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Fortification of Some Food Products (Cake) for the Preschool Aged Children

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Abstract: ***Children at this period of age eating Sweetened food products like cake which considered poor in nutritive value , where are children at this age needs many nutrient elements for growth. This research aimed to fortification of cake by replacing wheat flour with mixed of legume flour (beans , chickpea and lentil) and also replacing sun flower oil with olive oil and canola oil at ratio of replacement 10% , 20% and 30% to improve the nutritive value of cake . Results Showed that the values of chemical components increasing morally (P<0.05) with increasing in the ratio of replacement except for humidity , fat and energy . Also we are noticed statistical moral differences (P<0.05) in the content of in ineral elements with increased the ratio of replacement. Content of protein and mineral elements increased at ratio of replacement 30% for legume with olive oil and legumes with canola oil , this is showed positive indicator this ratio of replacement record low rate in loss of weight . Replacement at ratio 10% legume with olive oil record high ratio properties of colar and appearance , this ratio of replacement with olive oil and canola oil also record high ratio in propties of texture humidity and odor in sensory evaluation for adult and children.***

Keywords: Food fortification, sources of protein, nutritional problem

1. Introduction

The shortage of getting the nutrients elements is considered as one of the main reasons in occurrence of nutrition problems, and among of these elements are Fe , Ca , I, and Vit. B and Vit. C groups from which millions of people are suffering from their shortages around the world. Nutrition deficit is still considered as one of the most dangerous health problems at before children school age and it is the main reason of their death in many of Arabian countries that characterize of low to medium wages at which high ratios of them suffer from nutrient deficit as well as more than third of world population is suffering from micronutrient deficit (39).

Anemia is the wide spread problem in the general health (26), and there are many strategic ways to overcome of the occurred deficit in the possibility of getting the nutrient elements and to face malnutrition through diversification the eaten food and strengthening and enrichment the food with nutrient elements (13,26).

Wheat flour is the most consumption matter in the world and it is used in the baking products and contributes largely in supply human body with energy in spite of its low content of protein (24). Wheat proteins have little of the essential amino acids such as Lysine , Tryptophan , and Threonine (25).The put efforts for insurance and increase protein supply in human food encouraged using the high protein content plants as a component in different foods.

The used flour in cake production is responsible of the molecular size (16) and here there was no role for Kloten in cake production (16 . 27), and the legume flour may be used for cake production in purpose of nutrition value improvement such as chickpeas and Lupine flour(12 ,33) and by mixing the plant proteins with each other due to that the body cannot store the essential amino acids(3).

Legume grains are considered as an essential matter in human food (32) because they are good source of protein ,Fibers ,some mineral, vitamins , and little fats ,and they have good nutrition properties (14, 21 , 30 ,and 36) besides that legume protein has manyreflected careers on some properties such as solubility , gelatinization , and connection with water which play a role in structure and flavor formation according to their source either from chickpeas or peas or lupine (12,15,22,24 ,29,31 and 33) . Legume consumption has health positive effects (2) , and it decreases risks of heart diseases , cancers ,diabetes , vulnerability , blood hypertension and intestinal disorders , and decreases of low cholesterol level (5 , 38).And Because of their nutritional and health benefits, they need to be added in new markets because they are healthy foods (7) .

Due to unavailability of protein from its animal sources and its high price in the under developing countries ,there was orientation to use legume to compensate protein shortage. Many studies were done in order to enrich the flour to produce high protein pastry (3). The legumes were used in wheat and corn grains enrichment to upload Lysine ratio in foods in which grains are considered the main component (1) ,and in that economical and nutritional advantage (25).

The oils and fats are considered as essential component of human food as they provide the body by energy , soluble vitamins, (A, D, K and E) and the essential fatty acids which are considered necessary in growth and health ,increasing fat consumption by all society persons makes their vitamins enrichment an important step for getting them (26).

Ibrauium and Hegazy (2009) (20) mentioned that adding legume flour has many health advantages due to the good presence of nutrient fibers , carbohydrates , low fats , high concentration of the unsaturated fatty acids and quality improvement of the bakery products nutritionally (8). Use of legume in bakery production results decreasing of the total cholesterol in blood serum , and low density lipoprotein (LDL),while no change was observed in high density (HDL)and triple fats.

Sofyan et al (2013) (35) insisted on possibility of using 20% of lupine flour and 30% of corn flour , and also use corn starch in cake and bread production makes it more mellowness (4).

Hesham et al (2007) mentioned of possibility of use of chickpeas and peas flour partially with wheat flour in local bread baskets production and study the chemical content , color , and sensory properties ,the replacement ratios were 5% , 10% , 15% , the results were good because protein content was high with chickpeas and peas flours and its range was 24% to 35% (18).

