Chemical and Sensory Properties Evaluation of *Pandesal* Bread Produced From Wheat and Milkfish *(Chanos chanos)* Flour Mixtures

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Abstract *- This research was conducted to determine the chemical composition of pandesal bread produced from wheat and milkfish flour mixtures. This study also aimed to investigate the sensory level of acceptability of pandesal bread produced from wheat and milkfish flour mixtures as to appearance, aroma, taste, texture and general acceptability in 0%, 5%, 10% and 15% proportions of milkfish flour. Based on the findings of the study, the percentage of most acceptable treatment which is 95 % wheat flour with 5 % milkfish flour were; moisture content, crude protein, total fat, ash, carbohydrate and energy were 21.3, 10.9, 5.72, 1.58, 60.5 g/100 g. and 337 Kcal/100 g. respectively. In terms of appearance, aroma, texture, flavor, and general acceptability, significant differences were determined in the level of sensory acceptability of pandesal bread produced from wheat and milkfish flour mixtures with different proportions. The findings of this study also showed that there is a relation as to the proportional percentage of the different treatments in the sensory acceptability of the bangus pandesal – the lower the percentage of the milkfish flour added, the higher is the sensory acceptability of the finished product in terms of texture, taste and the general acceptability as a whole. As a recommendation, the results of adding milkfish flour into pandesal bread will be made the baseline database, using the information obtained, as a useful point of reference for further studies and to improve existing products and food processes, as well as for the development of new ones.*

Keywords: *Chemical, Sensory, Acceptability, Milkfish, Pandesal*

INTRODUCTION

Pandesal contains around 200 milligrams of sodium or salt which is basically used for providing flavor to the bread. The low sodium content is ideal for people with kidney disease or hypertension. The nutritional benefits of pandesal vary according to its recipe or ingredients. Some pandesal may have more fiber. Still others add eggs which allow the person eating the pandesal to obtain the nutritional benefits of eggs. It is also rich in iron, which is necessary in developing hemoglobin for carrying oxygen in the blood and helpful for people suffering from anemia, like pregnant women, for example. It is a convenient food prepared from flour and water through baking. It is a good source of macronutrients and micronutrients such as vitamins, minerals, protein, carbohydrates and fat that is essential for health. It is produced from wheat as a major raw material. It provides the primary structure to the baked bread products [9].

On the other hand, milkfish (*Chanos chanos)* is the predominant species being cultured in the Philippines. Milkfish is a traditional culture species, and has been studied for a long time. They are fast growing and can be raised in fresh and brackish water ponds and pens. Being one of the cheapest sources of protein, milkfish are acceptable to all socioeconomic strata in the country. They are very abundant in the Philippines since it is one of the biggest milkfish producers in the world [16].

Milkfish has many benefits as a source of good nutrition for human health. According to the website *articlesofhealthcare.com*, tests have been carried out and determined the benefits of milkfish being a source of nutrition and that it contains more Omega 3 than the other types of fish. Milkfish has Omega 3 content of 14.2 percent, while other fish varieties such as sardines only have 3.9 percent, salmon at 2.6 percent, and tuna at 0.2 percent. Omega fatty acids consist of omega 3, 6 and 9. Omega 3 is a type of polyunsaturated fat that cannot be produced by the human body. Omega 3 is important because it is an essential fatty acid that is formed from fatty acids such as EPA (eicosapentaenoic acid), DHA (docosahexaenoic acid) and ALA (a-linolenic acid) [2].

If diligently consumed, foods containing fatty acids such as what is contained in milkfish, could help the development of the brain and memory of children, prevent heart disease and high cholesterol levels, nourish the eyes, and reduce depression. Omega 3 is good for pregnant women. It can increase breast milk quality and production, resulting to healthier and smarter infants. In addition to Omega 3, protein content in milkfish of 20.38 percent is also higher than some other fish. Consuming milkfish can meet the protein needs of the body. The high nutrient content in milkfish can prevent coronary heart disease and also increase endurance [14].

Regular consumption of milkfish can prevent micronutrient deficiencies and can help in the development of the nervous system, specifically the brain, in infants. Furthermore, it can also reduce the risk of hypertension in adults [7].

