EVALUATION OF THE ORGANOLEPTIC AND PROXIMATE PROPERTIES OF NIGERIAN PEPPER MIX PROCESSED AND PRESERVED USING DIFFERENT TECHNIQUES

Afuye, Oluseeke Folake
Department of Hospitality Management, The Federal Polytechnic Ilaro, Ogun State, Nigeria
Corresponding Author E-mail: oluseeke.afuye@federalpolyilaro.edu.ng

Abstract

Pepper mix, which is also known as Nigerian stew, is a popular cuisine made with fresh tomatoes, red bell pepper, scotch bonnet pepper and onions. The irregular power supply in Nigeria has made preservation of processed pepper mix for stew difficult for housewives to manage. The study identified different processing and preserving techniques for Nigerian pepper mix, and evaluated the sensory qualities and proximate composition of seven (7) varieties of processed and preserved pepper mix samples, which were prepared as stew. These include sample processed with grinding stone then, cooked immediately; sample processed with grinding machine then, cooked immediately; sample processed with grinding machine then, frozen for some days; sample processed with grinding machine then boiled for some days till the water evaporates to form a thick paste; sample processed with the use of blender then, cooked immediately; sample processed by steaming the peppers whole for some days before blending; and sample processed by freezing the peppers whole for some days then blended with a blender. The proximate composition of these samples were analysed using predetermined standard procedures while the sensory evaluation was conducted with twenty trained taste panelist. Data obtained was analyzed using the Statistical Package for the Social Sciences (SPSS) version 20.0 alongside One way Analysis of variance (ANOVA) to determine the differences between the means and the significant differences which were separated at 5% probability level using Duncan's Multiple Range Test. The result of the study revealed that, stew prepared while making use of grinding stone and cooked immediately has the lowest moisture content. The lower moisture could be an advantage thereby increasing its shelf-life. It was also revealed that it increased in carbohydrate, protein, fat, ash and fibre contents therefore making it contain highest level of diet nutrition compared to other stew samples. Sensory qualities revealed highest values in appearance, flavour and aroma. Findings from the analysis of varieties of stew samples showed that these samples were found to be acceptable since there is no significant difference in the samples with respect to the sensory attributes. Result also indicated that the choice of the samples was highly influenced by appearance, taste and flavour among others as evidenced from the perceived sensory characteristics. Similarly, the proximate analysis showed that there is no significant difference in the samples in respect to moisture content, dry matter content, fat content, ash content, crude fibre content, crude protein content carbohydrate content and phytate content. However, it was observed that the choice of a sample was being influenced by the moderate level of moisture, moderate level of phytate content, moderate carbohydrate content, high level of dry matter content, high level of moisture content, low level fat content, low level of ash content, low fibre content, low crude protein content. The researcher recommends stew prepared by steaming the peppers whole and blended immediately is not a common method of processing pepper mix, though in some attributes it has the least value but it is highly recommended. it is an efficient way of preserving and processing pepper mix, as it saves time and cooking energy where there is no or irregular power supply.

Keywords: *Pepper Mix Properties, Nigeria Pepper, Preservation Techniques, Organoleptic Qualities, Pepper mix, Proximate composition*

INTRODUCTION

Pepper mix is a combination of fresh red bell peppers, tomatoes, scotch bonnet peppers and onions. This mixture is simmered in vegetable oil on a low heat to produce the Nigerian stew which is a popular dish in Nigeria and it is traditionally eaten with rice or boiled yam (Carter, 2019). The Nigerian stew is usually prepared and preserved to serve meals in a very brief time or emergencies. It is undoubtedly a staple in Nigerian household (The Kitchen Muse).

In Nigeria before the advent of technology, grinding stone was used by women to process tomatoes, red bell peppers, scotch bonnet peppers and onions into pepper mix to make stew. To ease the back and waist pains developed and complained about by users of grinding stones, this process was enhanced by the invention of electric/mechanical grinding machine. This machine is faster, more convenient and has the ability to ground in large amount but it is of high cost for personal usage. The modern era brought about the introduction of the electric blender which resulted in bringing convenience and relief in the area of grinding pepper mix and other food commodities easily and at any point in time without delay.