As kids are eating at this growth stage many of the sweated food products which have low nutrient value , while kids need the important nutrients for growth , so we tried to introduce rich products which enriched by good nutrient value needed by kids for growth and doing the daily activities with optimum form.

2. Materials and Methods

Legumes flour
Bean , chickpeas and lentils were brought from local markets and after cleaning ,they homemade grinded by using (Elaraby) grinder to get fine powder which then was sieved by sieve and put in polyethylene bags and stored till the time of use.

Shortened cake (fatty) production
The shortened cake was produced in laboratory and a standard cake mixture was used as it is described by (9) and the following materials were used.

Material	ratio (gram)
Flour	78
sunflower oil	23.4
Sugar	100
Egg	36
baking powder	2.9
Milk	79
Salt	1.5
Vanilla	1.2

This cake was considered as control treatment with the other treatments, then wheat flour that used in the above mixture was replaced by legumes flour and part of sunflower oil was replaced by olive and canola oils as it is shown in table (1).

Table 1: Ratios of replacing wheat flour by legumes flour and replacing sunflower oil by canola oil

Treatments symbol	Replacing ratio	Flour (gm.)		Oil (gm.)		
		Wheat	Legumes	Sun flower	Olive	Canola
A	-	78	-	23.4	-	-
A1	10	70.2	7.8	21.06	2.34	-
A2	20	62.4	15.4	18.72	4.68	-
A3	30	54.6	23.4	16.38	7.02	-
A4	10	70.2	7.8	21.06	-	2.34
A5	20	62.4	15.4	18.72	-	4.68
A6	30	54.6	23.4	16.38	-	7.02

Cake was prepared by using the traditional method and an electrical mixer according to (11), the flour , baking flour and salt were sieved and vanilla was added to the milk and then fat was mixed at medium speed for one minute , sugar then added and mixing was done for one and half minute, egg was added and mixed for one minute, third quantity flour was added alternately with third milk quantity ,the addition repeated twice and then the mixture was mixed for 45 second. 300 gram samples were taken and put in 15 cm diameter fatted , circled molds,then they were baked at oven (200 centigrade) for 20 minutes. The cakes were pulled out the oven and cooled , the cake size was measured and three replicate were used .

The approximate chemical composition of the produced cake
It was determined by using the standard methods that are described by (A.O.A.C.) (6).They are :-

Moisture determination :- 2-3 gram sample was put in known weight dish and heated in electrical oven at 105 Co until getting constant weight, then the dish was cooled and weighted.

Ash determination :- It was determined by ignition a sample in Muffle Furnace at 525 Co until sample color changed to gray color close to white.

Protein determination :- It was determined by using Kjeldahl method .The determined total nitrogen was estimated by multiplying with the factor (6.25) to get the percentage of protein.

Fat determination :- It was determined by using Sokslate apparatus to extract with oily ether to extract fat.

Total carbohydrates determination :- The total carbohydrate content beside the fibers were determined by using calculation difference method (15).

Energy determination :- It was estimated according to that one gram of fat produces nine calories ,one gram protein produces four calories and one gram carbohydrate produces four calories.

Mineral nutrients determination :- Fe , Ca and Zn were determined by using Atomic absorption spectrophotometer ,Model VSA,5000 according the method that is described by(19).The phosphorus was determined by using Spectronic 20 T apparatus according to the method that is described by (6).

The physical tests

Cake size measurement :-Cake size was measured in sign of its standing height (S.H) according to (11). Two centimeter thick slide of middle of cake was taken and put on paper and its shape was bounded by using a pencil and then five columns were drawn ,one column in the middle of the slide and two on each of the right and left halves of the slide in symmetrical positions inside the form of the drawn slide on the paper. The lengths of drawn columns were measured in centimeter unit by using a ruler and added and divided on the columns number to get the average of the numbers that represent the standing height value.

Sensory evaluation :- The sensory evaluation of the shortened cake was done by fifteen evaluators who were from the specialized staff of the Domestic Economic Department by using evaluation questionnaire (11)and using Hedomic scale (1 to 7) ,where 7 , 6, 5 , 4 ,3 , 2 ,1 represent excellent , very good , good ,medium ,pass , bad , very bad respectively . The shortened cake was evaluated after freezing by studying he following properties ,color , appearance ,texture , freshness , flavor ,general acceptance . Some of kids group also evaluated the cake to know their acceptance the treatments.

