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THE POSSIBILITY FOR USING FISH BONE POWDER TO SUPPLEMENT SOME KINDS OF BISCUITS

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ABSTRACT

The present study aimed to examine the possibility for using fish bone powder to supplement some kinds of biscuits .For achieved this purpose ,have been added fish bone powder was added at the rates of 3, 6 and 9% replacement respectively to wheat flour (%٧٢) for using in to prepare three kinds of biscuits (vanilla biscuit - orange biscuit - Lemon biscuits),and study the impact of those replacements on the chemical composition and rheological properties of wheat flour .It has also been to study the impact of those replacements on the sensory properties of the kinds of biscuits through 60 judges .Results indicated that the addition of fish bone powder to wheat flour at the rates of 3, 6 and 9% replacement has led to increase in the rates of each of the protein, ash, fat and calcium ,while decrease in moisture content as compared to wheat flour (100%) .Also ,results rheological properties showed that the use of fish bone powder by 9% has led to a decrease in both the of water absorption ,elasticity , extensibility, the proportional number and energy, also led to increase the arrival time and dough development, as compared to the control (100% wheat flour). The results of sensory properties has resulted in the addition of fish bone powder by 9% to biscuits (vanilla biscuit , oranges biscuit, lemon biscuit) did not show statistically significant differences ($P \leq 0.05$) in aroma, taste as well as color and overall acceptability as compared to the control. From the above study, it recommended for using fish bone powder by 9% in the supplement of biscuits .Also this study recommended as further studies was done to using the highest ratios above %٩ of fish bone powder.

Keywords: Fish Bone Powder – Supplement – Biscuits.

INTRODUCTION

Fish are an important source of protein for human consumption and globally approximately 148 million were harvested in 2010 (Yin and Park, 2014).

A considerable amount of the total marine fish catch is discarded as processing leftovers, including trimming, fins, bones, head, skin and viscera. One estimate suggests that current discards from the world's fisheries exceeds 20 million tons, equivalent to 25% of the total production of marine capture fisheries (Tongchan *et al*,2009).

The bone fraction, which comprises approximately 10-15% of the total body weight of fish (skin not included) is still regarded as waste (Malde *et al*, 2010a).

The fish bone is currently discarded or processed into bonemeal for animal feed, which is not economical (Hemung and Sriuttha, 2014).

Generated fish processing waste i.e the head, bones and skin scales are discarded and not used by the public or the fishing industry, thus, negatively impacted the environment. This waste, if managed well will have an important economic value because these wastes of the head bones and scales have a quite high mineral content; especially calcium and phosphor (Talib *et al*., 2014).

Fish bones have a high Ca content, and huge quantities of this raw material are available as a by-product from the fish industry(Malde *et al*, 2010a).

Fish bone has a high calcium (Ca) content, the Ca and phosphorus (P) comprise about 2% (20 g/kg dry weight) of the whole fish. The chemical composition of fish bones varied, in general, in oily fish (e.g. salmon) have higher lipid levels, and lower protein and ash levels as compared to lean species (e.g. cod)(Toppe *et al*,2007).

The bone fraction from fish has been regarded as waste. Due to the high mineral content of fish bones, this material can be considered well suitable as a natural calcium source(Malde *et al*, 2010b and Chakrabarty and Datta(De), 2015).

Bone is also the source of important minerals i.e sodium, phosphorous, and calcium. Among them, calcium ion (Ca2+) is important for development of human bone and teeth particularly in infant. Utilization of fish bone can be a natural source of Ca2+ for being food ingredient and Ca2+ supplementary. It would be the strategy to maximally utilize fish resource as well as to effectively reduce the waste from fishery industry(Hemung, 2013).