However, whether to grind pepper daily or in large amounts or at a convenient time is tasking especially when there is a need for storage for times of emergency. The irregular power supply in Nigeria has made preservation of processed pepper mix for stew difficult for housewives to manage. Most housewives find it difficult to preserve pepper mix, so they make use of the boiling method till the water in the processed pepper mix evaporates; this is the one of the easiest ways of preserving pepper where there is no light. Some people usually prefer fresh stew everyday because they do not like taking stew prepared for too long, while the working class people buy the idea of blending peppers in large quantities, portion and store in freezer, then use when required this method reliefs them of stress. These vegetables for pepper mix, when bought in bulk while in season or surplus unused during parties to avoid wastage and spoilage, in the absence of electricity can be steamed whole just for few minutes without adding water and thereafter blended in portions as required. This method is very efficient as it saves power and energy.

Food preservation has inevitable become a part and parcel of the life of a common man. Consequently, Nigerian housewives have adopted many techniques to process and preserve pepper mix. These techniques includes: the use of grinding stone and cooked immediately, use of grinding machine and cooked immediately, use of grinding machine and frozen for some days, use of grinding machine and boiled for some days till water evaporates to form a thick paste, use of electric blender and cooked immediately, steamed whole and blended immediately, frozen whole for some days and blended with electric blender. This study attempts to identify different processing and preserving techniques for pepper mix used to prepare Nigerian stew and to comparatively evaluate the organoleptic and proximate properties of stews prepared from the varieties of pepper mix.

MATERIALS AND METHOD

Materials

Equipment used includes: gas cooker, working table, grinding stone , grinding machine, electric blender, weighing scale, measuring cups, measuring spoons, cooking pots, cooking spoons, colander, mixing bowls, serving dishes, knife, plates, teaspoon, water glass, water jug, side plates and napkins.

Ingredients used includes: red bell peppers, tomatoes, scotch bonnet peppers, onions, salt, seasoning powder and vegetable oil were purchased from Sayedero market, Ilaro, Ogun state.

Method

Seven (7) varieties of processed and preserved pepper mix samples were prepared as stew these includes: the use of grinding stone and cooked immediately, the use of grinding machine and cooked immediately, the use of grinding machine and frozen for some days, the use of grinding machine and boiled for some days till water evaporates to form a thick paste, the use of electric blender and cooked immediately, steamed whole and blended immediately, frozen whole for some days and blended with electric blender. Sensory qualities and proximate composition of the varieties of stews were determined respectively. The recipes used for the preparation are presented in Table 2.

Table 1 Distributions of coded varieties of prepared stew

Sample A	Sample B	Sample C	Sample D	Sample E	Sample F	Sample G
Use of grinding stone and cooked immediately	Use of grinding machine and cooked immediately	Use of grinding machine and frozen for some days	Use of grinding machine and boiled for some days till water evaporates to form a thick paste	Use of electric blender and cooked immediately	Steamed whole and blended immediately	Frozen whole for some days and blended with electric blender.

Table 2: Recipes for the varieties of stew
*g ; grams, *tsp ; tea spoon, *ml ; millimetre, *Min ;minutes,

Ingredients	A	B	C	D	E	F	G
Scotch bonnet	150g	150g	150g	150g	150g	150g	150g
Red bell pepper	400g	400g	400g	400g	400g	400g	400g
Tomatoes	600g	600g	600g	600g	600g	600g	600g
Onions	300g	300g	300g	300g	300g	300g	300g
Water	125ml	500ml	500ml	500ml	250ml	250ml	250ml
Salt	1/4tsp	1/4tsp	1/4tsp	1/4tsp	1/4tsp	1/4tsp	1/4tsp
Seasoning powder	1/4tsp	1/4tsp	1/4tsp	1/4tsp	1/4tsp	1/4tsp	1/4tsp
Vegetable oil	500ml	500ml	500ml	500ml	500ml	500ml	500ml
Preparation time	10Mins	10 Mins	10 Mins	10 Mins	5 Mins	2Mins	2Mins
Cooking time	15 Mins	25 Mins	25 Mins	45 Mins	20 Mins	15 Mins	15 Mins
Total time	25 Mins	35 Mins	35 Mins	55 Mins	30 Mins	17 Mins	17 Mins

FRESH/ RAW (Scotch bonnet and Bell pepper, tomatoes, onions).

