Utilization of Fish Bone and Egg Shell to Nutritional support of Baton Sale'

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ABSTRACT

*Fish bone and egg shell are considered as waste products. Thus, reprocessing and eventual utilization of waste products have beneficial uses rather than their discharge to the environment which cause detrimental environmental effects. Fish bone and egg shell could be utilized as dietary calcium source and added to the produce calcium-rich bakery product (Baton sale'). Baton sale' was prepared from wheat flour supplemented by fish Tilapia bone and chicken egg shell in two concentrations **5%** and **7%**. Chemical composition of (wheat flour, egg shell and fish bone) and the fortified baton sale' products were measured. The nutritional value and sensorial properties were evaluated. The results indicated that addition of fish bone or egg shell powder gave a pronounced increase in gross chemical composition of baton Sale' as compared to control. Also most of the mineral increased than control especially Ca. All sensory evaluations were acceptable for all fortified baton Sale' as bakery products. The percentage calculated of the examine minerals were on percentage of RDA. Egg shell powder and fish bone are an appropriate and cheap source of calcium for human nutrition and easily prepared at home.*

Key words: *baton Sale', fish bone, egg shell*

INTRODUCTION

Wastes from the food processing industry have the following characteristics: large amounts of organic materials, varying amounts of solids depending on the source and high biochemical oxygen demand (BOD) or chemical oxygen demand **(Sharaf, 2005)**. Fortification of main foods is on the whole agreeable as an effective agreeable for as long as the daily requirements for a range of minerals and vitamins (**Fairweather and Teucher, 2002; Babarykin *et al*., 2004**). Fortification of calcium products would be beneficial in increase of the levels of calcium intake (**Kim and Mendis, 2006**), in specific for inhabitants groups with not enough their needs of dairy products and milk because of the lactose touchiness (**Luu and Nguyen, 2009**).

Widespread food products effectively reinforced with calcium in growing States and their products, corn flour, wheat flour, sugar, salt, oils and fats (**Singh *et al*., 2007**). These products are reinforced through utilizing mercantile salts of calcium like calcium citrate, calcium carbonate, and tri-calcium phosphate (**Singh *et al*., 2007**) whilst employment of normal Ca resources like fish bone can be more agreeable by consumers and be more functional in terms of existence of calcium-phosphate composition in which is comparable to the components of human bone (**Chuamani, 2010 and Hemung, 2013**).

Fish is one of the most noticeable resources of animal protein in the range of 17-20% and else elements for the reform a healthy body (**Arannilewa *et al*., 2005**). Fish bones are still a by-product and account for about 10-15% of total body weight (**Malde *et al*., 2010**). In many countries, these bones are considred industrial waste that is disposed of as waste, exposing the environment to pollution (**Stevanato *et al*., 2008**). In recent times, dried fish bone has been used as a dietary ingredient in diets for fish and other animals, with a suitable effect on growth and feed capacity compared with conventional diets (**Toppe *et al*., 2006**). Fish or fish products are sources of

about 10% of minerals, especially in Ca and P, and since they are an vital exporter of minerals and thence inclusive in feed (**Toppe et *al*., 2007**).

Egg shell offset from 9-12% of the total egg weight; it contains commonly of $CaCO_3$ (94%) with some $MgCO_3$ and Ca_3 $(PO_4)_2$ deposited on the organic matrix (**Bowero, 1992**). Calcium taken from egg shell is a good provenance of dietary calcium and is an alternative to crustaceans (**Suguro *et al*., 2000**). Further, Ca intake from egg shell was absorbed higher than that were taken from a mercantile provenance $CaCO_3$ (**Swiatkiewicz *et al*., 2015**). Numerous researchers recommend using egg shells as a provenance of calcium for human nutrition (**Schaafsma *et al*., 2000**). Eggshell and shell membranes are non- palatable by-products with little popular value but they may include biologically active compounds (**Nakano *et al*., 2003**), also, from the chemical point of view, the egg shell contains of dry matter (98%) and water (2%). The dry matter is composed of 93% ash and 5% crude protein. Average values of mineral contents in different parts of the egg and egg shell. Egg shells consist calcium and little amounts of other micro-elements, i.e. Mg, B, Co, Fe, Mn, Mo, S, Si and Zn (**Nakano *et al*., 2003**).