Calcium is the most abundant micronutrient found in human body. It accounts for 1.5% of the body weight (Chaimongkol, 2012), Calcium is an essential nutrient as all living cells require calcium to remain viable(Theobald, 2005), Inadequate intake of calcium in the human diet is one factor in the etiology of several disorders. Adequate calcium intake during growth is critical to the achievement of peak bone mass that may reduce the risk of osteoporosis (Tongchan *et al*,2009), it is an essential mineral for normal body function (e.g. bone growth, blood clotting and neurotransmission). Calcium is distributed throughout the body, 99% in the bone and 1% in the blood circulation with the plasma level of 8.5-10.5 mg/dL. Lack or an insufficiency of calcium can cause osteoporosis, heart disease and hemorrhage (Phiraphinyo *et al*, 2006).

Fish bones are a high value by-product from the fish farm industry and due to the high calcium content this resource can conveniently be utilised as a high quality food ingredient or supplement(Malde *et al*, 2010b)..

The current research aims to study the extent of possibility for using fish bone powder to supplement some kinds of biscuits.

MATERIALS AND METHODS

Ingredients :fish bone, wheat flour (72% extraction), eggs ,sugar ,baking powder , margarine, vanilla ,orange juice ,orange husked , lemon juice and lemon husked.

Preparing of fish bone powder: Fish bone powder was prepared according to the method described by Sirichokworrakit (2014) that fish bone was washed, boiled at 95°C for 10 minutes, soaked in 10 ppm chlorine for 90 minutes, soaked in 0.8% sodium hydroxide for 90 minutes, heated 121°C for 90 minutes under high pressure (15 lb.in-2) and dried at 90°C for 60 minutes. Then it was blended and sieved through an 80 – mesh screen. fish bone powder (FBP) was kept in sealed container at room temperature.

Preparing of biscuit:

The composition of kinds of biscuits in table (1)

Table(1):Composition of kinds of biscuits

Vanilla biscuit			
Ingredients	**Vanilla biscuit (WF100%)**	**Vanilla biscuit (WF 97% + FBP 3%)**	**Vanilla biscuit (WF 94% + FBP 6%)**
Wheat flour (72% extraction) + Fish bone powder	One cup (WF 100%+ FBP 0%)	One cup (WF 97%+ FBP 3%)	One cup (WF 94%+ FBP 6%)
Sugar	1/2 cup	1/2 cup	1/2 cup
Margarine	1/4 cup	1/4 cup	1/4 cup
Egg	one egg	one egg	one egg
Vanilla	one teaspoon	one teaspoon	one teaspoon
Baking powder	1/2 teaspoon	1/2 teaspoon	1/2 teaspoon
Orange biscuit			
Ingredients	Orange biscuit (WF100%)	Orange biscuit (WF 97% + FBP 3%)	Orange biscuit (WF 94% + FBP 6%)
Wheat flour (72% extraction) + Fish bone powder	One cup(WF 100%+ FBP 0%)	One cup(WF 97%+ FBP 3%)	One cup(WF 94%+ FBP 6%)
Sugar	1/2 cup	1/2 cup	1/2 cup
Margarine	1/4 cup	1/4 cup	1/4 cup
Egg	one egg	one egg	one egg
Orange juice	one teaspoon	one teaspoon	one teaspoon
Orange husked	1/2 teaspoon	1/2 teaspoon	1/2 teaspoon
Baking powder	1/2 teaspoon	1/2 teaspoon	1/2 teaspoon
Lemon biscuit			
Ingredients	Lemon biscuit (WF100%)	Lemon biscuit (WF 97% + FBP 3%)	Lemon biscuit (WF 94% + FBP 6%)
Wheat flour (72% extraction) + Fish bone powder	One cup (WF 100%+ FBP 0%)	One cup (WF 97%+ FBP 3%)	One cup (WF 94%+ FBP 6%)
Sugar	1/2 cup	1/2 cup	1/2 cup
Margarine	1/4 cup	1/4 cup	1/4 cup
Egg	one egg	one egg	one egg
Lemon juice	one teaspoon	one teaspoon	one teaspoon
Lemon husked	1/2 teaspoon	1/2 teaspoon	1/2 teaspoon
Baking powder	1/2 teaspoon	1/2 teaspoon	1/2 teaspoon

WF (wheat flour) , FBP (fish bone powder)

All types of biscuits prepared using the creaming method according to سابا (1995).

