J. Agric. Sci. Mansoura Univ., 33(8): 5879 - 5891, 2008

UTILIZATION OF PUMPKIN PULP AND SEEDS FLOURS AS NUTRIENT SUPPLEMENT OF WHEAT FLOUR BISCUITS

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ABSTRACT

This study was carried out to investigate the utilization of pulp and seeds flours of pumpkin as replacement of wheat flour at different levels (5,10,15,20%) to prepare rich protein and minerals biscuits for school children. The chemical composition of flours of wheat, pumpkin pulp and pumpkin seeds was determined. Chemical composition and physical properties as well as organoleptic evaluation of prepared biscuits were also determined. Elemental analysis of both pulp, defatted seeds flours of pumpkin and wheat flour as well as of prepared biscuits was performed. In addition, biological study using Albino white rats was done to evaluate biological parameters of prepared biscuits.

Results indicated that the pumpkin seeds flour (PSF) contain a high protein content (43.8%) compared with that of wheat flour (11.16%) and pumpkin pulp flour (PPF) (8.37%). Ash content of PPF (11.17%) was significantly higher than those of PSF (3.4%) and wheat flour that has only 1.1% of ash content. PSF has values of calcium, sodium, iron, zinc, potassium and phosphorus significantly higher than those of wheat flour. PPF is very rich of potassium, sodium, calcium and iron compared with wheat flour. The protein and minerals contents of biscuit made with PSF increased significantly with increasing the replacement ratio. The addition of pumpkin pulp flour as replacement of wheat flour until level of 20% led to a significant increase in minerals content. Moreover, it gave a very good effect on sensory characteristics and protein efficiency ratio of prepared biscuit. Biscuit samples contained PSF gave higher body weight gain of experimental rats and food efficiency ratio (FER) in comparison with wheat flour biscuits. As organoleptic evaluation, the biscuit samples contained PSF until 10% as replacement ratio of wheat flour are nearly similar to control sample. Based on the obtained results, the new product of biscuit contained PSF or PPF can be covered protein and minerals of nutritional needs of schoolchildren in developing countries and could be recommended as food aid in institutional feeding programs for pupils in different school stages.

INTRODUCTION

The fact that the nutritional quality of foods has become an increasingly important factor in the consumer's buying decision and the recommendation by the U.S. Dietary Goals (1977) to obtain more protein from sources low in total fat, saturated fat and cholesterol (Carlson, *et al.*, 1981). In many developing countries, the supply of animal protein is inadequate to meet the protein requirements of the rapidly growing population. This has necessitated contemporary research efforts geared towards the study of the food properties and potential utilization of protein from locally available food crops especially from neglected high protein oil seeds and legumes (Enujiugha and Ayodele-oni, 2003).

Pumpkin (*Cucurbita moschata*) has received considerable attention in recent years because of the nutritional and health protective value of the proteins from the seeds (Caili *et al.*, 2006). Moreover, research carried out in last few decades showed that they have antioxidants effects (Nkosi, *et al.*, 2006). A pumpkin is a squash fruit, usually orange in color when ripe; pumpkins belong to *Cucurbitaceae* family. Pumpkin seeds are a good source of essential fatty acids, protein, potassium, calcium, manganese and magnesium. These seeds in addition to its importance as an oil seeds (54% fat), it is a valuable source of protein (27%) with a fairly well-balanced amino acids composition (Long *et al.*, 1983). Pumpkin seed flours were used as protein supplements in a variety of local foods (Giami & Bekebain, 1992; Giami & Issac, 1999). Fruits are large, weighing up to 20kg, and containing 80 seeds on average (Schippers, 2000). Pumpkin seeds are utilized directly for human consumption as snacks after salting and roasting, in Arabian countries (Al Khaliffa, 1996). These seeds are excellent sources of protein and oil (Lazos, 1986). Pumpkin seed kernels could be utilized successfully as source of protein for human consumption. It has great potential for addition to food systems, not only as nutrient supplements but also as functional agents. However, very little information has been reported on the physicochemical and functional properties of pumpkin seed proteins (El-Adawy and Taha 2001). Pumpkin seed is of considerable nutritional value for human consumption due to its 37.8–45.4%oil and 25.2–37.0% protein. It enjoys valuable dietetic and medicinal advantages besides being a source of edible oils, proteins and minerals of good quality (Yoshida, *et al.*, 2004). Using of pumpkin pulp flour with infants food formula at level 5% led to improvement its minerals content and it had a very good effect on sensory characteristics and protein efficiency ratio of prepared formula (Gomaa, 2000). One potential food application for pumpkin seeds flour is its use in composite flours for the production of bakery products, such as bread and cookies (Giami *et al.*, 2005). Wheat bread and biscuits are widely consumed in many developing countries. Biscuits have been suggested as a better use of composite flour because of their ready to eat form, wide consumption especially in schools and relatively long shelf life (Lorens *et al.*, 1979). Biscuits with high sensory ratings have been produced from blends of wheat/cowpea, soybean, chickpea, safflower and pumpkin seeds (Okaka and Isich, 1990 and Giami *et al.*, 2005). In vitro protein digestibility of bread improved when pumpkin seed proteins were added (El-Soukkary, 2001).

