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FOREWORD

It is with great delight I welcome you to volume 4 issue 2 of Federal Polytechnic – Journal of Pure and Applied Sciences (FEPI-JOPAS). It is a peer-reviewed open-access multi-disciplinary Journal of global recognition which is referenced and indexed in African Journal Online (AJOL). It is a highly commendable Journal that publishes excellent research contributions and exhibiting also special attention to experience papers coming from the many application areas of pure and applied Sciences. FEPI-JOPAS publishes full-length research work, short communications, critical reviews and other review articles.

The aim of FEPI-JOPAS is to provide intellectual bedrock for both indigenous and international scholars with quality research outputs to express and communicate their research findings to a broader populace. It serves as a valuable platform for the dissemination of information to 21st Century researchers, professionals, policymakers, manufacturers, production staff, R & D personnel as well as governmental and non-governmental agencies. It also aimed to provide a platform for academics and industry practitioners to share cases on the application of management concepts to complex real-world situations in pure and applied sciences and related fields.

This volume 4 issue 2 of FEPI-JOPAS is loaded with quantum and well-featured diversity of trending topics in applied and basic research. These hot and trending topics are: Sustainable Art and Design: Activating Sighting as the Phenomenon of Representational Drawing; Assessment of Heavy Metals in Processed Meat (Tinko) Sold within Igbesa Community; The Hypoglycemic Effect of Musa Sapientum in Alloxan Induced Diabetic Albino Wistar Rat; Rainwater Quality Evaluation for Agricultural Use: Case Study of a Portland cement Producing Area; Analytical Approach to Investigating the Influence of Blood Group and Blood Genotype on the Performance of Students of Federal Polytechnic, Ilaro; Dough Mixing Time: Impact on Dough Properties, Bread-Baking Quality and Consumer Acceptability; Chemical Composition of Harvested Rainwater Around a Cement Factory in Ibeshe, Yewa North, Ogun State.

Furthermore, other topics to be encountered in this issue that have added colour and beauty to this edition are: Physicochemical properties and sensory evaluation of milk candy ‘toffee’ (a

NIGERIA candy) enrich with coconut, tigernut and groundnut; Informal Settlements in Developing Countries: Issues, Challenges and Prospects; Comparison of Sensory Properties of Meals Produced from Cowpea and Pigeon Pea; Automated Lecture Timetable Generation Using Genetic Algorithm; Septic Tanks Contamination in Groundwater Quality around Elementary Schools in Ibadan, Oyo State Nigeria; and Waste Disposal Systems in Some Selected Abattoirs Located in Ilaro Metropolis. FEPI-JOPAS has been centered on discerning the changing needs of the academic world and is committed to advancing research around the world by publishing the latest research in various academic fields and ensuring that the resources are accessible in print, digital, and online formats.

In addition, I would like to thank many people who worked so hard to ensure that publishing this issue 2 of volume 4 is a reality. I would like to thank the Editorial Board for their guidance and the publishing team for the continued support and effort in streamlining the publication process. I am grateful to the reviewers who provided timely and constructive reviews for the papers assigned to them. The authors are solely responsible for the information, date and authenticity of data provided in their articles submitted for publication in the Federal Polytechnic Ilaro – Journal of Pure and Applied Sciences (FEPI-JOPAS).

I am looking forward to receiving your manuscripts for the subsequent publications. You can visit our website (https://fepi-jopas.federalpolyilaro.edu.ng) for more information, or contact us via e-mail us at fepi.jopas@federalpolyilaro.edu.ng

Thank you and best regards.

Prof. Olayinka Oyewale AJANI

(Editor-in-Chief)

TABLE OF CONTENTS

https://fepi-jopas.federalpolyilaro.edu.ng Experimental

Comparison of Sensory Properties of Meals Produced from Cowpea and Pigeon Pea.

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Abstract

The study was conducted to compare the methods of processing, sensory qualities, and overall acceptability of food samples produced from two varieties of beans (cowpea and pigeon pea). The beans were processed and prepared into beans porridge, steamed beans pudding, and beans cake. The sensory qualities of the resulting products from the beans were assessed using a trained taste panelist. The data collected were subjected to descriptive and inferential statistics. The cooking time of cowpea and pigeon pea were determined. Pigeon peas took 4 hr to cook while; cowpea took 1hr30min to cook. Pigeon pea requires soaking before dehulling and it was soaked for 1 hr 35 min before it was blended. Cowpea was found to be rated higher when used to prepare steamed bean pudding compared to pigeon peas. Furthermore, the preference for pigeon pea porridge is higher than cowpea porridge in taste value but, there is no significant difference in their flavours. Although, their appearances and textures are different all meals are generally accepted on the same scale except for pigeon pea porridge which was found to be preferred more than other sub-varieties. Hence, the consumption of pigeon peas prepared into varieties of dishes should be encouraged.

