beverages and meat products**(Devinderet al., 2012).**Physicochemical properties of wheat bread supplemented with orange peel by products were studied by **(Wisalet al., 2013)** and found that fiber as a food industry by- products is recommended to be used as a food additives to gain nutritional and healthy benefit. **Sharobaet al., (2013)** studied the utilization of some fruits and vegetables waste as a source of dietary fiber and its effect on the cake making and its quality attributes. **Sara and Sherry (2010)** reported that carrots of many colors provide basic nutrition and bioavailable phytochemicals acting as a functional food. Chemical profile, functional and antioxidant properties of tomato peel fiber were studied by **(Inmaculladaet al., 2011)** and found that the content of total dietary fiber (TDF) was84.16% and the major fraction was the IDF (71.82%), formed mainly by hemicelluloses. The chemical, rheological and biological evaluation of grape pomace utilized in sponge cake production were studied by **(Yonis and El-Desouky, 2003).** They found that the best rheological properties of dough, containing different levels of dried grape pomace, proved to be at 7.5% level. Also, the results indicated that rats fed on diets, containing grape pomace, showed a decrease in their level of blood cholesterol.
Shchelkunov(2001) found that grape dietary fibers at the levels of 5 – 15% of the daily ration improved animals metabolic process, reduced the blood serum cholesterol level and lowered the glucose level. The utilization of different sources of dietary fibers such as apple peels and wheat bran to lower blood cholesterol was studied by **(May, 2002)** and

found that adding dietary fiber improved the colour, taste, odor and texture of biscuits.

Hafez and El-Hafez (2004) studied the use of orange pulp, grape and apple pomaces in the preparation of high fiber cakes. The results showed that these by-products were increased the water absorption, decreased the mixing stability of dough and reduced the level of serum cholesterol of rats. **(Sulieman, 2000)** produced high soluble dietary fibers by-product from the orange and lime peels to use a fiber supplement in bread making.

Elleuchet al., (2011) mentioned thatdietary fiber can also impart some functional properties to foods, e.g., increase water holding capacity, oil holding capacity, emulsification and gel formation**.** found that apple pomace and orange peel contained 78.2-89.8% and 64.3% total dietary fiber (as dry matter).

Otherwise, **James and Haub (2010)** studied the effects of dietary fiber and its components of metabolic health and reported that an inverse relationship between fiber consumption and the risk for coronary heart disease and several types of cancer. **Anyakudoand Omotayo (2015)** found that high intake of dietary fat caused significant increase in total body weight, altered ultrastructure of pancreatic tissue and hyperlipidemia in diabetic rats and recommended that dietary fats in diabetic menu should be rationalized to minimize cardiovascular and metabolic risks associated with high-fat diets. Rheological properties and quality evaluation of Egyptian balady bread and biscuits supplemented with flours of ungerminated and germinated legume seeds or mushroom were studied by **(Eissaet al., 2007)** the results obtained indicated that raw and germinated legumes flour could constitute a good alternative for balady bread manufacture.

Orange pulp, tomato pomace and carrot pulp are the most important wastes remaining after the processing of orange, tomato and carrot. These wastes represent about (45 – 58%, 15 – 30% and 35 – 50%) of the fresh orange, tomato and carrot, respectively.The total world production of oranges, tomatoes and carrots were 71.445.353, 163.963.255 and 37.226.640 metric tons, respectively during 2013 **(FAO, 2013).** Egypt produced 2.886.015, 8.533. 803 and 183.906 tons oforanges, tomatoes and carrots, respectively during 2013**(Statistical report, Ministry of Agriculture, Giza, Egypt).**

Therefore, the present objective was carried out to determine the chemical composition and biological effect of orange pulp, tomato pomace and carrot pulp on the metabolism of fats in rats and the possibility of utilization of these wastes in Balady bread and pies processing as a source of dietary fibers.