In this work, effect of supplementation of wheat flour with pumpkin flours (pulp and seeds) on chemical, physical, nutritional, and sensory evaluation of prepared biscuits was studied. The aim of this study is to investigate the possibility of using the pumpkin pulp and defatted seeds flour with wheat flour to prepare biscuits having high levels of protein, minerals and energy for use in food aid programs and could be included in institutional feeding programs for schoolchildren and adults as well.

MATERIALS AND METHODS

Materials:

Pumpkin fruits (*Cucurbita moschata c.v.* Balady), wheat flour (72% extraction) and the other ingredients used to make the biscuits were purchased from local market at Kafr El-sheikh City, Egypt. Chemicals and bio-chemicals of analytical grade were purchased from Gomhoria Co. for Chemical and Drugs, Egypt.

Methods:

1.Preparation of pumpkin pulp and seeds flours:

Pumpkin fruits were washed and cut into slices then the seeds were separated. The slices were peeled and blanched in boiled water for 10 min. The blanched slices were dried in a dry oven at 60°C for 18 hours and ground using Braun mill then screened through 60 mech sieve. Pumpkin pulp flour (PPF) was kept in polyethylene bags and stored in refrigerator at 4°C until used.

Pumpkin seeds were boiled in tap water for 1 hour to soften the seeds coats and dehulled manually then dried in an oven at 60 °C for 12 hours. Dried dehulled seeds were ground using (Braun mill) and screened through 60 mech sieve. Ground seeds were defatted in a Soxhlet apparatus for 8 hours using n-hexane to obtain pumpkin seeds flour (PSF). Pumpkin seeds flour (PSF) was kept in polyethylene bags and stored at 4 °C until used.

2. Preparation of the experimental biscuits:

Method of Gaines and Tsen (1980) with some modifications by Alobo (2001) was used to prepare the biscuit samples. Blends containing 5, 10, 15, and 20% of either defatted pumpkin seeds flour or pumpkin pulp flour were used as replacement of wheat flour (72% extraction) and the basic ingredients. The basic ingredients were 420g of flour blends, 130g corn oil, 200g sugar, 50g of whole egg, 5g of salt, 5g of vanilla, 15g of baking powder and water variable. The dry ingredients were thoroughly mixed in a bowl by hand for 3 min. Other ingredients were added and mixed in a rotary mixer (Moulinex model Depose type 171) for 5 min., using a wooden rolling pin; the doughs were sheeted on a pastry board to uniform thickness of 7 mm and cut into circular shapes of 6 cm diameter using a circular scone cutter. The cut dough pieces were backed at 210 °C for 12-15 min using preheated backing oven. After removal from the oven, biscuits were allowed to cool at room temperature for 2 hours and then divided into three lots; one lot was used immediately for the measurement of physical properties. The second was subjected to sensory evaluation and the third lot was used for chemical analysis and making of diet formulations for feeding the experimental rats.