The present investigation was initiated to discuss the prospect of incorporating egg shell and fish bone in baton sale'. This study is aims to improve market value of egg shell and fish bone by its utilization in value added products, as well as to provide highly sought after nutraceuticals in convenient form to the health conscious consumers.

MATERIAL & METHODS

Materials:

Wheat flour (72% extra), sugar, fresh yeast, skimmed milk, cumin seeds, oils, water, eggs and salt were obtained from local market at El-Mansoura City. Fish bone and Egg sell: Fish (Tilapia) were obtained from the fish market at El-Obour, Cairo, Egypt. Egg shell

was obtained from the farm near El-Mansoura City, Egypt.

Preparation of bon fish powder:

Bones of fish were separated and washed three times with alkaline solution (0.01 N NaOH) following with 3 times with distilled water. Bone fish oven dried at 70ºC over night to complete drying. Dry bones were put into a grinder to powder then sifted many times to become fine powder (40 mm sieve).

Preparation of egg shell powder:

Egg shell has been boiled in water for 30 min to kill any microbial growth on the surface. Eggs were washed well in water to remove any impurities, then leave to dry.Each Egg was broken and its contains were removed, Egg shells were obtain washed and boiled with deionized water for 10 min according to **(King'ori, 2011)** and dried in hot air oven at 100°C for 10 minutes to complete drying, the dried eggshell grind to powder by a household mill and then passes through sieve (40 mm sieve) as fine powder.

Preparation of baton sale':

All dry ingredients (Wheat flour, sugar, skimmed milk, cumin seeds and salt) were mixed together egg shell or fish bone by at several rate then the rate 5% and 7% were chosen as the best sensory evaluation. 5% 7% / 100 gm was replaced from total wheat flour content. Control baton sale′ dough was prepared according to the formula presented in table (A). To prepare the control treatment, the yeast is rubbed in sugar to melt completely then the warm milk is added and the mixture is turned over well and left for a short time (4 minutes). Flour is sifted with salt, then oil is put and rubbed with the fingertips to disappear completely, then salt and cumin were added. The egg is beaten. Long stick were formed and left to complete fermentation, the face was brushed with egg diluted with the milk. The face is sprayed with cumin, and baked in medium - heat oven to cook (**Yossef and El-Sheikh 2008).**

Table (A): Ingredient used in baton sale′ formulae.

Ingredients	Baton sale′		
	Control	5%	7%
Wheat flour	571	542.5	531.03
Fish bone or Egg shell powder	-	28.5	39.97
Oil (ml)	150	150	150
Milk	23	23	23
Eggs	250	250	250
Sugar	0.5	0.5	0.5
Salt	1.4	1.4	1.4
Yeast	2.8	2.8	2.8
Cumin	**1.3**	**1.3**	1.3

Sensory evaluation:

Sensory evaluation of baton sale′ was evaluated for appearance, flavor, color, thickness, smell, texture, taste and overall acceptability. The scoring of sensory characteristics ranges from 1-10 degree was determined **(Smith et al., 1972)**. Ten-member training committee consisting of students and female employees was selected in the Home Economics Department based on their experience and knowledge to baton sale′ for sensory evaluation. The tests were conducted under fluorescent lighting in the nutrition laboratory and the sensory evaluation was done at 10 am. The tap water was available to rinse the mouth between assessments**.**

Chemical analysis:

Moisture, crude fat, Ash, crude protein and cured fiber estimations were carried out according to the methods of **A.O.A.C. (2000**); Total carbohydrates were calculated by difference, Ca, P, Zn and Na by utilizing Atomic Absorption Spectrometry according to **Luten *et al*., (1996).**

Statistical analysis:

The outcomes were expressed as mean ± standard deviation (mean ± SD. Outcome were analyzed using one way classification. All data were statistically analyzed according to the technique of analysis

variance (ANOVA) test and the least significant difference (L.S.D) at <0.05 and Duncan's test, method was used to compare the difference between the means of treatment values to the methods described by **Gomez and Gomez, (1984)**. All statistical analyses were performed using analysis of variance technique by means of Co STATE Computer software.