↓

SORTING AND GRADING

↓

CLEANING (Washing and cutting of the peppers).

↓

GRINDING AND BLENDING.

↓

STEWING AND ADDITION OF SEASONINGS

↓

STEW IS READY

Figure 1. Flow chart showing processing of pepper mix and preparation of stew.

STUDY DESIGN

Proximate Analysis

The nutrient compositions of the processed hides were determined according to Association of Official Analytical Chemist (A.O.A.C., 1990).

Sensory Evaluation

The sensory qualities of all the samples were assessed by 20 trained panelists comprising of staff and Higher National Diploma (HND) students of hospitality management department of the Federal Polytechnic Ilaro, Ogun state. The samples of stew were coded and displayed for the panelists to taste.

much 2 and dislike extremely 1. The mouth was rinsed with water after tasting each sample.

Data Analysis and Statistical Tools Used

Data obtained were analyzed using the Statistical Package for the Social Sciences (SPSS) version 20.0. One way Analysis of variance (ANOVA) was used to determine the differences between the means and the significant differences were separated at 5% probability level using Duncan's Multiple Range Test.

Data Collection

Based on sensory methods and analysis (Iwe, (2002), the taste panelist were asked to assess the varieties of stew for the attributes of; appearance, colour, taste, texture, flavour, aroma, and overall acceptability on a nine point hedonic scale. Thus 9 -1 descending order. i.e. like extremely 9, like very much 8, like moderately 7, like slightly 6, neither like nor dislike 5, dislike slightly 4, dislike moderately 3, dislike very

RESULTS AND DISCUSSION
Results

Table 3: Mean and Standard Deviation of The Sensory Properties of The Samples

Sample	Appearance	Colour	Texture	Taste	Flavour	Aroma	Overall acceptability
A	8.05±0.92	8.04±0.78	7..65±1.15	7.65±1.10	8.16±1.25	8.31±0.90	8.15±0.85
B	8.00±0.65	7.80±0.88	7.60±0.88	7.84±0.82	7.58±0.91	7.71±0.88	8.38±0.89
C	7.62±1.07	7.74±1.01	7.41±1.17	7.08±1.58	8.08±1.06	7.92±0.90	7.72±0.77
D	8.00±1.14	7.98±1.11	7.48±1.37	7.75±1.54	7.48±1.35	7.48±1.38	8.25±0.71
E	7.81±0.83	8.24±0.93	7.98±1.18	7.87±1.37	7.61±0.96	7.80±0.99	8.01±1.15
F	7.97±0.94	7.67±0.76	7.12±1.15	7.60±1.16	7.57±1.96	7.20±1.42	7.70±0.97
G	7.18±1.40	8.15±1.01	7.82±1.43	7.62±1.38	7.58±1.44	7.97±1.01	7.78±1.20

Sample A = Processed with grinding stone and cooked immediately, Sample B = Processed with grinding machine and cooked immediately, Sample C = Processed with grinding machine and frozen for some days, Sample D = Processed with grinding machine and boiled for some days till water evaporates to form a thick paste, Sample E = Processed with blender and cooked immediately, Sample F = Steamed whole and blended immediately, Sample G = frozen whole for some days and blended with blender.

DISCUSSION

Based on the appearance characteristics of the stew varieties, it was deduced from Table 3 that the mean response of approximately 8 was observed for samples A, B, and D which is an indication that the samples are found to be rated highest with associated standard deviations of ±0.92, 0.65 and 1.14 respectively. This implies that the appearance of samples A, B and D are found to be more attractive compared to other samples with approximate average of 7, this may be due to the processing and preserving techniques.