Materials And Methods

Materials:

A. The by-products of Baladi orange (Citrus sinensis), Tomatoes (Lycopersiconesculentum)andcarrots (Daneuscarrota L.) were obtained from Vitrac Company, Kalyobiya. Wheat flour (82%) was obtained from the South Cairo Mills Company, at Cairo. Hard wheat flour (72%) was obtained from Cairo Co. for milling and baking, Cairo, Egypt. The other materials such as sucrose, yeast, salt (NaCl)), shortening, skimmed milk powder were obtained from the local market, Giza, Egypt.
B. Cholesterol was obtained as a pure white crystalline powder, obtained from El-Gomhouria Company for Medical Preparations, Cairo Egypt.
C. The basal diets was composed of corn starch (491), casein (200), corn oil (50), vitamins mixture (20), salt mixture (100), cellulose (30), choline (3) and sucrose(100) in g/kg diet according to **NRC (1995).**The hypercholesterolemic diet was basal diet with addition of 2 % cholesterol to induce hypercholesterolemia.
D. Experimental animals: thirty adult male white albino rats (Sprague Dawley strain) weighing 85 ± 3 g were obtained from of the research institute of ophthalmology, Giza, Egypt.

Methods:

1. Preparation of raw materials:

Drying method used for orange pulp, tomato pomace and carrot pulp are shown in Fig. 1.

Fig. 1

Raw materials
(Orange pulp, tomato pomace and carrot pulp)
↓
Soaking in citric acid 0.5% + NaClfor 5 min at 30 ℃
↓
Dehydration by air drying in an electric oven at 60℃ for 10 hrs
↓

The dehydrated samples were ground, sieved and packed in glass jars then stored at room temperature.

2.Chemical Analysis:

Moisture content, crude protein, total ash and crude fibers were determined according to the methodsdescribed in the **A.O.A.C. (2012).** Pectin was determined calorimetrically by carbazole sulfuric acid method according to the method described by **Reitmier and Lore (1996).**

Total dietary fiber was determined according to the method described by **Asp et al., (1983)**. Sodium and copper were determined using Berkin- Elmer Atomic Absorption Spectrophotometer as described in the **A.O.A.C. (2012).**

3. Rheological properties:

The farinograph instrument was used to determine the water absorption, arrival time, development time, stability mixing tolerance index and degree of softening of dough containing different levels (5, 7.5 and 10%) of dried orange pulp, tomato pomace and carrot pulp as described in **A.A.C.C. (2000).**

Extensograph test was carried out according to the method described by**A.A.C.C.(2000)**to measure the dough extensibility, resistance to extension, proportional number and dough energy.

4. Processing of Balady bread:

Balady bread was prepared by mixing each 100 gm flour 82% extraction (as a control) and replaced by 5,7.5 and 10% orange pulp, tomato pomace and carrot pulp in addition to 3 g compressed yeast, 2g sodium chloride and water (according to the farinograph test). The mixture was mixed in a mixture, (250 rpm) for 3-13 min, according to the farinograph test, then the dough was left for fermentation at 30 ℃ and 85% relative humidity for 30 min. After fermentation the dough was divided into 160 gm pieces. Each piece was mouled on a wooden board previously covered with a few flour and left to ferment for about 15 min, at the same mentioned temperature and relative humidity. The fermented dough pieces were flattened leaver were proofed at 30 – 33 ℃ and 85% relative humidity for one hour, then baked at 450 – 500 ℃ for 1 – 2 min in a rotary oven. The loaves were allowed to a cool in racks for about one hour before sensory evaluation **(Atia, 1986).**

5. Preparation of pies:

Pies were prepared according to the method of **A.A.C.C. (2000**). The supplementation with oranges, tomatoes and carrots by-products was within 5, 7.5 and 10%. The pies doughs were fermented for 60 min. at 30 ℃. Then, baked at 230℃ for 25 min.The constituents of pies are shown in Table (1).

Table (1):Formulation of pies supplemented with orange pulp, tomato pomaceand carrot pulp.

Ingredients (g)	Pies (supplemented with)									
	Contr	Orange pulp			Tomato poma			Carrot pulp		
Wheat flour (72%	100	95	92.5	90	95	92.5	90	95	92.5	90
Orange pulp	-	5	7.5	10	-	-	-	-	-	-
Tomato pomace	-	-	-	-	5	7.5	10	-	-	-
Carrot pulp	-	-	-	-	-	-	-	5	7.5	10
Sugar	10	10	10	10	10	10	10	10	10	10
Shortening	10	10	10	10	10	10	10	10	10	10
Skimmed milk powder	4	4	4	4	4	4	4	4	4	4
Yeast	1	1	1	1	1	1	1	1	1	1
Salt	1	1	1	1	1	1	1	1	1	1

6. Sensory evaluation:

Sensory evaluation of Balady bread was conducted by 10 panelists from the Food Technology Research Institute, Giza, Egypt. according to (**Atia, 1986**). Pies were evaluated for various qualities such as crust and crumb color, odor, taste and texture according to **Renoz (1975).**

7. Biological evaluation:

Experimental design

The rats were housed in wine cages under the normal laboratory conditions and fed on basal diet for five days as adaption period food and water were provided ad-libitum.