RESULTS & DISCUSSION

Sale of Baton Salé is one of the most important general bakery products that are used in general for the categories of its mix in Egypt. Due to its low cost compared to other reasonably priced processed foods, good nutritional quality and varied taste. Bakery products are sometimes used as a means to integrate various nutrient-rich ingredients.

In table (1) showed the chemical composition of some row materials utilized in the preparation of three kind from bakery production baton sale′. It could be demonstrated that fish bone powder contained the highest values in ash and protein, but egg shell powder was (48.4 & 1.56%) compared with wheat flour (0.59 & 12.09 %), whereas egg shell was the lowest values in protein and fat value, which recorded in wheat flour (12.09 & 1.82%) while highest value was in fish bone. From the same table, it could be seen that, the egg shell had the highest values in macro elements that fish bone and wheat flour, Ca, Mg, and P, these values were the lowest in wheat flour as mentioned in the Table. As for the microelements, indicated that values of Zn and Fe recorded the highest values in wheat flour comparing with fish bone and egg shell. **Walton et al., (1973)** resulted that the chemical compotation of egg shell was 91.1% ash, 7.56% protein, 0.24% lipid, 36.4% Ca, 0.0025% Fe, 0.097% K, 0.398% Mg, 0.152% Na and 0.116% P. Also, **Burley and Vadhera (1989)** studied the chemical composition of egg shell and reported that it content of water, protein, lipids, inorganic salts and total solids were 1.66, 6.40, 0.03, 91.1 and 97.4%, respectively.

Data given in table (2) showed the chemical

composition of baton sale′, it could be noticed that the moisture content for baton sale′ with egg shell 7% was the lowest value. The moisture was ranged between (10.43 to 11.52), the highest value was in fish bone. In the same Table, crude protein% content in baton sale′ ranged between (8.09 to 9.27%). The highest value noticed in fish bone 7%, but the lowest value was found in baton sale′ control. Protein was significant difference in all treatments at except fish bone 7%. Fat content was higher than control except with fish bone (5 & 7%). Fat was significantly increased in egg shell (5&7%) as comparing with baton sale′ control. Ash content was ranged from (2.99 to 4.03%). The highest value was noticed in egg shell 7%, but fish bone 5% had the lowest value. Ash content in all treatments showed significant compared with control at except with egg shell 7%. Finally carbohydrates contents % contained the highest value in fish bone 5% (70.28%) and the lowest one in egg shell 5% (69.07%). With all treatment, carbohydrates decreased as comparing with baton sale′ control samples except with fish bone (5 & 7%).

Data in table (3) illustrated mineral contents of baton sale′, including Ca, Mg, P, Zn, and Fe. Calcium (Ca) level was ranged between (203.4 to 259.3 mg/100g) in baton sale′ and the highest values was observed in fish bone 7%, while the lowest value was noticed in baton sale′ control. The highest value of phosphorus (P) in baton sale′ was found in egg shell 7% (68.2 mg/100g) comparing with its control. **Salem et al., (2012)** when fortified biscuit and butter cake with egg shell, showed that the most declared effect of biscuit was shown in calcium. The supplement of egg shell powder led to a major raise in calcium, calcium to phosphorus ratio and iron contents in the fortified butter cake**.** Regarding to the same table noticed that the highest value of manganese (Mg) in fortified baton sale′ comparing with control. Manganese level in baton sale′ ranged between (21.8 to 47.6 mg/100g), the highest value observed in fish bone 7% (47.6 mg/100g), while the lowest one