Chemical analyses:

Protein, fat, ash and moisture content were determined according to the A.O.A.C (2000),while calcium was determined using Atomic Absorption Spectrophotometer according to the methods outlined in A.O.A.C. (1990).

Sensory properties: Sensory property for Biscuits was evaluated by 60 adult according to Watts et al., (1989).

Rheological properties:

The farinograph and extinsograph tests were carried out in the lab of Food Technology Research Institute, Agriculture Research Center, Giza, Egypt.

Statistical analysis :

All the obtained data were statistically analyzed by SPSS computer soft ware. The calculated occurred by analysis of variance ANOVA and follow up test LSD by SPSS ver.11.5 according to Artimage and Berry (1987).

RESULTS AND DISCUSSION

Effect of treatments on chemical composition of wheat flour:

Data in table (2) showed the effect of treatments on chemical composition of wheat flour. Results cleared that the addition of fish bone powder at the rates of 3%, 6% and 9% to wheat flour has increased each of the protein(11.85, 11.94, 12.03, 12.11, respectively) , ash(0.52, 2.77 , 5.04, 7.29, respectively), fat(1.06, 1.20, 1.35, 1.48, respectively) , calcium(12.94, 14.58, 16.23, 17.88, respectively) , and reduced moisture content (11.99,11.70,11.42,11.29, respectively) as compared to the control (100% wheat flour).

The results of the current study were similar with these of Abdel-Moemin (2015) , who showed that addition of cooked fish bones to cookies led to an increase in protein, ash, calcium and decreased in moisture.

Table (2): Effect of treatments on chemical composition of wheat flour

Composition	Treatments			
	Control (wheat flour)	**WF (97%) + FBP (3%)**	**WF (94%) + FBP (6%)**	**WF (91%) + FBP (9%)**
Moisture(g%)	11.99	11.70	11.42	11.29
Protein (g%)	11.85	11.94	12.03	12.11
Ash (g%)	0.52	2.77	5.04	7.29
Fat (g%)	1.06	1.20	1.35	1.48
Ca (mg%)	12.94	14.58	16.23	17.88

WF (wheat flour) , FBP (fish bone powder)

Effect of treatments on rheological properties:

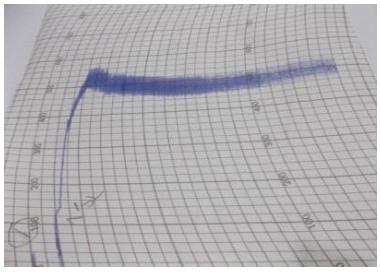
The data in table (3) , and figures 1 to 6 showed the effect of treatments on farinograph parameters. The results revealed that the addition of fish bone powder at rates of 3%, 6% and 9% to wheat flour has led to decrease the rate of water absorption (62.7,60.2, 59, 57.5 , respectively) , which is probably due to a change in the proportion of gluten and increase the proportion of fat. Also, the use of fish bones powder as 3% and 9% led to an increase in arrival time , which is probably due to a change in gluten ratio and lack of water absorption, also led to a decrease in extensibility, which is probably due to a change in the proportion of gluten and the lack of water absorption and increase fat ratio.

The results of the current study were similar with those of Sirichokworrakit (2014), who indicated that water absorption decreased as the levels of Tilapia Bone Flour increased from 0-15%.

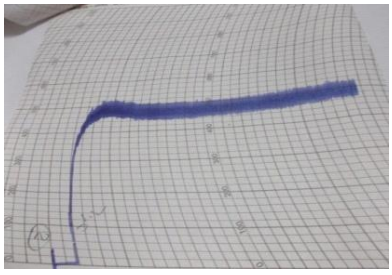
Table (3): Effect of treatments on rheological properties.