Statistical analysis

Statistical Analysis System .2012 ,SAS (34) program was used in data analysis to study effect of the different treatments in the studied properties according to the completely randomized design (CRD) . The significant differences were compared between the mediums by test the least significant difference (LSD).

3. Result and Discussion

1-The chemical and mineral content of the shortened cake production

Table (2) shows the chemical analysis of shortened cake that was produced in laboratory .Ratios of the chemical composition increased significantly (P <0.05) with increase of replacing ratio except moisture, fat and energy ,it may be notice that the moisture content increased slightly and not significantly with replacing ratios increase and its maximum increase ratio was when 30% legume plus canola oil were replaced and it was 25.36 ,while fat content increased not significantly and the highest fat ratio increase was in A3 treatment (replacing ratio 30% legume plus olive oil) and it was 31.30 and A6 treatment (replacing ratio 30% legume plus canola oil) and it was 13,36. The increase in protein , ash ,moisture and fibers ratio may attributed to the their high contents in the legumes and that gave a positive indicator on nutrient value increase of the produced cake especially in protein content, the recorded increases in protein in A3 treatment (replacing ratio 30% legumes plus olive oil)and A6 treatment (replacing ratio 30% legumes plus canola oil) were the highest and they were 11.8 and 11.89 respectively.

Table 2: The chemical analysis of the laboratory cake production

Treatment	Medium ± Standard error						
	moisture	ash	protein	fat	fibers	carbohydrate	energy
A	22.74 ± 0.42	1.19±0.08	8,65±0.53	12.43±0.71	0.56±0.02	56.27±0.46	370.74±1.38
A1	23.31±0.35	1.63±0.07	9.58±0.44	12.58±0.24	0.92±0.07	54.53±0.72	369.66±0.64
A2	23.91±0.26	2.03±0.04	10.62±0.41	12.93±0.09	1.29±0.07	52.54±0.63	369.01±0.59
A3	24.31±0.19	2.55±0.08	11.84±0.31	13.29±0.28	1.83±0.04	50.56±0.35	360.21±0.74
A4	23.22±0.22	1.56±0.08	9.55±0.32	12.62±0.52	0.93±0.07	54.61±0.52	370.22±0.62
A5	23.84±0.51	2.09±0.01	10.67±0.07	12.86±0.33	1.34±0.02	52.63±0.44	368.94±0.63
A6	24.354±0.31	2.50±0.02	11.89±0.32	13.35±0.50	1.87±0.01	50.41±0.27	369.35±0.62
LSD value	NS 2.78	*0.329	*1.824	*1.931	*0.502	*3.719	7.218
				NS			NS
NS = not significant at(P < 0.05)*							

Table (3) shows the laboratory produced shortened cake content of the mineral elements that included Ca , P , Fe and Zn ,the results indicated presence of significant differences (P< 0.05) in the mineral elements with increase of replacing ratio except A1 treatment (replacing ratio 10% legumes plus olive oil) and A4 treatment (replacing ratio 30% legumes plus canola oil) ,the highest ratio increase was recorded in A3 treatment (replacing ratio 30% plus olive oil) and A6 treatment (replacing ratio 30% plus canola oil) in all the treatments compared with the control treatment (A).This is considered from the positive indicators of the good nutrition value of the cake because the necessary mineral elements were available to kid growth in this important stage.

Table 3: Effect of the studied treatments on the nutrient elements

Treatment	medium ± standard error			
	P	Ca	Fe	Zn
A	101.20±0.74	69.20±0.55	0.92±0.02	0.57±0.02
A1	118.75±0.58	79.54±0.41	1.42±0.04	0.95±0.02
A2	143.83±0.56	87.63±0.25	1.89±0.04	1.18±0.05
A3	161.35±0.46	98.87±0.24	2.25±0.08	1.53±0.02
A4	119.27±0.32	77.67±0.32	1.38±0.05	0.89±0.04
A5	139.67±0.50	85.44±.48	1.91±0.03	1.21±0.02
A6	160.52±0.39	98.97±0.41	2.23±0.03	1.56±0.04
LSD value	*12.63	*8.59	*0.548	*0.449
(P<0.05)*				

2- Effect of replacing on height of the laboratory cake.

Tablet (4) shows that size of the laboratory produced cake after grilling had the largest height in the control treatment (5.32) cm and the less height was in the treatment A6 and A3 which their ratios were 4.74 and 4.95 cm respectively. It was clear that cake height decrease with increasing of replacing ratio and that agrees with (20) finding. The results showed that the differences between treatments significant at (P < 0.05)and this gradually decline of cake size may be due to increase of the used replacing ratios.