in baton sale′ control. Data in table (3) demonstrated that the level of zinc (Zn) ranged between (3.29 to 4.39 mg/kg), the highest value was found in the fish bone 7% and the lowest value in egg shell 7%. **Yamaguchi, (2015)** who explained zinc benefit, an essential trace element, plays a vital function in the organizing of bone metabolism. **Payal et al., (2018)** who reported the lack of nutritional zinc led to impediment of bone growth**.** Accumulating studies refer to that zinc has a very significant role in the keeping balance of bone. **Holloway et al. (1996)** who was given proof of a vital role for nutritional zinc in bone tissue accumulation and retention. From obtained data in the same table, it was observed that iron(Fe) concentration was decreased with adding treatments comparing with baton sale′ control, the highest value noticed in control, while the lowest value in egg shell 7%. These outcome in agree with those given by **Koshihara *et al.*, 2001; Jung *et al*., 2006; Toppe *et al.*, 2006 and FAO, 2014.**

Nutrients intake of mineral (Ca, Mg, P, Zn, and Fe) in 100g baton sale′ samples supplemented with egg shell and fish bone (5 & 7%) for male, female and children are present in **table 4**. Data reveal marked increases in Ca intake of fortified baton sale′ compared with control and the highest value indicated with 7% fish bone up to 19.9% compared with control up to15.6% for male, female and children. The obtained result also showed same trend for all minerals with using 7% fish bone except P and Fe. On the other hand, P recorded the highest value with addition of 7% egg shell while Fe decreased with all addition comparing with the control for male, while for female and children, Fe for control and fish bone 5% was the same value. The obtained result indicated that the presence of 7% fish bone had caused a great increase in most of minerals in the supplemented baton sale′ and consequently raised the nutritive value of wheat flour used for baton sale′ **(FDA 2016)**

Data in table 5 showed the sensory evaluation including

appearance, color, texture, smell, taste, flavor, thickness and overall acceptability of baton sale′. The appearance ranged from (9.01 to 9.94), the highest was found in control followed by egg shell 5%, but the lowest value was fish bone 7%.

Color was the best value in the control baton sale′ (9.79) followed by egg shell 7% (9.54), while the lowest value was in (9.34) fish bone 7%.

Texture was ranged between 9.38 in fish bone 7% to 9.85 in control. The smell was acceptable which ranged from (9.50 in fish bone 7% to 9.96 in control baton sale′). Meanwhile, taste is a sensation perceived by the tongue and influenced by the texture. Taste ranged from (9.40 to 9.94 in baton sale′) the highest value in control baton sale′ followed by egg shell 5% (9.80) and the lowest was in fish bone 7%.

Flavor was the highest in control baton sale′ (9.93) followed by egg shell 5% (9.81) and the lowest was in (9.43) fish bone 7%. Thickness was ranged between (9.32 to 9.85), the highest mean values recorded with control baton sale′ followed by egg shell 5% while the lowest value was recorded in fish bone 7%. Overall acceptability was the highest in control baton sale′ (9.84) followed by eggshell 5% (9.71) and the lowest was in fish bone 7% (9.30).

CONCLUSION

Study can be concluded that eggshell powder is an appropriate and cheap source of calcium for human nutrition easily prepared at home. Fish bone powder supplementation with wheat flour did not produce important changes in flavor and texture in baton sale′ up to 7%. When add fish bone and egg shell to baton sale′ increased nutritional value for it.

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Table (1): Chemical composition of wheat flour, fish bone and egg shell powder on dry weight.