Tests		Treatments			
		Control (wheat flour)	**WF (97%) + FBP (3%)**	**WF (94%) + FBP (6%)**	**WF (91%) + FBP (9%)**
Farinograph	Water absorption(%)	62.7	60.2	59.0	57.5
	Arrival time (min)	1.0	1.5	1.0	1.5
	Dough development (min)	1.5	2.0	1.5	2.0
	Stability (min)	12>	12>	12>	12>
Extinsograph	Elasticity (B.U)	290	140	120	140
	Extensibility (mm)	125	120	140	120
	Proportional number	2.32	1.16	0.85	1.16
	Energy (C m^2)	45	25	25	25

WF (wheat flour) , FBP (fish bone powder)

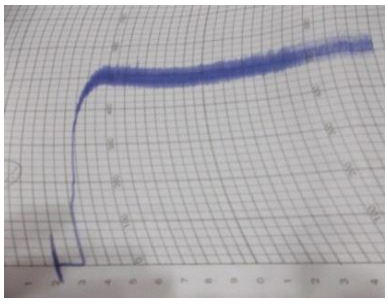


Control (100% wheat flour)

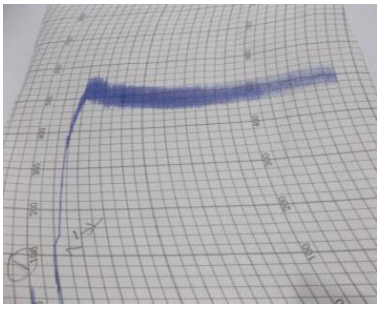


%٣ fish bone powder

Fig 1: Effect of addition 3% fish bone powder on farinograph parameters.

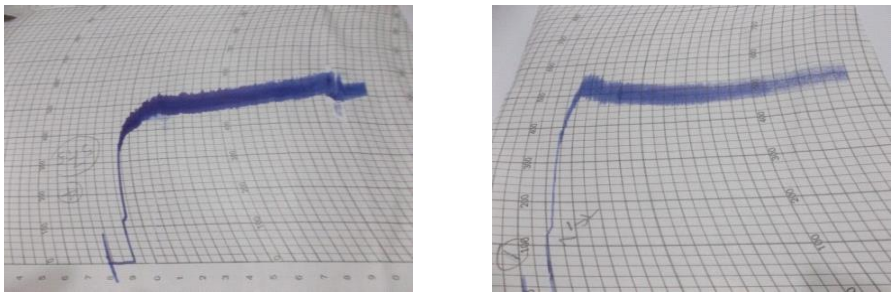


Control (100% wheat flour)



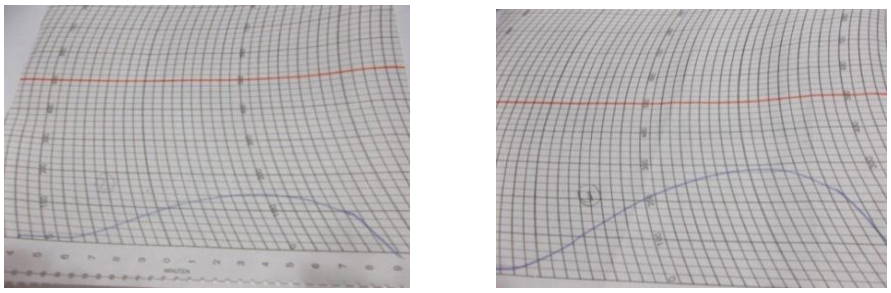
%٦ fish bone powder

Fig 2: Effect of addition 6% fish bone powder on farinograph parameters.



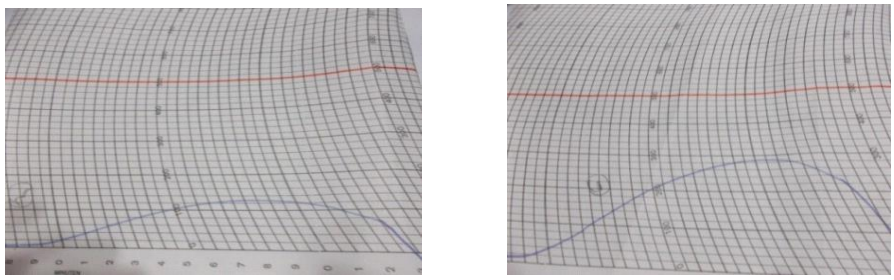
Control (100% wheat flour) **%٩ fish bone powder**

Fig 3: Effect of addition 9% fish bone powder on farinograph parameters.