3. Chemical analysis:

Moisture, crude protein, fat, fiber and ash contents of wheat flour, pumpkin pulp flour, pumpkin seeds flour and prepared biscuits samples were determined according to the method described in the A.O.A.C (2000). Total carbohydrates were calculated by difference. Available carbohydrates were

calculated by subtracting crude fiber from total carbohydrates. Calcium, iron, magnesium, potassium, sodium and zinc were estimated using atomic absorption (Pye Unican model SP 1900) according to the method of A.O.A.C. (2000). Phosphorus was determined according to the method of Perkins (1975). Phytic acid was determined according to the method of Wheeler and Ferrel (1971). Energy was calculated by multiplying available carbohydrate and protein contents by 4 and fat content by 9 as reported by Liu, *et al.* (1990).

4. Physical properties of biscuits

Five replicates for each sample were measured for weight, diameter, height (thickness) and hardness (texture). The method of Zoulias *et al.*, (2002) was used for the measurement of biscuits diameter, where four units were placed next to each other and the total diameter was measured. Then all four units were rotated by 90^0 and the new diameter was measured. The average of the two measurements divided by four and was taken as the final diameter of biscuits. Spread ratio was expressed as diameter/height. Hardness was measured by a compression test using a pulley type shear frames as described by (Giami, 1991). The mean shear stress value of ten units was calculated.

5. Sensory Analysis:

Organoleptic evaluation of different prepared biscuits was performed by a semi-trained panel of twenty members using nine-point hedonic-scale ratings for color, taste, aroma, texture and overall acceptability with 9 being the highest score "extremely liked" and 1 being the lowest score "extremely disliked" (Watts *et al.*, 1989). The mean of each characteristic scores was calculated and it considered.

6. Biological evaluation:

Sixty weanling albino rats (26 days) of an average weight 42±2 gm were obtained from experimental house of Veterinary Medicine Faculty, Cairo Univ., Egypt. Animals were divided into ten groups, each of them six rate (3 males + 3 females) according to the following scheme:

Group1: fed on Basel diet (Negative control)
Group2: fed on wheat flour biscuit (Positive control)
Group3: fed on biscuit containing 5% PPF as replacement of wheat flour
Group4: fed on biscuit containing 10% PPF as replacement of wheat flour
Group5: fed on biscuit containing 15% PPF as replacement of wheat flour
Group6: fed on biscuit containing 20% PPF as replacement of wheat flour
Group7: fed on biscuit containing 5% PSF as replacement of wheat flour
Group8: fed on biscuit containing 10% PSF as replacement of wheat flour
Group9: fed on biscuit containing 15% PSF as replacement of wheat flour
Group10: fed on biscuit containing 20% PSF as replacement of wheat flour

Basel diet containing casein (its protein content 80%) 21%, cane sugar 10%, corn starch 54%, corn oil 10%, vitamin mixture 1% and salt mixture 4%) as reported by Babu and Srinivasan, (1997). Each group was housed in separated cage at 25 ± 2^0C with 12 hours light : dark cycle. Rats were fed on previous diets and water ad libitum for 6 weeks.

Body weight gain, food intake, protein intake, food efficiency ratio (FER) as body weight gain/ food intake and protein efficiency ratio (PER) as

body weight gain/protein intake were determined according to A.O.A.C. (2000).

Statistical analysis:

Most of the received data were analyzed statistically using the analysis of variance and the means were further tasted using the least significant difference test (LSD) as outlined by Steell and Torrie (1980).

RESULTS AND DISCUSSION

Chemical composition of flours:

The chemical composition of wheat flour, pumpkin pulp flour (PPF) and pumpkin seeds flour (PSF) is recorded in Table (1). The obtained results show that PSF contain a significant high content of crude protein (43.8%) compared with that of wheat flour (10.16%) and PPF (8.37%). Pumpkin pulp flour contains highest contents of ash and fiber (11.17 and 7.50%) followed by PSF (3.4 and 2.7%, respectively), while wheat flour has the lowest contents (1.1 and 0.7%). This indicates that pumpkin seeds flour is very rich in protein and minerals compared with wheat flour. This means, the pumpkin seeds flour when is added to bakery products would be improved their protein and minerals content. On the other hand, Pumpkin pulp flour is very rich in minerals but poor in protein comparing with wheat and pumpkin seeds flours.