Based on the colour attributes of the stew varieties, average colour of the selected stews indicated that all the stews samples were rated approximately 8. This is evidence that the stew samples have similar colour. However, sample E was rated highest than others; this may be due to the blending process which is the most hygienic process because, exposure of onions to air changes the colour most especially using grinding stone and grinding machine.

From the texture characteristics, analysis indicates that sample E was rated highest (7.98±1.18) this might be because little water was added while blending the peppers which made the texture of the pepper mix to be thick and stew easily compare to the stew produced from the use of grinding machine that takes longer time to stew, followed by samples G, A, and B respectively with respective means of 7.82, 7.65 and 7.65. Only sample F was slightly liked due to lowest mean value of 7.12±1.15. This is an indication that sample E has the best texture.

Based on taste attribute, it can be deduced that the mean response of sample E was 7.87 with standard deviation of ±1.37, this indicates that sample E was rated highest as responded by the evaluators, this is probably because it is the most common procedure and taste most homes are accustom with and it is labour saving. This is followed by sample B which is making use of grinding machine it implies that those that love to eat outside and also partying are used to this taste. The sample with the least value is sample

C, this is probably because the taste has been denatured and it no longer retains its freshness as it has been frozen for some days.

On the flavour characteristics, analysis indicates that all the samples have approximately 7 rating on average, however, sample A was rated highest than the other samples of stew, this may be due to the natural flavour of the grinding stone used to grind fresh pepper into pepper mix to make stew. Sample D has the least value, this is not farfetched due to the fact that it was boiled for some days to evaporate the moisture content, and invariably it loses its flavour and freshness.

Based on aroma characteristics, sample A has an average value of 8.31±0.90 followed by sample G with 7.97±1.01. Hence sample A was most liked followed by sample G. Sample F was least rated this may be probably due to the processing technique, it was steamed whole for some days before blending , it must have lost some of it fresh aroma to vapour before it was blended and stewed.

The overall acceptability of the sensory quality report depicts that, the average response for sample B was 8.38±0.89, this may be probably because this technique is what most people are accustom with. Sample C has the least mean response rate. Hence, sample B is more acceptable compared to other varieties.

Sampled Stew and Attribute Test of Significant Effect

Table 4: Tests of Between-Subjects Effects (ANOVA)

Source	Sum of Squares	Df	Mean Square	F	Sig.
Model	74687.581[a]	16	4667.97	1756.923	0.000
Sample	24.765	7	3.537	1.3313	0.705
Attribute	45649.432	10	4564.943	1718.146	0.000
Error	87.678	33	2.6569		
Total	74775.259	36			

a. R Squared = .075 (Adjusted R Squared = .085)

The test of significance in Table 4, indicates a non-significant difference in the mean response of the stew evaluated, since F-value of 1.33 with associated p-value 0.71 > 0.05 level of significance. This implies that there is no variation in extent of likes per each of the stew by the evaluators. In addition, result of the ANOVA test as indicated from the table above showed that attributes such as appearance, colour, texture, flavour, aroma, taste, and overall acceptability were also found not to be different from one stew sample to another as responded by evaluators.

Table 5: Tests of Overall Mean

SAMPLE	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
A	8.414	.175	8.324	8.623
B	8.234	.175	8.227	8.543
C	8.273	.175	8.180	8.434
D	8.743	.175	8.299	8.433 / 8.233
E	8.546	.175	8.344	8.321
F	8.354	.175	8.432	8.311
G	8.234	.175	8.365	8.111

Table 5, showed the marginal means of likeness codes of the stew combinations. It can also be deduced from the table that overall acceptability of each of the stew combination (D) were found to be higher than others.