The rats were randomly classified into five groups of six rats each. The first group was a control fed on basal diet only while the others four groups were fed on hypercholesterolemic diet. The hypercholesterolemic groups were reclassified into control + and other three groups fed on experimental vegetable in 7.5 % of diet as constituent of dietary fibers which were orange pulp, tomato pomace and

carrot pulp groups. The experiment continued for five weeks (35 day). The food intake was estimated daily and body weight gain was recorded weekly at the end of the experiment the rats were anesthetized and blood samples were collected from hepatic vein in clean centrifuged tubes.

Biochemical analysis

The blood was left to coagulate then centrifuged at 3000 rpm for 15 min to obtain serum.Total cholesterol level was determined in the blood serum as mentioned by **Meiattini*et al.*, (1978).**

Total lipids on blood serum were determined by kits **(Schmit, 1964).** Total cholesterol in the serum was determined by the method of **Schettler and Nussel (1975).** Enzymatic colorimetric determination of triglycerides was determined according to **Fossati and Prencipe (1982)**. The determination of low density lipoprotein (L.D.L.) was carried out according to the method of **Burstein *et al.*, (1970)**. Liver function tests of rats: ALP (Alkaline phosphatase) was determined by phenyl phosphatase method as described by **Polin*et al.*, (1962).** GOT (Glutamic Oxaloacetate Transaminase) and GPT (Glutamic Pyruvic Transaminase) were determined by malic dehydrogenase coupled spectrophotometric method (25 ℃) according to **De Ritis*et al.*, (1965).**

8. Statistical analysis:

Data for sensory and biological evaluation were statistically analyzed according to **Snedecor and Cochran (1982).** Least significant difference (L.S.D.) was calculated at 0.05 level as significance.

Results And Discussion

1. Chemical analysis of dried orange pulp, tomato pomace and carrot pulp:

The chemical analysis of total fibers and alcohol insoluble residues of dried orange pulp are presented in Table (2). From these data it could be noticed that orange pulp, tomato pomace and carrot pulp contained 82.17, 79.06 and 81.22% of total fibers including pectin (on dry weight basis), respectively. Meanwhile, total pectin represented 36.40, 29.94 and 27.97%, respectively. Degree of esterification of pectin in orange pulp was high (81.43) followed by tomato pomace (56.79), while carrot pulp recorded the lowest value of D.E. (22.48).

Furthermore, the total protein of orange, tomato and carrot wastes represented 7.12, 8.98 and 6.23, respectively. From the same table it could be indicated that orange pulp contained the highest percentage of protein followed by orange pulp. These results are similar to those obtained by (**Elleuch*et al.*, 2011** and **Devinder*et al.*, 2012**).

2. Effect of supplementation of wheat flour (72% extraction) with different levels of dietary fibers:

The farinograph test of dough pies made from wheat flour (72% extraction) substitute with different sources of dietary fibers (orange pulp, tomato pomace and carrot pulp) with the percentage of 5, 7,5 and 10% and also the control sample. Data in Table (3) show that the addition of dried orange pulp, tomato pomace and carrot pulp at different levels increased the water absorption%, arrival time (min.)and development time (min.) of the dough as compared with the control sample, while this increment was found to be related to the levels of dietary fiber. Results in the same table indicate that, the stability (min.) of dough decreased by the addition of different levels of dietary fibers in the dough. Otherwise, mixing tolerance index and degree of softening (B.U.) increased by the addition dietary fibers. These results are in accordance with those obtained by (**Yonis and El-Desouky, 2003** and **Wisal*et al.*, 2013**).

3. Sensory evaluation of pies:

Sensory characteristics of pies with dried orange pulp, tomato pomace and carrot pulp are presented in Table (4). These sensory characteristics included crumb color, odor, taste, mastication, texture and crust color. It could be seen that sensory characteristics of pies were improved upon the use of dried carrots and orange pulps. The maximum improvement in sensory characteristics of the prepared pies was obtained when dried carrot pulp was used at 7.5% level followed by dried orange pulp, while pies supplemented with dried tomato pomace recorded the lowest score for the tested parameters. These results are

similar to those obtained by (**Hafez and El-Hafez, 2004** and **Sharoba*et al.*, 2013**).