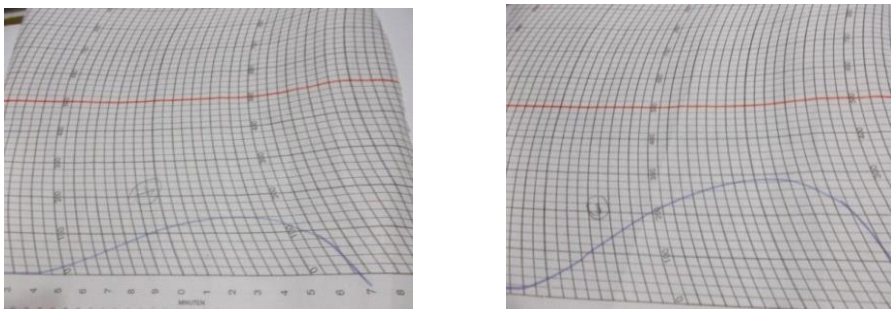
Control (100% wheat flour) **%٣ fish bone powder**

Fig 4: Effect of addition 3% fish bone powder on extensograph parameters.



Control (100% wheat flour) **%٦ fish bone powder**

Fig 5: Effect of addition 6% fish bone powder on extensograph parameters



Control (100% wheat flour) **%٩ fish bone powder**

Fig 6: Effect of addition 9% fish bone powder on extensograph parameters.

Effect of treatments on sensory evaluation of kinds of biscuits:

Effect of treatments on sensory evaluation of produced kinds of biscuits are presented in tables (4,5,6). Results cleared that not significant ($P \leq 0.05$) differences between control (wheat flour (100%)) and produced kinds of biscuits(vanilla biscuit , orange biscuit , lemon biscuit) of 3%, 6% and 9% FBP in sensory properties (Aroma, Taste, Color, Overall Acceptability) .

The results of the current study were similar with those of Sirichokworrakit (2014), who showed that addition of 5% fish bone flour to noodles has received high overall acceptability, as well as the results of the current study were similar with Abdel-Moemin (2015) , who showed that the enriched cookies improved the sensory attributes with the best scores for the 6% followed by 12% cooked fish bones.

Table (4): Effect of treatments on sensory evaluation of vanilla biscuit

Treatments	Properties			
	Aroma (10 scores)	Taste (40 scores)	Color (10Scores)	Overall Acceptability (٢٠scores)
	Mean±SE	Mean±SE	Mean±SE	Mean±SE
Control (wheat flour(100%))	10± 0.00 [a]	40 ± 0.00[a]	10 ± 0.00[a]	20 ± 0.00[a]
WF (97%) + FBP (3%)	9.94 ±0.03 [a]	39.97± 0.02[a]	9.97 ± 0.02[a]	19.96 ±0.03[a]
WF (94%) + FBP (6%)	9.93 ± 0.03[a]	39.96 ±0.02 [a]	9.95 ±0.03[a]	19.95± 0.03[a]
WF (91%) + FBP (9%)	9.93 ±0.03 [a]	39.95 ± 0.03[a]	9.95 ±0.03[a]	19.93 ±0.04[a]

- WF (wheat flour) , FBP (fish bone powder)
- Different letters on same column represent statistically significant (p< 0.05) difference between means.

Table (5): Effect of treatments on sensory evaluation of orange biscuit

Treatments	Properties			
	Aroma (10 scores)	Taste (40 scores)	Color (10scores)	Overall Acceptability (٢٠ scores)
	Mean±SE	Mean±SE	Mean±SE	Mean±SE
Control (wheat flour(100%))	10 ± 0.00[a]	40± 0.00 [a]	10± 0.00[a]	20± 0.00[a]
WF (97%) + FBP (3%)	9.97± 0.02[a]	39.98± 0.01[a]	9.99±0.01[a]	19.98± 0.01 [a]
WF (94%) + FBP (6%)	9.96 ± 0.02[a]	39.97± 0.02[a]	9.98±0.01 [a]	19.98± 0.02[a]
WF (91%) + FBP (9%)	9.95± 0.03[a]	39.97± 0.02[a]	9.98±0.01[a]	19.96± 0.02 [a]

- WF (wheat flour) , FBP (fish bone powder)
- Different letters on same column represent statistically significant (p< 0.05) difference between means.