Table 1: Chemical composition of flours of wheat, pumpkin pulp and pumpkin seeds

Components	Wheat flour	PPF	PSF
Moisture %	11.48 a	9.52 b	7.70 c
Crude protein %	10.16 b	8.37 c	43.8 a
Fat %	1.60 a	1.33 b	0.86 c
Crude fiber %	0.70 c	7.50 a	2.70 b
Ash %	1.10 c	11.17 a	3.40 b
Total carbohydrates	75.66 a	69.61 b	44.24 c
Available carbohydrates	74.96 a	62.11 b	41.54 c
Energy (Kcal/100g)	351.55 a	293.89 b	349.1 a

PPF = pumpkin pulp flour, PSF = defatted pumpkin seeds flour.
Values followed by the same letter in row are not significantly different at P<0.05.

Minerals composition of pumpkin pulp, pumpkin seeds and wheat flours:

From the results in Table (2), it could be observed that the phosphorus, potassium, magnesium and calcium are the major elements in both pumpkin seeds flour and wheat flour followed by sodium, iron and zinc in each, while in pumpkin pulp flour the major elements are sodium, potassium, calcium, magnesium and phosphorus. The results show also that the pumpkin seeds flour contains higher values in all determined elements except sodium compared to wheat flour and it is very rich in phosphorus (788 mg/100g). Sodium, potassium and calcium contents of pumpkin pulp flour are

extremely higher than those of wheat flour but the latter contain higher content of phosphorus.

The iron content of pumpkin seeds is higher three times than that of wheat flour also pumpkin pulp flour have iron content higher than that of wheat flour. The iron is important for the schoolchildren, which mostly needs more iron to avoid the anemia especially in developing countries. The results indicated that the pumpkin flour from either pulp or seeds is a good source for the minerals.

Table 2: Minerals composition of wheat, pumpkin pulp and pumpkin seeds flours.

Minerals (mg/100g)	Wheat flour	PPF	PSF
Calcium	51.01 c	194.90 a	168.9 b
Sodium	24.56 b	1670.50 a	21.3 bc
Potassium	168 c	1588.50 a	385.4 b
Magnesium	137 bc	146 b	374 a
Iron	2.82 bc	3.55 b	6.14 a
Zinc	2.12 b	2.40 b	5.80 a
Phosphorus	316 b	80.80 c	788 a
Phytic acid (mg/100g)	16.70 b	17.20 b	38.40 a

PPF = pumpkin pulp flour, PSF = pumpkin seeds flour.
Values followed by the same letter in row are not significantly different at P<0.05.

Chemical composition of biscuit

The results in Table (3) indicate that protein and fat contents of biscuit made using different levels of PPF as substitution of wheat flour were slightly lower than those of control and they decreased with increasing the substitution level. In contrary, its crude fiber and ash contents were higher than that of control and they increased significantly with increasing the substitution level, where the crude fiber and ash contents increased from 2.15 and 1.33% in control to 3.37 and 3.34% in biscuit contained 20% pumpkin pulp flour.

The data in the same Table show that protein content of biscuit contained PSF as substitution of wheat flour was significantly higher than that of control and it increased markedly with increasing the replacement ratio (from 11.4% in control to 18.3 in biscuit contained 20% PSF). In addition, the crude fiber and ash contents of biscuits prepared using PSF as replacement of wheat flour were higher than those of biscuit control but its fat content was slightly lower than that of control. These mentioned effects increased with increasing of replacement level. It could be noticed that biscuit supplemented with PSF was considered more nutritive. The consumption about 100g of the sample contained 20% PSF would provide more than 65% of the recommended daily requirement for protein (25-30g/day) and about one of six of the requirement for energy (1790-2500 Kcal/day) for children aged between 5 and 19 years as recommended by FAO/WHO (1973), This fact suggests that biscuits supplemented with PSF could usefully be included in institutional feeding programmes for children. The values obtained for protein (13.1 – 18.3g/100g) and energy (385 – 389.4 Kcal) of biscuits supplemented

with PSF agreed with these reported by Young *et al,* (1985) who mentioned that the cookies produced and recommended for use in food aid programmes had protein and energy contents ranging from 15.1 to 20% and 297 - 422 Kcal/100g.