Table 6: Duncan Multiple Range Tests on Homogeneous Subsets Based on Stew Samples

Stew	N	Subset 1	Subset 2
A	490	8.28[a]	
B	490	8.34[a]	8.34[b]
C	490	8.35[a]	8.35[b]
D	490	8.38[a]	8.38[b]
E	490	8.22[a]	8.43[b]
F		8.15[a]	8.27[b]
G	490	8.21[a]	8.33[b]
Sig.	490	0.161	0.224

On the homogenous subsets list of the samples in Table 6, indicates the Duncan post hoc test that does provide homogenous subset results as the groups are listed in order with their means respectively. The means that are listed under each subset comprise a set of means that are not significantly different from each other.

Appearance	490	8.31
Texture	490	8.21
Taste	490	8.19
Flavour	490	8.05
Aroma	490	8.02
Colour	490	8.08
Overall Acceptability	490	8.32

Table 7:   Duncan Multiple Range Tests on Homogeneous Subsets Based Attributes

Attributes	N	Subset 1

It can also be seen from subset 1 of table 8, that mean response from the appearance, texture, taste, and overall acceptability attributes were found to be highest amongst other attributes.

Proximate Analysis

Table 8: Duncan Multiple Range Tests on Homogeneous Subsets Based Attributes

Sample	Moisture Content	Dry Matter Content	Fat Content	Ash Content	Crude Fibre Content	Crude Protein Content	Carbohy Drate Content	Phytate %
A	57.65	42.35	16.22	2.43	1.72	12.87	9.12	0.573
B	77.33	22.67	9.65	1.68	1.04	6.76	3.56	0.548
C	79.96	20.31	8.13	1.47	1.14	5.94	3.41	0.563
D	71.66	28.34	3.63	1.37	1.32	6.10	5.93	0.518
E	74.39	25.61	10.24	1.94	1.27	8.14	4.03	0.611
F	74.46	25.54	9.61	1.76	1.21	9.15	3.79	0.582
G	76.46	23.55	9.02	1.56	1.17	7.24	4.56	0.604

The result of proximate composition of stew samples as revealed in Table 8 shows that sample C has the highest value of moisture content of 79.96 due to the quantity of water added in the cause of grinding and when frozen as it absorbed water. Sample A has the least moisture content with value of 57.65, which is because little water was added in the process of grinding with grinding stone. In terms of dry matter content, sample A has the highest value of dry matter content. The least dry matter content was observed with sample C.

Based on the fat content Sample A has the highest value of 16.22, while sample D has the least fat level (3.63).According to Lehman (2020), fat which comes from the food we consume, form part of the structural building blocks of the body. They are also responsible for absorption of fat-soluble vitamins, hormone signaling, growth and brain development, and are important for maintaining hair and skin health.
Sample A has the highest ash content with the value of 2.43 with sample D having the least ash content with the value of 1.37. According to

Baker, (2020), ash refers to any inorganic material, such as minerals, present in food. It is called ash because it is the residue that remains after heating removes water and organic material such as fat and protein. Generally, any natural food will be less than 5 percent ash in content, while some processed foods can have ash content of more than 10 percent.
The highest crude fibre content was observed in sample A with 1.72 and the lowest content observed in sample B with the value of 1.04. According to Bray (2020), peppers do contain a significant amount of fiber, the amount can vary a lot between varieties. Soluble fiber is beneficial for more than just digestion and constipation, it can help to treat illnesses like diabetes and heart disease as well.
Based on crude protein content, the highest value was observed in sample A (12.87) and the least was observed in sample C with the value of 5.04.. Bray, (2020) also noted that , All fruits contain some protein and peppers are fruits, which means that all varieties of peppers contain protein. As with most fruits, though, the protein content is relatively low, but they still have

enough of it to be a significant source. As protein is essential for cell and tissue growth, adequate intake of protein is particularly important during periods of rapid growth or increased demand, such as childhood, adolescence, pregnancy and breastfeeding (Eileen and Fionnuala, 2019).