According to Adeleke et al, [1] milkfish or "bangus" can be used to create a wholesome flour. Milkfish flour is produced from edible parts of milkfish - which is properly dehydrated and milled into flour. It has an attractive color, pleasant appearance and reduced moisture content which makes it to have a relatively longer shelf life. It can be used as a fortifier for bread since it contains high protein. Protein serves as antibodies and is a primary source of amino acids, the building block of cellular protein.

Furthermore, a nutrient or substance is considered an appropriate fortifier when and only the nutrient is stable in the food under normal conditions of storage, distribution, and use. Fortification of food has become a means of ensuring nutritional adequacy of the diet [11].

Bread fortified with milkfish flour is advantageous since fish is high in water content and equally, protein found in it has a high water holding capacity. Having higher values of protein due to the addition of the milkfish flour mixture, it leads to the increase in the percentage protein recorded in the fortified product, making it technically feasible. This fortifier ingredient in manufacturing this product is very beneficial to human's health [15].

It came naturally as a challenge for this research to find a way on how to improve the different kinds of experiences that consumers usually get out of this classic bread without compromising the heritage that comes with it. As pandesal is made mainly out of flour, eggs, yeast, sugar, and salt, it entails that it contains only very minimal nutritional value.

As an answer, the study aimed to create novelty bread that will incorporate a cost- efficient ingredient (milkfish flour in 0%, 5%, 10% and 15% proportions) to make an improved version of it that could appeal to the masses.

OBJECTIVES OF THE STUDY

The study determined the sensory acceptability of using milkfish flour in making *pandesal* bread as a fortifier, specifically, according to appearance, aroma, taste, texture, and general acceptability. It will also aim to find out the chemical composition of *pandesal* bread produced from wheat and milkfish flour mixtures as to moisture content, ash, crude protein, total fat, carbohydrate and energy. In addition, this study also aims to know if there are significant differences in the level of acceptability of *pandesal* bread produced from wheat and milkfish flour mixtures as to appearance, aroma, taste, texture, and general acceptability.

MATERIALS AND METHOD

Research Design

The study used an experimental method to determine chemical properties of the prepared flour from the milkfish and its application in baking.

Preparation of Sample

Fresh milkfish were purchased from a local wet market in Calinog, Iloilo, originally from Roxas City, Capiz, Philippines. Commercial wheat flour and other ingredients such as sugar, salt, yeast, shortening, butter oil, bread improver and buttermilk were purchased from a local bakery supplier.

Production of Milkfish Flour

Initially, fresh milkfish were washed thoroughly with potable water to remove extrinsic matters. The gills, scales and skin were removed. Washed and made into fillet cuts, they were then soaked in 30 grams sodium chloride for 10 minutes to reduce the moisture content and to improve its taste. The cuts were blanched in boiling water, then drained and dried for seven days under the sun. After which, the sun-dried milkfish fillet were grounded into flour using a kitchen blender and was then sieved to achieve the fine, powdery form and were then kept in sealed containers for further use.

Preparation of Composite Flours

The flour mixtures were prepared by substituting whole wheat flour with milkfish at different proportions (0%, 5%, 10%, and 15 %) by using a kitchen blender. Flour sample with 100 % of whole wheat served as the control.

Table 1. Formulation for Wheat and Milkfish Composite Flours

Ingredients (%)	Samples A (100% Wheat Flour) Control	B (95%Wheat Flour - 5% Milkfish Flour)	C (90 %Wheat Flour - 10%Milkfish Flour)	D (85 % Wheat Flour- 15% Milkfish Flour)
Wheat Flour (g)	2000	1,900	1,800	1,700
Milkfish Flour (g)	0	100	200	300
Sugar (g)	300	300	300	300
Salt (g)	30	30	30	30
Yeast (g)	20	20	20	20
Water (g)	890	890	890	890
Shortening (g)	60	60	60	60
Butter Oil (g)	60	60	60	60
Improver (g)	8	8	8	8
Buttermilk (g)	60	60	60	60
Total Batter Weight (g)	**3,428**	**3,428**	**3,428**	**3,428**

Preparation of Bread

Flour and all other ingredients were weighed accordingly and manually mixed to form dough, and then kneaded until the gluten was fully developed. The dough was set aside for 20 minutes. After that, the dough was cut to a desired weight approximately 35-50 grams and then rounded and rolled on the prepared crumbs. They were then put in baking trays and were then given a final proof of about 1 – 1.5 hours and finally baked at 350 Fahrenheit for about 10-12 minutes.