Table (3): Chemical composition of biscuits made with different substitution levels of PPF and PSF

Components% / Samples		Moisture	Crude protein	Fat	Crude fiber	Ash	A. C.	Energy Kcal/ 100g
Wheat flour biscuit(Control)		8.63 b	11.40 b	7.83 a	2.15 d	1.33 ef	68.66 a	390.7 a
PPF	5%	8.70 b	11.31 b	7.81 a	2.41 bc	1.82 d	67.95 ab	386.8 a
	10%	8.81 a	11.14 b	7.79 a	2.72 b	2.32 c	67.22 b	383.0 ab
	15%	8.90 a	10.96 c	7.77 a	3.00 ab	2.85 b	66.52 c	379.2 b
	20%	9.00 a	10.78 c	7.75 a	3.37 a	3.34 a	65.76 d	375.3 b
PSF	5%	8.67 b	13.1 bc	7.78 a	2.26 cd	1.45 e	66.74 bc	389.4 a
	10%	8.71 b	14.8 b	7.73 a	2.36 c	1.57 de	64.83 e	388.1 a
	15%	8.82 a	16.5 ab	7.70 a	2.46 bc	1.69 d	62.85 f	386.5 a
	20%	8.91 a	18.3 a	7.62 b	2.56 bc	1.81 d	60.79 g	385.0 ab

A.C.= available carbohydrates, PPF = pumpkin pulp flour, PSF = pumpkin seeds flour.
Values followed by the same letter in column are not significantly different at P<0.05.

Minerals composition of prepared biscuit

The results in Table (4) show that biscuit supplemented with PPF has very high levels of calcium, sodium and potassium but it has somewhat low level of phosphorus compared with those of control.

Table 4: Minerals composition (mg/100g) of biscuits made using PPF and PSF at different levels as replacement for wheat flour.

Elements / Samples		Ca	Na	K	Mg	Fe	Zn	P	Phytic acid
Wheat flour biscuit (Control)		42.2 e	322.0 e	111.3 f	105.7 c	3.20 c	2.12 c	367.0 e	4.61 e
PPF	5%	48.7 d	404.5 d	181.8 e	105.7 c	3.24 c	2.11 c	355.2 ef	4.64 e
	10%	54.9 c	488.6 c	251.3 c	105.8 c	3.28 c	2.10 c	343.4 f	4.67 e
	15%	61.1 b	573.4 b	320.8 b	105.9 c	3.32 bc	2.10 c	331.6 fg	4.70 e
	20%	67.3 a	658.6 a	390.3 a	106.0 c	3.36 bc	2.09 c	319.8 g	4.73 e
PSF	5%	48.1 d	321.8 e	137.2	106.9 bc	3.37 bc	2.30 bc	390.6 d	5.65 d
	10%	54.0 c	321.6 e	163.1	108.1 b	3.54 b	2.48 b	414.2 c	6.70 c
	15%	59.9 b	321.4 e	189.0 e	109.3 ab	3.75 a	2.68a	437.8 b	7.75 b
	20%	65.8 a	321.2 e	214.9 d	110.5 a	3.86 a	2.82 a	461.4 a	8.80 a

PPF = pumpkin pulp flour, PSF = defatted pumpkin seeds flour.
Values followed by the same letter in column are not significantly different at P<0.05.