Samples	Wheat flour	Fish bone	Egg shell
Macronutrients g/100g (%)			
Moisture	11.93	2.46	1.15
C. protein	12.09	14.81	1.65
T. Fat	1.82	5.82	1.37
T. Ash	0.59	70.83	48.4
T. carbohydrates	73.57	6.08	47.43
Macro-elements mg/100g			
Ca	18.3	598.2	730
Mg	23.7	157.6	350
p	49.6	288.4	375.4
K	109.2	371	17.06
Na	3.85	55	33.3
Micro-elements (ppm)			
Zn	7.71	5.66	0.99
Fe	12.53	1.6	1.4
Mn	6.94	1.53	3.16
Cu	1.53	0.62	0.063

Table (2): Gross chemical composition of baton sale′ bakery (on dry weight bases g/100g)

Treatments	Moisture %	C. protein %	T. Fat %	Ash %	T. carbohydrates %
Control	11.88[a] ±0.03	8.09[e] ±0.03	6.95[c] ±0.03	2.18[d] ±0.02	69.90[c] ±0.02
5% Egg shell powder	10.96[c] ±0.05	8.72[c] ±0.04	7.60[a] ±0.05	2.85[b] ±0.005	69.07[e] ±0.05
7% Egg shell powder	10.43[d] ±0.03	9.03[b] ±0.03	7.19[b] ±0.04	4.03[a] ±0.05	69.32[d] ±0.04
5% Fish bone powder	11.52[b] ±0.04	8.49[d] ±0.02	6.72[d] ±0.03	3.99[e] ±0.06	70.28[a] ±0.04
7% Fish bone powder	10.93[c] ±0.05	9.0[a] ±0.05	6.49[e] ±0.05	5.31[c] ±0.03	70.00[b] ±0.06

Each value is the mean ± SD

Mean values in each column have different subscript (a, b, c, d……..) are significant different P<0.05

Table (3) Mineral contents of baton saleʹ bakery (on dry weight bases g/100g)

Treatments	Ca mg/100g	Mg mg/100g	P mg/100g	Zn mg/kg	Fe mg/kg
Control	203.4 ^{e} ±0.30	21.8 ^{e} ±0.20	52.7 ^{e} ±0.40	3.71 ^{c} ±0.04	15.21 ^{a} ±0.02
5% Egg shell powder	235.4 ^{d} ±0.20	27.3 ^{d} ±0.10	61.6 ^{b} ±0.20	3.52 ^{d} ±0.02	14.37 ^{d} ±0.02
7% Egg shell powder	251.6 ^{b} ±0.20	36.2 ^{c} ±0.20	68.2 ^{a} ±0.20	3.29 ^{e} ±0.08	13.87 ^{e} ±0.03
5% Fish bone powder	242.8 ^{c} ±0.40	43.1 ^{b} ±0.50	57.1 ^{d} ±0.30	4.18 ^{b} ±0.02	14.97 ^{b} ±0.04
7% Fish bone powder	259.3 ^{a} ±0.30	47.6 ^{a} ±0.40	60.5 ^{c} ±0.30	4.39 ^{a} ±0.02	14.71 ^{c} ±0.02

Each value is the mean ± SD

Mean values in each column have different subscript (a, b, c, d……..) are significant different P<0.05

Table (4): Percentage of some minerals intake from 100g baton sale′ comparing with RDA for male, female and children

Treatments	Male						Female						Children > 4 y					
	Control	5% [illegible]	7% [illegible]	5% Fish	7% Fish	RDA	Control	5% [illegible]	7% [illegible]	5% Fish	7% Fish	RDA	Control	5% [illegible]	7% [illegible]	5% Fish	7% Fish	RDA
Ca %RDA	15.6	18.1	19.3	18.6	19.9	**1300 mg**	15.6	18.1	19.3	18.6	19.9	**1300 mg**	15.6	18.1	19.3	18.6	19.9	**1300 mg**
Mg %RDA	5.5	6.8	9.1	10.8	11.9	**400 mg**	7.03	8.8	11.7	13.9	15.4	**310 mg**	5.2	6.5	8.6	10.3	11.3	**420 mg**
P %RDA	7.5	8.8	9.7	8.2	8.6	**700 mg**	7.5	8.8	9.7	8.2	8.6	**700 mg**	4.2	4.9	5.5	4.6	4.8	**1250 mg**
Zn %RDA	3.4	3.2	3.0	3.8	4.0	**11 mg**	4.6	4.4	4.1	5.2	5.5	**8 mg**	3.4	3.2	3.0	3.8	4.0	**11 mg**
Fe %RDA	19.0	18.0	17.3	18.7	18.4	**8 mg**	8.3	8.0	7.7	8.3	8.1	**18 mg**	8.3	8.0	7.7	8.3	8.1	**18 mg**