Proximate Composition

Proximate analysis of *pandesal* bread was performed independently by adopting Official Methods of Analysis International. Moisture content was determined by indirect method (AOAC method 930.22); crude protein by Kjeldahl Method using Block Digestion and Steam Distillation; Total fat by Acid Hydrolysis and Solvent Extraction using Soxtec System HT2 and Petroleum Ether as Solvent; and ash content by Direct Method (AOAC 2010 method 930.22). Carbohydrate content was calculated by difference (100 – Sum of Moisture, Ash, Protein and Fat) and Energy in kilocalories per 100 g is the sum of protein, fat and carbohydrate multiplied by the general Atwater factors 4-9-4 respectively. This was done at Regional Standards and Testing Laboratory, Department of Science and Technology VI, La Paz, Iloilo City.

Sensory Evaluation

The finished products were evaluated in terms of appearance, aroma, texture, taste, and general acceptability using a modified sensory evaluation score sheet based on 5-point hedonic scale with one representing the least score and 5 as the highest score. The evaluation was done by thirty panelists from the Food Technology Department, WVSU-Calinog Campus. The respondents were composed of ten faculty members, ten food technology students and ten food enthusiasts. The panelists were instructed to rinse their mouth with water in between samples evaluations.

Statistical Analysis

The mean was used in determining the level of sensory acceptability of the product as to appearance, aroma, texture, taste, and general acceptability. Standard deviation was used to determine the homogeneity or heterogeneity of the data in the acceptability level of *pandesal* bread from wheat and milkfish flour mixtures in terms of appearance, aroma, taste, texture and general acceptability. In determining the significant differences in the acceptability level when classified according to certain categories, Friedman's Analysis of Variance (ANOVA) and Post-Hoc Test using Wilcoxon Signed Rank Tests were used and set at 0.05 alpha.

The following continuum was used in the interpretation of data: 4.20 – 5.00 Liked extremely, 3.4 – 4.19 Liked very much, 2.6 – 3.39 Liked moderately, 1.8 - 2.59 Liked slightly 1.0 - 1.79, Disliked very much.

RESULTS AND DISCUSSION

Chemical Composition of *Pandesal* Bread Produced from Wheat and Milkfish Flour Mixtures as to Moisture, Ash, Crude Protein, Total Fat, Carbohydrate and Energy

In Table 2, the proximate analysis of *bangus pandesal* was presented. Proximate analysis included the moisture content, ash content, crude protein content, crude fat content, total carbohydrates content and energy content. These analyses are important for determination of food quality, microbial stability and can be used for nutritional labeling.

Based on the results of proximate analyses of the product the percentage of moisture content, crude protein, total fat, ash, carbohydrate and energy were 21.3 %, 10.9 %, 5.72 %, 1.58 %, 60.5 % g/100 g. and 337 Kcal/100 g respectively.

Table 2. Proximate Analysis Results of *Pandesal* Bread Produced from Wheat and Milkfish Flour Mixtures

Sample Description	Parameter	Result
125 g. sample of *Bangus Pandesal* with 95 % Wheat Flour and 5 % Milkfish Flour Mixtures	Moisture	21.3 % g./100 g.
	Ash	1.58 % g./100 g.
	Crude Protein	10.9 % g./100 g.
	Total Fat	5.72 % g./100 g.
	Carbohydrate	60.5 % g./100 g.
	Energy	337 Kcal/100 g.

The protein content is a key specification for wheat and flour purchasers since it is related to many processing properties, such as water absorption. Protein content can also be related to finished product attributes, such as texture and appearance. When proteins were combined with water, it forms gluten (North American Export Grain Association. (2011)

Crude fiber was a measure of the quantity of indigestible cellulose, pentosans, lignin, and other components of this type in present foods [3].

Fat content determines the free fatty lipids of flour. This property can be used as the basis in determining processing temperatures as well as auto-oxidation which can lead to rancidity and can also affect flavor of the food.