Table (2):Chemical analysis of total fibers and alcohol insoluble residues of orange pulp, tomatopomace and carrot pulp (on dry weight basis).

Samples	Total dietary fibers	Total pectin	DE*	Total protein
Orange pulp	82.17±3.22	36.40±1.56	81.43±3.16	7.12±1.36
Tomato poma	79.06±4.13	29.94±2.12	56.79±4.12	8.98±2.11
Carrot pulp	81.22±2.06	27.97±3.22	22.48±1.62	6.23±1.13

DE* = Degree of esterification of pectin. ± = Means standard error.
All results are expressed as mean ± SD

Table (3): Farinograph parameters of wheat flour (72% extraction) substituted with orange pulp, tomato pomace and carrot pulp dietary fibers.

By-products% i the blend	Water absorption%	Arrival time (min)	Development time (min)	Stability (min)	Mixing tolerance index (B.	Degree of softening (B.U.)
Control	57.0	1.5	2.0	8.0	25	60.0
Orange pulp						
5	65.6	2.5	3.0	6.5	45	90
7.5	66.8	3.0	4.5	5.5	50	110
10	68.2	3.5	6.0	5.0	60	120
Tomato pulp						
5	67.8	2.0	2.5	7.5	50	90
7.5	68.5	2.5	4.0	6.5	55	100
10	70.1	3.0	5.5	6.0	60	110
Carrot pulp						
5	67.9	2.0	3.0	6.0	55	100
7.5	68.7	2.5	4.5	5.0	60	110
10	70.2	3.5	6.0	4.5	65	125

Table (4):Sensory evaluation of pies supplemented with orange pulp, tomato pomace and carrot pulp dietary fibers.

Pies samples	Crumb color (10)	Odor (25)	Taste (25)	Mastication (20)	Texture (10)	Crust Color (10)
Control	9.1±0.20	21.4±0.38	22.0±0.51	18.3±0.39	9.2±0.15	9.1±0.20
Pies with 5% (O.P.)	9.2±0.18	22.5±0.40	22.8±0.47	19.0±0.46	9.5±0.22	9.4±0.15
Pies with7.5% (O.P.)	9.4±0.21	23.2±0.31	23.0±0.43	19.2±0.53	9.4±0.13	9.5±0.26
Pies with 10% (O.P.)	9.3±0.16	22.1±0.34	22.5±0.38	18.5±0.19	9.2±-.28	9.2±0.30
Pies with 5% (T.P.)	9.0±0.15	20.2±0.28	21.5±0.53	18.5±0.23	9.3±0.16	9.1±0.18
Pies with7. 5% (T.P.)	8.8±0.22	19.7±0.32	21.1±0.49	18.3±0.38	9.1±0.21	8.9±0.23
Pies with 10% (T.P.)	8.5±0.17	19.3±0.35	20.7±0.36	18.0±0.51	9.0±0.30	8.7±0.28
Pies with 5% (C.P.)	9.3±0.25	22.6±0.43	22.4±0.58	18.8±0.44	9.6±0.33	9.3±0.32
Pies with 7.5% (C.P.)	9.5±0.30	23.4±0.45	22.9±0.52	18.4±0.28	9.5±0.17	9.2±0.14
Pies with 10% (C.P.)	9.4±0.28	22.9±0.49	22.1±0.45	18.1±0.56	9.2±0.23	9.1±0.27
L.S.D at 0.05	0.647	1.095	1.071	0.986	0.589	0.542

(O.P) : Orange pulp. (T.P.): Tomato pomace. (C.P.) : Carrot pulp
All results are expressed as mean ± SD.

4. Effect of dietary fibers on the properties of wheat flour dough (82% extraction) and dough substitutes:

The farinograph parameters of dough prepared from wheat flour (82%) substituted by 5,7.5 and 10% orange pulp, tomato pomace and carrot pulp dietary fibers are presented in Table (5). The obtained data reveal that water absorption of flours increased gradually with increasing the added levels of dietary fibers. The arrival time, development time and stability time (min) of dough increased with increasing the added levels of dried orange pulp, tomato pomace and carrot pulp compared with the control. The dough supplemented with carrot pulp recorded the highest value of water absorption, arrival time, development and stability times followed by dough supplemented with tomato pomace, while dough supplemented with orange pulp recorded the lowest values. Otherwise, dough weakness decreased gradually with increasing the added different levels of dietary fibers compared to the control sample. These results are in agreement with those of **Laban (2001).** From the same table, extensograph parameters showed that extensibility of dough

decreased with increasing the level of dietary fibers. Meanwhile, the resistance to extension increased with increasing the replacement level of dietary fibers. These results are similar to those obtained by (**Eissa*et al.* 2007**and **Hussein *et al.*, 2013**).