The effect of using PPF (either increment or decrement) on minerals contents of biscuit increased with increasing its substitution ratio. Biscuits contained PSF have high values of all minerals except sodium comparing with control. However, phytic acid has been identified as one of the major drawbacks limiting the nutritional quality of oil seeds and legumes by lowering the bio-availability of minerals (Lopez *et al.*, 2002). The levels of phytic acid (4.64 – 8.8 mg/100g) found in biscuits supplemented with PPF or PSF was

within the range of (0-20 mg/100g) reported for bakery products (Lopez *et al.*, 2002). These results are in close with Ekpedeme *et al.*, (2000) and Giami *et al.*, (2005). From the above mentioned data, it can use the pumpkin flour either from pulp or seeds in shoring the wheat flour biscuit to obtain a good and satisfied biscuit rich in minerals for schoolchildren.

Table (5): Physical parameters of biscuits made using different levels of PPF and PSF

Samples \ Parameters		Weight (g)	Diameter D(cm)	Height H(cm)	Spread ratio D/H	Hardness
Wheat flour biscuit (Control)		13.65 d	10.72 a	1.53 a	7.13 b	55.41 a
PPF	5%	13.56 d	10.74 a	1.55 a	6.93 bc	55.32 a
	10%	13.49 d	10.75 a	1.57 a	6.85 c	55.21 a
	15%	13.43 de	10.76 a	1.58 a	6.81 c	55.09 ab
	20%	13.37 de	10.78 a	1.59 a	6.78 c	54.92 b
PSF	5%	13.92 c	9.81 b	1.44 b	7.05 b	55.11 ab
	10%	14.52 bc	9.13 c	1.24 c	7.58 a	53.81 c
	15%	14.84 b	8.33 d	1.12 d	7.54 a	53.22 d
	20%	15.44 a	7.73 e	1.10 d	7.00 b	48.65 e

PPF = pumpkin pulp flour, PSF = defatted pumpkin seeds flour.
Values followed by the same letter in column are not significantly different at P<0.05.

Physical characteristics of biscuit:

Data presented in Table (5) indicate that the physical characteristics of produced biscuits. There was a slight difference between biscuit supplemented with PPF or PSF and the control in the physical properties. The biscuit supplemented with PPF had slightly high height and diameter and slightly low weight comparing with control. In contrast, the biscuit supplemented with PSF had smaller height and diameter and greater weight than those of control. These effects increased with increasing levels of replacement. These results were similar to those reported by Sath *et al*, (1981), Ordorica-Falomir and Paredes-Lopez (1991) and McWatters *et al*, (2003) for cookies prepared from wheat-great marten bean, wheat-safflower and wheat cowpea flour blends. The differences between the physical properties of biscuit made with pumpkin flours and that made using wheat flour may be related to the differences in chemical composition such as fiber and protein contents.

Sensory evaluation:

The results in Table (6) show that sensory characteristics of biscuit contained PPF were better or similar to those of wheat flour biscuit (control), except the texture of sample contained 20% PPF that had somewhat lower score than that of control. This may be due to PPF consist of high fiber content. In addition, sensory characteristics of samples prepared using PSF until 10% substitution ratio had nearly similar scores compared with those of control. Using of PSF at levels more than 10% lead to decrease the scores for sensory characteristics of biscuit especially aroma of sample contained 20% PSF that recorded (7) compared to 8.4 in control. This may be attributed to the high content of protein in defatted pumpkin seeds flour compared with that of wheat and pumpkin pulp flours. This result indicates the seeds flour of

pumpkin may need to some procedures to improve its flavor such as roasting, germinating or steaming of seeds. McWatters, (1985) mentioned that steaming for 30 min. at 100°C improved the flavor of cowpea flour used in cookies-preparation. Alobo, (2001) reported that the biscuit made from sesame seed flour showed highly rated for flavor. It could be also noticed that hardness (texture) scores estimated by the panelists were in agreement with the measurement of physical compression test. Generally, all samples prepared with PPF and PSF were acceptable for the sensory evaluation.

Table (6): Sensory analysis of biscuit prepared using PPF and PSF as replacement of wheat flour.