Ash content refers to the mineral content of the flour. Bakers need to know the quantity of ash as it will have an impact on water absorption, nutrition (mineral content), fermentation activity. Ash in flour can also affect color, imparting a darker color to finished products. Some specialty products requiring particularly white flour call for low ash content while other products, have high ash content [6].

The moisture provides the measure of water content and total solid content of flour. It also determines the storage ability and quality of flour. The higher moisture content above 14% attracts mold, bacteria, and insects all of which cause deterioration during storage. Organisms naturally present in the flour will start to grow at high moisture, producing off odors and flavors.

The Level of Acceptability and Quality of Bangus *Pandesal* in Terms of Appearance, Aroma, Texture, Taste and its General Acceptability when Proportioned into the following:

a. treatment A 100% wheat flour or controlled variable; b. treatment B enriched with 95 % wheat flour and 5% of milkfish flour; c. treatment C enriched with 90 % wheat flour and 10% of milkfish flour; and d. treatment D enriched with 85 % wheat flour and 15% of milkfish flour.

The sensory acceptability level of *pandesal* enriched with different proportions of milkfish flour in terms of appearance of treatments A and B were *"liked extremely"* (Ms=4.33, 4.37 and 4.20; SDs= 0.76, 0.67 and 0.81) while treatment C and D were *"liked very much"*, (Ms=3.90; SDs=0.71) respectively.

Table 3. Sensory Acceptability Level of *Pandesal* Bread Produced from Wheat and Milkfish Flour Mixtures with Different Proportions in Terms of Appearance

Appearance	Mean	Description	Std. Deviation
Treatment A	4.33	Liked extremely	0.76
Treatment B	4.37	Liked extremely	0.67
Treatment C	3.90	Liked very much	0.71
Treatment D	4.19	Liked very much	0.81

The sensory acceptability level of *pandesal* enriched with different proportions of milkfish flour in terms of aroma of treatments A, B, C and D were *"liked very much"* (Ms=4.00,3.87,3.47 and 3.63; SDs=0.83,0.94, 0.90 and 0.72) respectively.

The sensory acceptability level of *pandesal* enriched with different proportions of milkfish flour in terms of texture of treatments A, C and D were *"liked very much"* (Ms=4.03, 3.63 and 3.93; SDs= 0.85, 0.89 and 0.64) while treatment B was *"liked extremely"*, (Ms=4.23; SDs=0.86) respectively.

Table 4. Sensory Acceptability Level of *Pandesal* Bread Produced from Wheat and Milkfish Flour Mixtures with Different Proportions in Terms of Aroma

Aroma	Mean	Description	SD
Treatment A	4.00	Liked very much	0.83
Treatment B	3.87	Liked very much	0.94
Treatment C	3.47	Liked very much	0.90
Treatment D	3.63	Liked very much	0.72

Table 5. Sensory Acceptability Level of Pandesal Bread Produced from Wheat and Milkfish Flour Mixtures with Different Proportions in Terms of Texture

Texture	Mean	Description	SD
Treatment A	4.03	Liked very much	0.85
Treatment B	4.23	Liked extremely	0.86
Treatment C	3.63	Liked very much	0.89
Treatment D	3.93	Liked very much	0.64

The sensory acceptability level of *pandesal* enriched with different proportions of milkfish flour in terms of taste of treatments B, C and D were *"liked very much"* (Ms=4.07, 3.63 and 3.87; SDs= 1.02, 0.85 and 0.82) while treatment A was *"liked extremely"*, (Ms=4.20; SDs=0.81) respectively.

Table 6. Sensory Acceptability Level of *Pandesal* Bread Produced from Wheat and Milkfish Flour Mixtures with Different Proportions in Terms of Taste

Taste	Mean	Description	SD
Treatment A	4.20	Liked extremely	0.81
Treatment B	4.07	Liked very much	1.02
Treatment C	3.63	Liked very much	0.85
Treatment D	3.87	Liked very much	0.82

The sensory acceptability level of *pandesal* enriched with different proportions of milkfish flour in terms of its general acceptability of treatments B, C and D were *"liked very much"* (Ms=4.17, 3.67 and 3.67; SDs=0.70, 0.99 and 0.80) while treatments A was *"liked extremely"*, (Ms=4.23; SDs=0.80) respectively.