Table 4: Effect of the studied treatment on the standing height

Treatments	Medium ± standard error
A	5.32±0.28
A1	5.19±0.17
A2	5.08±0.24
A3	4.95±0.33
A4	5.41±0.26
A5	5.01±0.39
A6	4.74±0.18
LSD value	0.309*
(P<0.05)*	

Table (5)shows loss average of paste weight and affected by baking operation and by the obtained increase of replacement ,the highest loss ratio (6.63%) was in A

treatment and here there were significant differences at p < 0.05 level, while there were less weight loss (5.82 and 5.76) in the (A6 and A3) respectively.

Table 5: Effect of the studied treatments on weight loss average and loss ratio

Treatments	Medium ± Standard error	
	The loss in weight(gm.)	Loss ratio (%)
A	21.22±0.42	6.63±0.09
A1	20.37±0.35	6.36±0.12
A2	19.77±0.21	6.17±0.08
A3	18.64±0.52	5.82±0.13
A4	20.23±0.32	6.31±0.08
A5	19.63±0.25	6.12±0.15
A6	18.48±0.09	5.76±0.07
LSD value	*1.704	*0.538
(P<0.05)*		

3-Effect of replacing wheat flour by legumes flour on the sensory properties of the laboratory cake

Table(6) shows the results of cake samples sensory properties and it may be noticed that the obtained values by the color and appearance were approximate in all the treatments color property and the highest color property value was in A1 treatment (replacing ratio 10% legumes plus olive oil)and the lowest was in A5 treatment (replacing 20% legumes plus canola oil),while A6 treatment (replacing 30% legumes plus canola oil)got the less appearance property value. The rest properties ,texture ,freshness and flavor values were also approximate and A1 and A4 treatments got highest values in which they decreased with increase of replacing ratios.

Generally ,the general acceptance of these properties ranged between 6.13 in control treatment to 5.60 in A6 treatment ,LSD value was the highest in flavor property ,it was 6.73 in A1 treatment and it was at less value in A3 treatment (5.40).The differences between the studied treatments were significant among them.

Table 6: Effect of the studied treatments on the sensory evaluation properties

Treatments	Medium ± Standard error					
	Color	appearance	Texture	freshness	flavor	general acceptance
A	5.93±0.14	6.20±0.38	5.93±0.11	6.06±0.09	5.80±0.12	6.13±0.57
A1	6.40±0.32	6.20±0.39	6.13±0.25	6.06±0.19	6.33±0.32	6.33±0.31
A2	5.93±0.27	5.86±0.22	5.40±0.26	6.06±0.28	5.80±0.12	5.93±0.44
A3	5.60±0.22	5.46±0.38	5.06±0.23	5.00±0.19	5.40±0.22	5.40±0.41
A4	6.00±0.39	6.20±0.27	6.13±0.4.	6.00±0.30	5.80±0.26	6.13±0.37
A5	5.13±0.24	5.53±0.35	5.20±0.17	5.33±0.39	5.66±0.26	5.86±0.35
A6	5.46±0.29	5.26±0.41	4.80±0.36	5.46±0.27	5.66±0.48	5.60±0.32
LSD value	1.045 NS	0.883*	1.178*	0.963*	0.802 NS	0.874 NS
NS= not significant at (P<0.05)*						

Table(7)shows kids sensory evaluation values of the cake samples. It may noticed that A4 treatment (replacing 10% legumes plus olive oil)got the highest sensory evaluation by the kids.

Table 7: Kids Sensory evaluation averages.

Treatments	Final sensory evaluation degrees medium
A	100
A1	90.9
A2	93,93
A3	90.9
A4	100
A5	81.8
A6	90.9

Table(8) shows how much the products save of kid daily nutrient assessed at age (1 – 3) year ,it may be noticed that 50 gram of product weight saved 36.7% of protein from the assessed for one full day , 21% of carbohydrates and 17.7% of energy and the rest ratios of the nutrient elements are explained in the table.

Table 8: The saved ratios of the product.

Nutrient elements	units	DRI	A4 treatment	Saved Ratios by daily nutrient assessed %
Energy	Calorie /day	1046	370.22±0.62	17.7
Protein	gm/day	13	9.55±0.32	36.7
Carbohydrates	gm/day	130	54.61±0.52	21
Fibers	gm/day	19	0.93±0.07	2.4
Ca	mg/day	500	77.67±0.32	7.7
P	mg/day	460	119.27±0.32	12.9
Fe	mg/day	7	1.38±0.05	9.9
Zn	mg/day	3	0.89±0.04	14.8

DRI = The reference value for the nutrient eaten from the nutrient elements (17).

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