Table (6): Effect of treatments on sensory evaluation of lemon biscuit

Treatments	Properties			
	Aroma (10 scores)	Taste (40 scores)	Color (10scores)	Overall Acceptabili ty (٢٠scores)
	Mean±SE	Mean±SE	Mean±SE	Mean±SE
Control (wheat flour(100%))	10 ± 0.00[a]	40 ± 0.00[a]	10±0.00[a]	20 ±0.00[a]
WF (97%) + FBP (3%)	9.96 ±0.02 [a]	39.90 ± 0.06[a]	9.96±0.02[a]	19.98± 0.01[a]
WF (94%) + FBP (6%)	9.94 ±0.03 [a]	39.90 ±0.04[a]	9.93 ±0.04[a]	19.97 ±0.02[a]
WF (91%) + FBP (9%)	9.93± 0.03[a]	39.89 ±0.04 [a]	9.90 ±0.06[a]	19.96± 0.02[a]

- WF (wheat flour) , FBP (fish bone powder)
- Different letters on same column represent statistically significant (p< 0.05) difference between means.

CONCLUSIONS

The current study concluded that the possibility of using fish bone powder (9% replacement) in supplement of some kinds of biscuits (vanilla biscuits, orange biscuits , lemon biscuits).

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مدي إمكانية استخدام مطحون عظم السمك في تدعيم بعض أصناف البسكويت

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تهدف الدراسة الحالية إلي معرفة مدي إمكانية استخدام مطحون عظم السمك في تدعيم بعض أصناف البسكويت ، ولهذا الغرض تم إضافة مطحون عظم السمك بنسب ٣ و ٦ و ٩% استبدال علي التوالي إلي دقيق القمح (استخلاص ٧٢ %) المستخدم في إعداد ٣ أصناف من البسكويت (بسكويت فانيليا – بسكويت برتقال – بسكويت ليمون)، وقد تم دراسة تأثير تلك الاستبدالات علي التركيب الكيميائي والخواص الريولوجية لدقيق القمح ، كما تم دراسة تأثير تلك الاستبدالات علي الخواص الحسية لأصناف البسكويت وذلك من خلال ٦٠ محكم .ولقد أسفرت نتائج الدراسة عن أن إضافة مطحون عظم السمك إلي دقيق القمح بنسب ٣ و٦ و٩% استبدال قد أدي إلي ارتفاع في نسبة كل من البروتين ، الرماد ، الدهون والكالسيوم ، وانخفاض في نسبة الرطوبة وذلك مقارنة بدقيق القمح (١٠٠ %). كما أظهرت نتائج الخواص الريولوجية أن استخدام مطحون عظم السمك بنسبة ٩% قد أدي إلي انخفاض في كل من نسبة امتصاص الماء ، المرونة ، المطاطية ، الرقم النسبي والطاقة ، كما أدي إلي زيادة في زمن الوصول وزمن العجن ، وذلك بالمقارنة بالكنترول (١٠٠% دقيق قمح) .أما نتائج الخواص الحسية فقد أسفرت عن أن إضافة مطحون عظم السمك بنسبة ٩% إلي البسكويت (بسكويت فانيليا ، بسكويت برتقال ، بسكويت ليمون) لم يظهر فروق دالة إحصائيا عند مستوي معنوية 05. في الرائحة والطعم و اللون والتقبل العام مقارنة بالكنترول .ومما سبق توصي الدراسة باستخدام مطحون عظم السمك بنسبة ٩% في تدعيم البسكويت ، كما توصي الدراسة بعمل مزيد من الدراسات باستخدام نسب أعلي من ٩% مطحون عظم السمك .