Table 7. Sensory Acceptability Level of *Pandesal* Bread Produced from Wheat and Milkfish Flour Mixtures with Different Proportions in Terms of General Acceptability

Taste	Mean	Description	SD
Treatment A	4.23	Liked extremely	0.73
Treatment B	4.17	Liked very much	0.70
Treatment C	3.67	Liked very much	0.99
Treatment D	3.67	Liked very much	0.80

Table 8A. Friedman Test Result for the Differences in the Level of Sensory Acceptability of *Pandesal* Bread from Wheat and Milkfish Flour Mixtures with Different Proportion in Terms of Appearance

Proportions	Mean Rank	Df	Chi - Square	Sig.
Treatment A	2.80			
Treatment B	2.77			
Treatment C	1.97	3	15.765	0.001*
Treatment D	2.47			

**p<0.05 significant at 0.05 alpha*

Table 8A shows the Friedman Test Results for the differences on the level of sensory acceptability of *pandesal* bread in terms of appearance at 0.05 level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportions.

It shows that there is a significant difference in the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportions in terms of appearance. The treatments ratings were statistically different with p-value of 0.001 which is lower than the 0.05 alpha level of significance. Therefore, the Friedman's ANOVA rejects the null hypothesis that states that there is no significant difference on the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportion in terms of their appearance.

Table 8B shows the pair-wise comparison of the different proportions revealed no significant differences in the acceptability level in terms of appearance between treatment A and treatment B, z=0312, p=0.755; treatment A and treatment D, z=0.755, p=0.450; treatment B and treatment D, z=1.508, p=0.132; and treatment C and treatment D, z=1.803, p=0.0.071. This means that treatment A and treatment B, treatment A and treatment D, treatment B and treatment D, and treatment C and treatment D are comparable in the sensory acceptability level in terms of appearance. The results generated on these treatment comparisons yielded p>0.05.

A significant difference existed between treatment A and treatment C, z=2.629, p=0.009 and treatment B and treatment C z=2. 560, p=0.010. This means that treatment A and treatment B, and treatment A and treatment D are not comparable in the sensory acceptability level in terms of appearance.

Table 8B. Post Hoc Test Using Wilcoxon Signed Rank Test for the Differences in the Level of Sensory Acceptability of *Pandesal* Bread from Wheat and Milkfish Flour Mixtures with Different Proportion in Terms of Appearance

Compared Variables	Z	Sig.
Treatment A – Treatment B	0.312	0.755
Treatment A – Treatment C	2.629*	0.009
Treatment A – Treatment D	0.755	0.450
Treatment B – Treatment C	2.560*	0.010
Treatment B – Treatment D	1.508	0.132
Treatment C – Treatment D	1.803	0.071

**p<0.05 significant at 0.05 alpha*

Table 9A shows the Friedman Test Results for the differences on the level of sensory acceptability of *pandesal* bread in terms of aroma at 0.05 level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportions.

Table 9A. Friedman Test Result for the Differences in the Level of Sensory Acceptability of *Pandesal* Bread from Wheat and Milkfish Flour Mixtures with Different Proportion in Terms of Aroma

Proportions	Mean Rank	Df	Chi - Square	Sig.
Treatment A	2.83			
Treatment B	2.70			
Treatment C	2.17	3	7.884	0.048*
Treatment D	2.30			

**p<0.05 significant at 0.05 alpha*

It shows that there is a significant difference in the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportions in terms of aroma. This is mainly because of the pungent smell of the milkfish flour that may still be evident after it has been processed from being raw into its flour form. The treatments ratings were statistically different p-value of 0.048 which is lower than the level of significance which is 0.05. Therefore, the Friedman's ANOVA rejects the null hypothesis that there is no significant difference on the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportion in terms of their aroma.

Table 9B shows the pair-wise comparison of the different proportions revealed no significant differences in the acceptability level in terms of aroma. This means that treatment A and treatment B, treatment B and treatment C, treatment B and treatment D, and treatment C and treatment D are the same in the sensory acceptability level in terms of aroma.