Carbohydrate content was highest in sample A (9.12) with the least value of 3.41 which was observed in sample C. According to Bray (2020), peppers are often promoted as a low-carb food that is safe both for people who are trying to lose weight and for those who need to control

blood sugar. It is important to note that much of the total carbohydrate in peppers is from dietary fiber, which is important for gut and heart health. Lastly, the phytate content with the highest was observed in sample E with 0.61 and the least observe is sample D. Phytochemicals are antioxidants found in plant-based foods. Although they are not required for body function, they may have a very powerful impact on health. Phytates reduce the risk for cancer and also prevent heavy metal toxicity (Lehman, 2020)

Table 9: Tests of Between-Subjects Effects (ANOVA) of Stew and Attributes Test of significant effect

Source	Sum of Squares	Df	Mean Square	F	Sig.
Model	74687.581[a]	16	4667.97	1756.923	0.000
Sample	24.765	7	3.537	1.3313	0.855
Attribute	45649.432	10	4564.943	1718.146	0.000
Error	87.678	33	2.6569		
Total	74775.259	36			

a. R Squared = .073 (Adjusted R Squared = .035)

The test of significance in Table 9 indicated a non-significant difference in the mean response of the samples evaluated since F-value of 1.33 with associated p-value 0.85 > 0.05 level of significance. This implies that there is no variation in stew samples over moisture content, dry matter content, fat content, ash content, crude fibre content, crude protein content, carbohydrate content and phytate content.

4.0   CONCLUSION
The result of the study revealed that, stew prepared making use of grinding stone and cooked immediately has the lowest moisture content. The lower moisture could be an advantage thereby increasing its shelf-life. It was also, revealed that it increased in carbohydrate, protein, fat, ash and fibre contents therefore making it contain highest level of diet nutrition compared to other stew samples. Sensory qualities revealed highest values in appearance, flavour and aroma.

Findings from the analysis of varieties of stew samples showed that these samples were found to be acceptable since there is no significant difference in the samples with respect to the sensory attributes. Furthermore, result also indicated that the choice of the samples was highly influenced by appearance, taste and flavour among others as evidenced from the perceived sensory characteristics.

Similarly, the proximate analysis showed that there is no significant difference in the samples in respect to moisture content, dry matter content, fat content, ash content, crude fibre content, crude protein content carbohydrate content and phytate content. However, it was observed that the choice of a sample was being influenced by the moderate level of moisture, moderate level of phytate content, moderate carbohydrate content, high level of dry matter content, high level of moisture content, low level fat content, low level of ash content, low fibre content, low crude protein content.

5.0   RECOMMENDATIONS
As a result of the data analysis, the researcher has been able to make the following suggestions.

Stew prepared by steaming the peppers whole and blended immediately is not a common method of processing pepper mix, though in some attributes it has the least value but it is highly recommended. it is an efficient way of preserving and processing pepper mix, as it saves time and cooking energy where there is no or irregular power supply.

The shelf-life of the stews can also be researched with regards to the ingredients used in preparing stew. Further studies can be conducted with organic vegetables grown in similar environment.

REFERENCES

1. AOAC. (1990). Official methods of analysis of official analytical chemists.
2. Baker, M.(2019). What is in ash food? www.livestrong.com Internet retrieved: 11 - 05 - 2020
3. Bray, M. (2020). Fiber In Pepper: The Fact and Fiction in www.pepperscale.com Internet retrieved: 15 - 05 - 2020
4. Bray, M. (2020). Protein In Pepper: The Fact and Fiction in www.pepperscale.com Internet retrieved: 15 - 05 - 2020
5. Bray, M. (2020). Carbohydrate In Pepper: The Fact and Fiction in www.pepperscale.com Internet retrieved: 15 - 05 - 2020
6. Carter, B. (2019). Nigerian Beef Stew https://tasty.co/recipe/nigerian-beef-stew Internet retrieved: 11 - 05 - 2020
7. Eileen, C. and Fionnuala, M. (2019). Encyclopedia of food security and sustainability in food security, Nutrition and Health Internet retrieved: 11 - 05 - 2020
8. Iwe, M. O. (2002). Handbook of sensory methods and analysis. Rojoint Communication Services Ltd., Enugu, Nigeria, 7-12.
9. Lehman, S. (2020). An overview of Nutrition for a Better Diet. Published in Verywell Fit and Reuters Health.