RDA: Recommended dietary allowances according to FDA (2016)

Table (5): The sensory evaluation of baton sale′ bakery

Characteristics	Control	Egg shell powder 5%	Egg shell powder 7%	Fish bone powder 5%	Fish bone powder 7%
Appearance	9.94 [a] ±0.04	9.01 [e] ±0.05	9.27 [d] ±0.07	9.64 [c] ±0.04	9.73 [b] ±0.04
Color	9.79 [a] ±0.03	9.56 [c] ±0.02	9.64 [b] ±0.04	9.49 [c] ±0.06	9.34 [d] ±0.04
Texture	9.85 [a] ±0.05	9.72 [b] ±0.04	9.60 [c] ±0.08	9.41 [d] ±0.06	9.38 [d] ±0.05
Smell	9.96 [a] ±0.05	9.85 [b] ±0.05	9.60 [d] ±0.05	9.71 [c] ±0.05	9.50 [e] ±0.04
Taste	9.94 [a] ±0.04	9.80 [b] ±0.05	9.67 [c] ±0.03	9.73 [bc] ±0.05	9.40 [d] ±0.03
Flavor	9.93 [a] ±0.06	9.81 [b] ±0.04	9.55 [c] ±0.05	9.62 [c] ±0.05	9.43 [d] ±0.04
Thickness	9.85 [a] ±0.04	9.70 [b] ±0.03	9.65 [b] ±0.05	9.43 [c] ±0.02	9.32 [d] ±0.05
Overall acceptability	9.84 [a] ±0.02	9.71 [b] ±0.04	9.60 [c] ±0.05	9.45 [d] ±0.05	9.30 [e] ±0.04

Each value is the mean ± SD

Mean values in each row have different subscript (a, b, c, d……..) are significant different *P<0.0 5*

الاستفادة من عظام السمك وقشر البيض في الدعم التغذوي للباتون ساليه

اشرف رفعت محمد الزيني - هالة عزت مصطفي الكواوي –عبير حسني محمد العيسوي

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الملخص العربي

تعتبر عظام السمك وقشر البيض من المخلفات . من المفيد إعادة معالجتها واستخدامها بدلاً من تصريفها إلى البيئة مما يسبب تأثيرات بيئية ضارة. تعتبر عظام السمك وقشر البيض مصدر للكالسيوم الغذائي. هدفت الدراسة بالاستفادة من عظام السمك وقشر البيض بإضافتهم للدقيق لانتاج مخبوز غني بالكالسيوم (باتون ساليه).تم تدعيم الباتون ساليه بمسحوق عظم السمك ومسحوق قشرة البيض بنسبة ٥ %و ٧ %. تم تقدير التركيب الكيميائي لقشرة البيضة وعظام السمك ودقيق القمح ومنتجات بالباتون ساليه المدعمة . أيضا ، تم تقدير بعض المعادن. وقد تم تقدير القيمة الغذائية ،والخصائص الحسية . أشارت النتائج التي تم الحصول عليها إلى أن إضافة عظام السمك أو مسحوق قشر البيض ادت الي زيادة معنويه في التركيب الكيميائي للباتون ساليه مقارنة بالكنترول و أيضا زيادة معظم المعادن عن الكنترول وخاصة الكالسيوم. أظهرت النتائج أن كل التقييمات الحسية كانت مقبولة للباتون ساليه المدعم . كما تم حساب النسبة المئوية من المعادن التي تم تقديرها بالنسبة للتوصيات الغذائية اليوميه للمرأة والرجل والاطفال .

الكلمات المفتاحية: *عظام السمك - قشر البيض- الباتون ساليه*