Table 9B. Post Hoc Test Using Wilcoxon Signed Rank Test for the differences in the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportion in terms of aroma.

Compared Variables	Z	Sig.
Treatment A – Treatment B	0.683	0.495
Treatment A – Treatment C	2.573*	0.010
Treatment A – Treatment D	2.202*	0.028
Treatment B – Treatment C	1.770	0.077
Treatment B – Treatment D	1.188	0.235
Treatment C – Treatment D	1.165	0.244

**p<0.05 significant at 0.05 alpha*

A significant difference existed between treatment A and treatment C, z=2.629, p=0.010 and treatment A and treatment D z= 2.202, p=0.028 which are lower than 0.05 alpha level of significance. This means that treatment A and treatment C, and treatment A and treatment D are not the same in the sensory acceptability level in terms of aroma.

Table 10A. Friedman test result for the differences in the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportion in terms of texture.

Proportions	Mean Rank	Df	Chi - Square	Sig.
Treatment A	2.57			
Treatment B	2.93			
Treatment C	2.10	3	10.630	0.014*
Treatment D	2.40			

**p<0.05 significant at 0.05 alpha*

Table 10A shows the Friedman Test Results for the differences on the level of sensory acceptability of *pandesal* bread in terms of texture at 0.05 level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportions.

It shows that there is a significant difference in the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportions in terms of texture. The treatments ratings were statistically different p-value of 0.014 which is lower than the level of significance which is 0.05. Therefore, the Friedman's ANOVA rejects the null hypothesis that there is no significant difference on the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportion in terms of their texture.

Table 10B. Post Hoc Test Using Wilcoxon Signed Rank Test for the differences in the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportion in terms of texture.

Compared Variables	Z	Sig.
Treatment A – Treatment B	1.303	0.193
Treatment A – Treatment C	1.739	0.082
Treatment A – Treatment D	0.735	0.462
Treatment B – Treatment C	2.511*	0.012
Treatment B – Treatment D	1.933	0.053
Treatment C – Treatment D	1.617	0.106

*p<0.05 significant at 0.05 alpha

Table 10B shows the pair-wise comparison of the different proportions revealed no significant differences in the acceptability level in terms of texture between treatment A and treatment B, z=1.303, p=0.193; treatment A and treatment C, z=1.739, p=0.082; treatment A and treatment D, z=0.735, p=0.462; treatment B and treatment D, z=1.933, p=0.053; and treatment C and treatment D, z=1.617, p=0.106. This means that treatment A and treatment B, treatment A and treatment C, treatment A and treatment D, treatment B and treatment D, and treatment C and treatment D are the same in the sensory acceptability level in terms of texture.

A significant difference existed between treatment B and treatment C, z=2.511, p=0.012. This means that treatment B and treatment C are not the same in the sensory acceptability level in terms of texture.

Table 11A. Friedman test result for the differences in the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportion in terms of taste

Proportions	Mean Rank	Df	Chi - Square	Sig.
Treatment A	2.83			
Treatment B	2.72			
Treatment C	2.08	3	10.483	0.015*
Treatment D	2.37			

**p<0.05 significant at 0.05 alpha*

Table 11A shows the Friedman Test Results for the differences on the level of sensory acceptability of *pandesal* bread in terms of taste at 0.05 level of sensory acceptability of pandesal bread from wheat and milkfish flour mixtures with different proportions.

It shows that there is a significant difference in the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportions in terms of taste. The treatments ratings were statistically different p-value of 0.015 which is lower than the level of significance which is 0.05. Therefore, the Friedman's ANOVA rejects the null hypothesis that there no significant difference on the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportion in terms of their taste.