Table (5):Effect of dietary fibers on the properties of wheat flour dough (82% extraction).

Substitution in the blends	Farinograph					Extensograph			
	Water absorption	Arrival time (min.)	Developn time (min	Stabi time (min.	Dough weakness *+(B.U)	Extensibil (min.)	Resistanc +(B.U)	Proportio number	Energ (cm2)
Control ble	55.2	1.5	3.0	5.5	90	126	290	2.3	29
Orange pul									
5%	58.3	2.0	3.5	6.0	80	97	427	4.40	31
7.5%	60.4	2,5	4.5	7.0	70	60	1146	19.10	48
10%	62.9	3.0	6.0	8.0	50	55	1023	18.60	53
Tomato pomace									
5%	65.3	3.5	5.5	10.0	60	105	574	5.47	35
7.5%	66.5	4.0	6.0	11.0	40	86	1976	22.98	51
10%	68.1	4.5	7.0	12,5	30	70	1360	19.43	60
Carrot pulp									
5%	67.5	4.0	6.5	10.5	70	90	512	5.69	40
7.5%	69.0	4.8	8.0	12.0	60	65	1418	21.81	57
10%	70.2	5.5	9.0	14.0	50	54	1029	19.05	65

*+(B.U.) : Brabender units.

5. Effect on the quality and sensory properties of Balady bread:

a. Quality properties of Balady bread:

The results presented in Table (6) reveal the effect of orange pulp, tomato pomace and carrot pulp at 5, 7.5 and 10% levels on weight, higher volume and specific volume of Balady bread.

It could be indicated that all samples were approximately in loafs weight within 1-4 grams differences. The loaf height decreased gradually according to the dietary fibers added compared to the control. The Balady bread samples substituted with carrot pulp dietary fibers recorded the highest scores of quality properties followed by orange pulp, while Balady bread supplemented with tomato pomace recorded significant decreased. Balady bread samples supplemented with 5% dietary fibers recorded the highestscores of quality properties followed

by 7.5% dietary fibers. These results are in agreement with those of **(Eissa*et al.*, 2007).**

b. Sensory evaluation of Balady bread:

Results presented in Table (6) show the sensory characteristics of Balady bread produced from wheat (82%) and replacement with 5,7.5 and 10% dietary fibers. The properties included loaf emitary, layer separation, surface color, crumb texture and color, crust color as well as odor, taste and overall acceptability. Total scores were expressed as excellent (90 – 100), very good (80 – 89%), good (70 – 79%) and refused (less than 70%). Results show that no significant differences in all the properties between the 5, 7.5 and 10% dietary fiber in Balady bread, whereas the total scores were very good except for Balady bread supplemented with 10% tomato pomace dietary fibers. From the same table, it could be noticed that overall acceptability and total scores of sensory properties were slightly decreased by increasing the levels of dietary fibers in Balady bread. These results are in accordance with those obtained by (**Hussein *et al.*,2013**).

6. Body weight gain, food intake and food efficiency ratio (FER) of different experimental rats groups:

Table (7) shows the food intake and body weight gain and food efficiency ratio for Albino rats fed with dietary fibers for 35 days. It could be noticed that rats fed on the control diet without the addition of dietary fibers or cholesterol recorded the significant increase of final body weight, gain in body weight, daily gain in body weight, daily food intake for rats and feed efficiency, while rats fed on the control diet supplemented with cholesterol recorded significant decreased. The rats fed on diets supplemented with 7.5% orange and carrot pulps recorded significant increase of gain in body weight, daily gain in body weight and daily food intake compared with rats fed on diets supplemented with 7.5% tomato pomace or control diet with the addition 0.25% cholesterol. These results are in agreement with those found by (**Yonis and El-Desouky,2003** and **Anyakudo and Omotayo, 2015**) who reported that consumption of high dietary fat altered blood lipid profile with significant weight gain consumption.

Table (6):Quality and sensory properties of baladybread supplemented with dietary fibers from dried orange pulp, tomato pomace and carrot pulp.