Samples \ Parameters		Color	Taste	Aroma	Texture	Overall acceptability
Wheat flour biscuit (Control)		8.8 a	8.7 a	8.4 a	8.6 ab	8.5 ab
PPF	5%	8.9 a	8.8 a	8.4 a	8.6 ab	8.6 a
	10%	8.9 a	8.8 a	8.3 a	8.5 b	8.5 ab
	15%	8.8 a	8.7 a	8.3 a	8.4 bc	8.4 b
	20%	8.8 a	8.7 a	8.4 a	8.3 c	8.4 b
PSF	5%	8.8 a	8.8 a	8.1 b	8.7 a	8.5 ab
	10%	8.8 a	8.7 a	7.9 c	8.7 a	8.4 b
	15%	8.5 b	8.4 b	7.7 d	8.5 b	8.2 c
	20%	7.6 c	7.2 c	7.0 e	8.1 d	7.4 d

PPF = pumpkin pulp flour, PSF = pumpkin seeds flour.
Values followed by the same letter in column are not significantly different at P<0.05.

Evaluation of protein quality of biscuits:

Results of biological evaluation of protein quality for prepared biscuit samples using experimental animals are presented in Table (7). Data show that diet contained biscuit prepared using PPF as replacement of wheat flour at different levels gave body weight gain and PER higher while FER similar compared with diet contained wheat flour biscuit. On the other hand, it gave significantly low body weight gain and FER but high PER compared with Basel diet.

Table (7): Biological evaluation of protein quality attributes of experimental biscuits.

Diets		Biological Parameters				
		Weight gain(g)	Food Intake(g)	Protain Intake(g)	F.E.R.	P.E.R
Basel diet		49.22 ab	314.8 b	53.5 b	0.150 bc	0.920 d
Wheat flour biscuit		32.13 g	305.1 e	34.9 e	0.105 d	0.921 d
PPF biscuits	5%	33.12 ef	312.6 b	35.1 e	0.106 d	0.944 c
	10%	33.42 e	318.5 a	35.2 e	0.105 d	0.949 c
	15%	32.89 f	315.6 b	34.3 f	0.104 d	0.959 c
	20%	32.65 fg	310.1	33.1 g	0.105 d	0.986 b
PSF biscuits	5%	44.13 d	313.2 c	42.3 d	0.141 c	1.019 ab
	10%	45.24 c	286.8 g	42.5 d	0.158 b	1.064 a
	15%	48.62 b	307.2 d	50.7 c	0.158 b	0.959 c
	20%	49.87 a	298.2 f	54.6 a	0.167 a	0.913 d

PPF = pumpkin pulp flour, PSF = pumpkin seeds flour, FER = Body weight gain (g)/Food intake (g), PER = Body weight gain (g) / protein intake (g).
Values followed by the same letter in column are not significantly different at P<0.05.

In case of diet contained biscuit supplemented with PSF, body weight gain and FER were significantly high compared with those obtained in case of diet contained wheat flour biscuit or that supplemented with pumpkin pulp flour. PER was widely differ where it was higher in case of diet supplemented with 5 and 10% PSF than that occurred in case of Basel diet, contained wheat flour biscuit or that contained biscuit supplemented with pumpkin pulp flour. Diet contained biscuit supplemented with 20% defatted pumpkin seeds flour (PSF) gave body weight gain and FER higher than those of another diets but it gave PER lower than that of another diets. These results are in agreement with Badawy *et al* (1993), Bessar (1998) and Giami *et al.*, (2005). It could be observed that using of pumpkin pulp flour and defatted pumpkin seeds flour as substitution of wheat flour had a positive effect on biological properties of prepared biscuit and led to improvement the functional properties of protein.

CONCLUSION

From the obtained results, it could be concluded that wheat flour biscuit supplemented with pumpkin pulp flour until 20% have a good acceptability (as sensory analysis) with high minerals content. Wheat flour biscuit supplemented with defatted pumpkin seeds flour till 20% was accepted for sensory characteristics and it has high protein and minerals contents. The biscuits prepared with either pumpkin pulp or defatted seeds flour as substitution of wheat flour until 20% recorded high biological parameters. In addition, these biscuits can be covered protein and minerals nutritional needs of schoolchildren in developing countries from inexpensive and available sources. New prepared biscuit could be recommended as food aid in institutional feeding programs for pupils in different school stages and adults as well.