Table 11B. Post Hoc Test Using Wilcoxon Signed Rank Test for the differences in the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportion in terms of taste

Compared Variables	Z	Sig.
Treatment A – Treatment B	0.392	0.695
Treatment A – Treatment C	2.782*	0.005
Treatment A – Treatment D	1.895	0.058
Treatment B – Treatment C	1.881	0.060
Treatment B – Treatment D	1.255	0.210
Treatment C – Treatment D	1.327	0.185

**p<0.05 significant at 0.05 alpha*

Table 11B shows the pair-wise comparison of the different proportions revealed no significant differences in the acceptability level in terms of taste between treatment A and treatment B, z=0.392, p=0.695; treatment A and treatment D, z=1.895, p=0.058; treatment B and treatment C, z=1.881, p=0.060; treatment B and treatment D, z=1.255, p=0.210; and treatment C and treatment D, z=1.327, p=0.185. This means that treatment A and treatment B, treatment A and treatment D, treatment B and treatment C, treatment B and treatment D, and treatment C and treatment D are the same in the sensory acceptability level in terms of taste.

A significant difference existed between treatment A and treatment C, z=2.782, p=0.005. This means that treatment A and treatment C are not the same in the sensory acceptability level in terms of taste.

Table 12A shows the Friedman Test Results for the differences on the level of sensory acceptability of *pandesal* bread in terms of general acceptability at 0.05 level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportions.

Table 12A. Friedman test result for the differences in the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportion in terms of general acceptability

Proportions	Mean Rank	Df	Chi - Square	Sig.
Treatment A	2.90			
Treatment B	2.83			
Treatment C	2.18	3	15.015	0.002*
Treatment D	2.08			

**p<0.05 significant at 0.05 alpha*

It shows that there is a significant difference in the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportions in terms of general acceptability. The treatments ratings were statistically different p-value of 0.002 which is lower than the level of significance which is 0.05. Therefore, the Friedman's ANOVA rejects the null hypothesis that there is no significant difference on the level of sensory acceptability of pandesal bread from wheat and milkfish flour mixtures with different proportion in terms of their general acceptability.

Table 12B. Post Hoc Test Using Wilcoxon Signed Rank Test for the differences in the level of sensory acceptability of *pandesal* bread from wheat and milkfish flour mixtures with different proportion in terms of general acceptability.

Compared Variables	Z	Sig.
Treatment A – Treatment B	0.295	0.768
Treatment A – Treatment C	2.278*	0.023
Treatment A – Treatment D	2.876*	0.004
Treatment B – Treatment C	2.422*	0.015
Treatment B – Treatment D	2.777*	0.005
Treatment C – Treatment D	0.034	0.973

**p<0.05 significant at 0.05 alpha*

Table 12B shows the pair-wise comparison of the different proportions revealed no significant differences in the acceptability level in terms of general acceptability between treatment A and treatment B, z=0.295, p=0.768; and treatment C and treatment D, z=0.034, p=0.973. This means that treatment A and treatment B, and treatment C and treatment D are the same in the sensory acceptability level in terms of general acceptability.

A significant difference existed between treatment A and treatment C, z=2.278, p=0.023; treatment A and treatment D, z=2.876, p=0.004; treatment B and treatment C, z=2.422, p=0.015; and treatment B and treatment D, z=2.777, p=0.005. This means that treatment A and treatment C, treatment A and treatment D, treatment A and treatment D, treatment B and treatment C, and treatment B and treatment D are not the same in the sensory acceptability level in terms of general acceptability.

CONCLUSION

Based on the findings, it can be concluded that the sensory acceptability of the *bangus pandesal* is primarily based on the proportional percentage of the of the milkfish flour added to the whole wheat flour – the lower the percentage of the milkfish flour added, the higher is the sensory acceptability of the finished product in terms of texture, taste and the general acceptability as a whole.

There is indeed a significant difference in the general acceptability of the *bangus pandesal*. Statistically significant means a result is unlikely due to chance. In this case wherein there are only small sample sizes, they often do not yield statistical significance. Since they did, the differences themselves tend also to be practically significant; that is, meaningful enough to warrant actions/ recommendations.

RECOMMENDATION

Local *pandesal* manufacturers should use milkfish flour in making *pandesal* because it is acceptable and it contains high nutritional value.

Fishermen should engage more in milkfish production and find ways to improve methods to yield a high quality harvest.

Educators, guardians and parents should serve *bangus pandesal* to children as an alternative high nutritional value food. More recipes be developed using milkfish.

More studies should be conducted focusing on the nutritional value of milkfish flour. It is highly recommended that this study be used as a baseline data for future studies which will dwell on specific aspects it may be useful for (like feasibility studies and the likes).

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