Balady bread samples		*Quality properties				Sensory properties									
**W.F 82%	***D.F.%	Weight (g)	Higher (cm)	Volume (cm)	Specific volume (cm3/g)	Sematir (10)	Layer Separat (10)	Surface Color (10)	Crumb		Crust color (10)	Odor (10)	Taste (10)	Overall acceptabil (20)	Total Score (100)
									Texture (10)	Color (10)					
100	0	145.20	5.1	575	3.96	9.14	8.91	9.18	9.10	9.15	9.20	9.17	9.30	18.65	91.80
95	5% (O.P.)	146.40	4.3	498	3.40	8.35	8.36	8.52	8.45	8.3o	8.35	895	8.90	17.28	85.46
92.5	7.5% (O.P.)	147.23	4.1	467	3.17	8.26	8.31	8.29	8.13	8.10	8.04	8.76	8.65	16.31	82.85
90	10% (O.P.)	148.10	3.8	435	2.94	8.21	8.10	7.96	7.78	7.70	7.80	8.51	8.48	15.60	80.14
95	5% (T.P.)	145.97	4.2	482	3.30	8.00	8.28	8.75	8.67	8.20	8.11	8.47	8.76	16.70	83.94
92.5	7.5% (T.P.)	146.81	4.0	461	3.14	8.10	8.17	8.43	8.30	8.04	7.92	8.19	8.51	15.92	81.58
90	10% (T.P.)	147.53	3.6	428	2.85	7.90	7.96	8.11	7.92	7.50	7.45	7.93	8.34	14.56	77.67
95	5% (C.P.)	147.30	4.4	511	3.47	8.29	8.43	9.05	9.00	8.50	8.58	8.86	9.15	17.69	87.55
92.5	7.5% (C.P.)	148.06	4.2	486	3.28	8.36	8.39	8.87	8.75	8.35	8.36	8.68	9.03	16.91	85.70
90	10% (C.P.)	148.90	4.0	459	3.08	8.31	8.26	8.65	8.56	8.12	8.15	8.45	8.71	16.10	83.35
*Means of three measurements						L.S.D at 0.05= 0.7	0.54	0.56	0.72	0.60	0.62	0.68	0.61	1.16	

**W.F. : Wheat flour (82%). ***D.F. : Dietary fiber
(O.P.) = Orange pulp (T.P.) = Tomato pomace. (C.P.) = Carrot pulp.

Table (7):Body weight gain, food intake and food efficiency ratio (FER) of different experimental rats groups.

Variables / Groups	I.b.w g/rat	F.b.w. g/rat	Gain in body		D.g. in b.w. (g/rat)	D.F.i. for rat (g/rat)	(F.E.R.)
			g/rat	%			
Control (-)	82±2[a]	115±3[a]	33±1[a]	40.24	0.94	8.08±0.1[a]	0.116±0.002[a]
Control (+)	85±3[a]	105±4[c]	20±0.5[d]	23.52	0.57	5.02±0.5[c]	0.113±0.001[c]
Orange pulp	83±4[a]	108±2[b]	25±1.2[b]	30.12	0.71	6.36±0.6[b]	0.112±0.003[d]
Tomato	88±2[a]	110±3[ab]	22±0.6[c]	25.00	0.63	5.54±0.8[b]	0.114±0.001[c]
Carrot pulp	85±4[a]	110±4[ab]	25±1.3[b]	29.41	0.71	6.25±0.5[b]	0.114±0.002[b]

Mean values in each row having different superscript (a, b,c,d…) are significant different at $p < 0.05$

I.b.w. = Initial body weight. F.b.w. = Final body weight.

D.g. in b.w. = Daily gain in body weight. D.F.i. for rat = Daily food intake for rat.

F.E. = Feed efficiency. Values are means ± SD

7. Effect of dietary fibers on the fat profile in Albino rats:

The results in Table (8) show the effect of dietary fibers on serum cholesterol, low density lipoprotein cholesterol, total lipids and triglycerides in rats after 5 weeks. It could be noticed that rat fed on the control diet supplemented with 0.25% cholesterol recorded significant increase of cholesterol, L.D.L, total lipids and triglycerides followed by rats fed with control diet without the addition of cholesterol. Besides, rats fed on diets supplemented with 7.5% orange pulp tomato pomace and carrot pulp recorded lower concentration of serum cholesterol, low density lipoprotein cholesterol, total lipids and triglycerides than rats fed on negative or positive control diets (-or+ cholesterol). On the other side, rats fed with diets containing 7.5% carrot pulp recorded the lowest concentration of cholesterol, L.D.L. and total lipids followed by rats fed on 7.5% tomato pomace, while rats fed on diets supplemented with orange pulp recorded higher concentration of cholesterol, L.D.L. and total lipids. Besides, rats fed on diets supplemented with tomato pomace recorded lower concentration of triglycerides compared with those fed on diets supplemented with orange pulp or carrot pulp. These results are in accordance with those reported by (**Shchelkunov, 2001; May, 2002** and **James and Haub, 2010)**.