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الاستفادة من دقيق لب و بذور القرع العسلي كمدعم غذائي لبسكويت دقيق القمح

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أجريت هذه الدراسة بهدف الاستفادة من دقيق لب وبذور القرع العسلي المنزوع الدهن بنسب استبدال ٥, ١٠, ١٥, ٢٠% لدقيق القمح لتحسين خواص البسكويت الحسية والغذائية لاستخدامه في برامج تغذية طلاب المدارس. فتم دراسة تأثير خلط دقيق القمح بدقيق القرع العسلي (سواء البذور أو اللب) على الخواص الكيميائية والطبيعية والغذائية والحسية للبسكويت الناتج كما أجريت دراسة بيولوجية على فئران التجارب البيضاء لتقييم جودة البروتين.

ويمكن تلخيص النتائج فيما يلي:

١ - أوضحت نتائج التحليل الكيميائي ارتفاع واضح في محتوي دقيق البذور منزوع الدهن من البروتين الخام مما أدي إلي زيادة ملحوظة في نسبة البروتين في البسكويت الناتج عندما تم استبدال دقيق القمح بدقيق بذور القرع العسلي.

٢ - كما أظهرت النتائج أن محتوى دقيق القرع العسلي سواء البذور أو اللب من المعادن عالي جدا مقارنة بدقيق القمح و خاصة الصوديوم والبوتاسيوم والماغنسيوم والكالسيوم والحديد مما أدي إلي ارتفاع ملحوظ في محتوي البسكويت الناتج من هذه المعادن.

٣ - نتائج التقييم الحسي للبسكويت الناتج من تدعيم دقيق القمح بدقيق القرع العسلي أظهرت أن استخدام دقيق اللب حتى ٢٠% كان له تأثير جيد جدا علي الخواص الحسية أما استخدام دقيق البذور منزوع الدهن أكثر من ١٠% كان له تأثير سلبي لحد ما علي الخواص الحسية وخاصة الرائحة لكنها في كل الأحوال كانت مقبولة.

٤ - نتائج التجربة البيولوجية أظهرت أن البسكويت الناتج من استخدام دقيق اللب بنسب استبدال حتى ٢٠% أدي إلي زيادة كفاءة البروتين لكن نتائج الوزن المكتسب وكفاءة الغذاء كانت متشابهة مع تلك لبسكويت دقيق القمح. أما استخدام دقيق البذور منزوع الدهن حتى ٢٠% أدي إلي زيادة كبيرة في الوزن المكتسب وكفاءة الغذاء وكفاءة البروتين وهذه الخواص تزداد بزيادة نسب الاستبدال (عدا كفاءة البروتين انخفضت بزيادة الاستبدال عن ١٠%).

٥ - بناءً علي النتائج المتحصل عليها فان المنتج الجديد من البسكويت المدعم بنسبة ٢٠% من دقيق لب القرع العسلي غني جدا بالعناصر المعدنية الضرورية لطلبة المدارس مثل الكالسيوم والماغنسيوم والفوسفور والحديد كما انه يتميز بخواص حسية وبيولوجية جيدة. أما البسكويت المدعم بدقيق البذور غني جدا بالبروتين والعناصر المعدنية وخواص بيولوجية جيدة ويمكن استخدامه بنسب استبدال حتى ١٠ أو ١٥% فقط لتلافي التأثير السلبي للمستوي الأعلى من ذلك علي الخواص الحسية.

وأخيرا يمكن القول أن البسكويت الناتج من استبدال دقيق القمح بدقيق القرع العسلي يفي بالاحتياجات الغذائية من البروتين والعناصر المعدنية لطلاب المدارس في الدول النامية كما يمكن أن يوصى به كمنتج غذائي جيد في برامج التغذية لطلاب المدارس في مختلف المراحل الدراسية.