8. Effect of dietary fibers on liver function tests:

Data in Table (9) reveal that, the effect of dietary fiber on liver functional tests GOT (Glutamic Oxaloacetate Transaminase), GPT and ALP (Alkaline Phosphatase) in Albino rats after 5 weeks. The GOT was 126.39 and 147.66 U/L for the negative and positive control, respectively. While, it was 115.22, 109.55 and 106.77 U/L for rats fed on diet containing 7.5% percentage of orange pulp, tomato pomace and carrot pulp, respectively. On the other hand, GPT was 59.89 and 65.92 U/L for the negative and positive control, respectively. Meanwhile, it was 58.96, 54.36 and 55.78 U/L for rats fed on diet supplemented with orange pulp, tomato pomace and carrot pulp, respectively. Besides, the ALP was 133.96, 148.93, 131.99, 133.92 and 130.86 for rats fed with negative and positive control, orange pulp, tomatopomace and carrot pulp, respectively. From the same table, it could be noticed that GOT, GPT and ALP values were lower on serum of rats fed on diet supplemented with orange pulp, tomato pomace and carrot pulp compared with negative and positive control. These results indicate that rats fed on the diet supplemented with orange pulp, tomato pomace and carrot pulp as a source of dietary fibers had an improvement of the liver functional tests. Besides, rats fed on diet containing carrot pulp recorded lower level of GOT, GPT and ALP than the other treatments. Similar results were obtained by (**May, 2002** and**Onyeie*et al.*, 2012).**

Table (8):Effect of dietary fibers on serum cholesterol, low density lipoprotein, total lipids and triglycerides at the end of study.

Groups / Variables	Hypercholester in group				
	Control (-	Control (+)	Orange pul 7.5 %	Tomato poma 7.5 %	Carrot pulp 7.5 %
Cholesterol (mg/d	271.56±7.2	599.11±20.4	227.66±7.2	213.77±7.62^{d}	205.32±6.12^{d}
L.D.L. (mg/dl)	255.79±6.9	515.76±19.6	213.62±7.5	196.42±6.98^{d}	189.71±5.62^{e}
Total lipids (mg/d	597.39±7.8	630.45±22.9	445.96±9.2	415.83±7.79^{d}	410.55±7.91^{d}
Triglycerides(mg/	99.22±4.88	99.22±5.79^{a}	60.36±5.13^{b}	56.39±3.32^{b}	59.22±4.21^{b}

Mean values in each row having different superscript (a, b,c,d…) are significant different at $p < 0.05$
*L.D.L. = Low Density Lipoprotein. All results are expressed as mean ± SD

Table (9): Serum aminotransferase enzymes activity GOT, GPT and alkaline phosphatase levels of different experimental rats groups.

Tests	Control (-)	Control (+)	Orange pulp	Tomato poma	Carrot pulp
G.O.T.	126.39±4.11^{b}	147.66±5.14^{a}	115.22±4.21^{c}	109.55±5.16^{c}	106.77±5.22^{cd}
G.P.T.	59.89±3.61^{b}	65.92±2.91^{a}	58.96±3.24^{b}	54.36±3.42^{bc}	53.78±3.16^{c}
A.L.P.	133.96±5.70^{b}	148.93±5.76^{a}	131.99±6.33^{b}	133.92±7.34^{b}	130.86±5.22^{b}

Mean values in each row having different superscript (a, b,c,d…) are significant different at $p < 0.05$
G.O.T. = Glutamate Oxaloacetate Transferase. G.P.T. = Glutamate Pyruvate Transferase.
A.L.P. =Alkaline Phosphatase. All results are expressed as mean ± SD.

9. Effect of dietary fibers on serum sodium and copper in rats:

Table (10) shows the effect of dietary fiber on serum sodium and copper in rats after 5 weeks. It could be indicated that rats fed on diet supplemented with 7.5% dried orange pulp, tomato pomace and carrot pulp recorded significant decreased of sodium and copper elements compared with negative and positive control. Meanwhile, rats fed on carrot pulp recorded significant decreased of sodium and copper followed by rats fed with diet supplemented with orange pulp. While, rats fed on diet supplemented with tomato pomace recorded significant increase of sodium and copper elements compared with the carrot and orange pulps. Theseresultsare similar to those obtained by **(May, 2002).**

Table (10): Effect of dietary fibers on serum sodium and copper (mg/100 ml) of different experimental rats groups.

Tests	Control (-)	Control (+)	Orange pulp	Tomato poma	Carrot pulp
Sodium	201.03±7.92^{a}	147.66±5.14^{c}	190.26±8.11^{a}	196.39±7.91^{a}	180.73±8.72^{b}
Copper	111.82±6.11^{b}	113.96±6.57^{b}	90.66±5.26^{c}	91.13±5.62^{c}	85.22±4.17^{cd}

Mean values in each row having different superscript (a, b,c,d…) are significant different at $p < 0.05$
All results are expressed as mean ± SD.

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التأثير الخافض للكوليسترول لبعض منتجات المخابز المدعمة بألياف البرتقال والطماطم والجزر

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الملخص العربى

يهدف هذا البحث إلي دراسة تأثير إضافة بعض الألياف الغذائية من مخلفات البرتقال والطماطم والجزر بنسبة ٥ ، ٧.٥ ، ١٠% كمصدر للألياف فى صناعة الفطائر والخبز البلدى وتم تقدير الخواص الريولوجية والتقييم الحسى لكليهما. وبدراسة الخواص الريولوجية وجد أن عملية الإستبدال بمخلفات البرتقال، الطماطم والجزر المجففة فى صناعة الفطائر تزيد من نسبة إمتصاص العجينة للماء وفترة تكوين العجينة ودرجة المسامية ودرجة ضعف العجينة. كما أظهرت الخواص الحسية تحسناً ملحوظاً فى كل من اللون والرائحة والطعم للفطائر المضاف لها مخلفات الجزر والبرتقال بنسبة ٧.٥% مقارنة بالعينة الكنترول. كما أدت إضافة هذه المخلفات بنفس نسب الإستبدال إلى دقيق القمح لتصنيع الخبز البلدى إلى زيادة كمية الماء الممتص وزمن الوصول ووقت الخلط وثبات العجينة وأيضاً المرونة والرقم النسبى وذلك بزيادة نسبة الإستبدال. كما أدت إلى إنخفاض فى إرتفاع وحجم الرغيف بزيادة نسبة الإستبدال. وأظهرت نتائج التقييم الحسى للخبز البلدى أن إضافة هذه المخلفات بنسبة ٥ ، ٧.٥% على التوالى كانت هى أفضل نسب الإستبدال.

وتم إختيار عينات الخبز البلدي التي تمت إضافة مخلفات البرتقال والطماطم والجزر لها بنسبة ٧.٥ % وأجريت تجربة بيولوجية علي ٣٠ من فئران التجارب حيث قسمت إلي خمسة مجموعات . المجموعة الأولي كنترول سالب أما باقي المجموعات الأربعة فتم تغذيتها علي مسحوق كوليسترول لإحداث إرتفاع في كوليسترول الدم ثم تم تقسيمها إلي كنترول موجبومجموعة البرتقال ومجموعة الطماطم ومجموعة الجزر وأسفرت نتائج التجربة البيولوجية علي أن تناول الخبز البلدي المدعم بنسبة ٧.٥ % من مخلفات كل من البرتقال والطماطم والجزر أدي إلي خفض وزن الفئران ونسبة الكوليسترول ودهون الدم بجانب تحسين في كل وظائف الكبد ومستوي الصوديوم والنحاس مقارنة بالمجموعة الموجبة.

وتوصي الدراسة بضرورة إضافة كل من مسحوق مخلفات المصانع من البرتقال والطماطم والجزر عند تصنيع الخبز البلدي لرفع مستوي الألياف الطبيعية فيه والذي كان له أثر فعال في خفض كوليسترول ودهون الدموتحسين وظائف الكبد مما أدي إلي تحسين حالات مرضي إرتفاع الكوليسترول.

الكلمات الكاشفة: الكوليسترول – الألياف –البرتقال – الطماطم – الجزر – منتجات المخابز – الخبز البلدى.