Keywords: Acceptability, comparison, cowpea, pigeon pea, processing method, and sensory properties.

INTRODUCTION

Under exploitation and neglect of our indigenous food crops are some of the problems of hunger and malnutrition in Nigeria, as it is still widespread in both rural and urban communities. Legumes are low-priced sources of protein-rich foods that are important in alleviating protein malnutrition in the tropics; they are the next important food crop after cereals. Legumes are rich sources of protein, energy, vitamins, dietary fiber, minerals, and oil (FAO, 1988 in Wikipedia, 2019). Despite a large number of existing grain legumes in Nigeria, their consumption as staple foods is centered mainly on cowpeas and groundnut. Several other locally available species like the pigeon pea, which have remarkable adaptation to tropical conditions are less commonly used (Enwere 1998 in Obi Okafor, 2011).

Cowpea (*Vigna unguiculata*) is an annual herbaceous legume from the genus *Vigna*. Due to its tolerance for sandy soil and low rainfall, it is an important crop in the semiarid regions across Africa and Asia (FAO, 1985 in Okafor, 2011). The crop is mainly grown for its seeds, which are high in protein, although the leaves and immature seed pods can also be consumed (Walker and Kochar, 2010). All parts of cowpea are used as all are rich in nutrients and fiber (FAO, 1988 in Wikipedia, 2019).

Pigeon pea (*Cajanus cajan*) is an important legume crop cultivated across several countries throughout the tropics and subtropics, they are cultivated in India, Malaysia, Indonesia, the Philippines, Caribbean, East and West Africa (Sarkar, Panda, Yadav & Kandasamy, 2018). It is a locally available, affordable, and underutilized grain legume (Akinyele, et al., 1991, in Obi Okafor, 2011), Pigeon pea is grown for its edible seeds; the fresh tender seeds may be boiled and consumed together with the pod as a vegetable while the matured seeds are usually consumed in cooked form (cooked beans) as it is

desirous for its taste (Enwere, 1998 in Obi Okafor, 2011).

The mature seeds of pigeon pea apart from being hard to cook are hard to dehull thus the drudgery process of dehulling the seed is also limiting the utilization of pigeon pea to other forms of food products apart from cooking the seeds (Fasoyiro, Akande, Arowora, Sodeko, Sulaiman, Olapade & Odiri, 2010). This study attempts to determine the sensory qualities and to examine the methods of processing, dehulling, preparation time, and the utilization of these legumes in other forms of meals hence; beans porridge, steamed beans pudding, and beans cake.

MATERIALS AND METHOD

Materials

Equipment used includes a gas cooker, working table, electric blender, weighing scale, measuring cups, measuring spoons, cooking pots, steaming pot, frying pan, spatula, cooking spoons, perforated spoon, colander, mixing bowls, frying pan, serving dishes, knife. plates, teaspoon, water glass, water jug, spatula, mould, casserole dishes, side plates, and napkins.

Pigeon pea was purchased from a retail market: Oja Odan market in Ogun State while other ingredients such as cowpea, onion, red bell pepper, scotch bonnet, seasoning cubes, salt, mackerel fids, crayfish oil, and vegetable oil were sourced from Sayedero market, Ilaro, Ogun state.

Method

Three (3) different samples of bean products were prepared from each of the two varieties of beans pigeon pea and cowpea. These include beans porridge, steamed beans pudding, and beans cake altogether making six different samples. The sensory qualities of the varieties of bean products were determined respectively. The recipes used for the preparation are presented in Table 1.

Table 1: Recipes for the varieties of beans products

Ingredients	Beans porridge		Steamed bean pudding		Beans cake	
	Cowpea	Pigeon pea	Cowpea	Pigeon pea	Cowpea	Pigeon pea
Beans (picked) (g)	450	450	300	300	300	300
Water (added for boiling) (L)	2.5	5.5	___	___	___	___
Water(added to paste) (mL)	___	___	225	350	50	80
Water	___	___	3	2	___	___

(for steaming) (L)						
Onion (crushed) (g)	200	200	200	200	200	200
Red bell pepper(crushed) (g)	___	___	200	200	200	200
Scotch bonnet (crushed) (Tsp)	2	3	2	2	2	2
Crayfish (g)	___	___	100	100	___	___
Smoked fish (g)	___	___	500	500	___	___
Vegetable oil (added to paste) (mL)	___	___	120	150	___	___
Vegetable oil (for frying)(L)	___	___	___	___	1	1
Seasoning cube	___	___	2	2	___	___
Salt (tsp)	2	2	1	1	1.5	1.5
Palm oil(mL)	170	200	___	___	___	___
Preparation time (Min)	15	10	40	145	40	145
Cooking time (Min)	100	240	60	80	30	45
Total time	115	250	100	225	70	190

(Min)

*g ; grams, *tsp ; tea spoon, *ml ; millimetre, *L ; litre, *Min ;minuites, *Hr ;hours

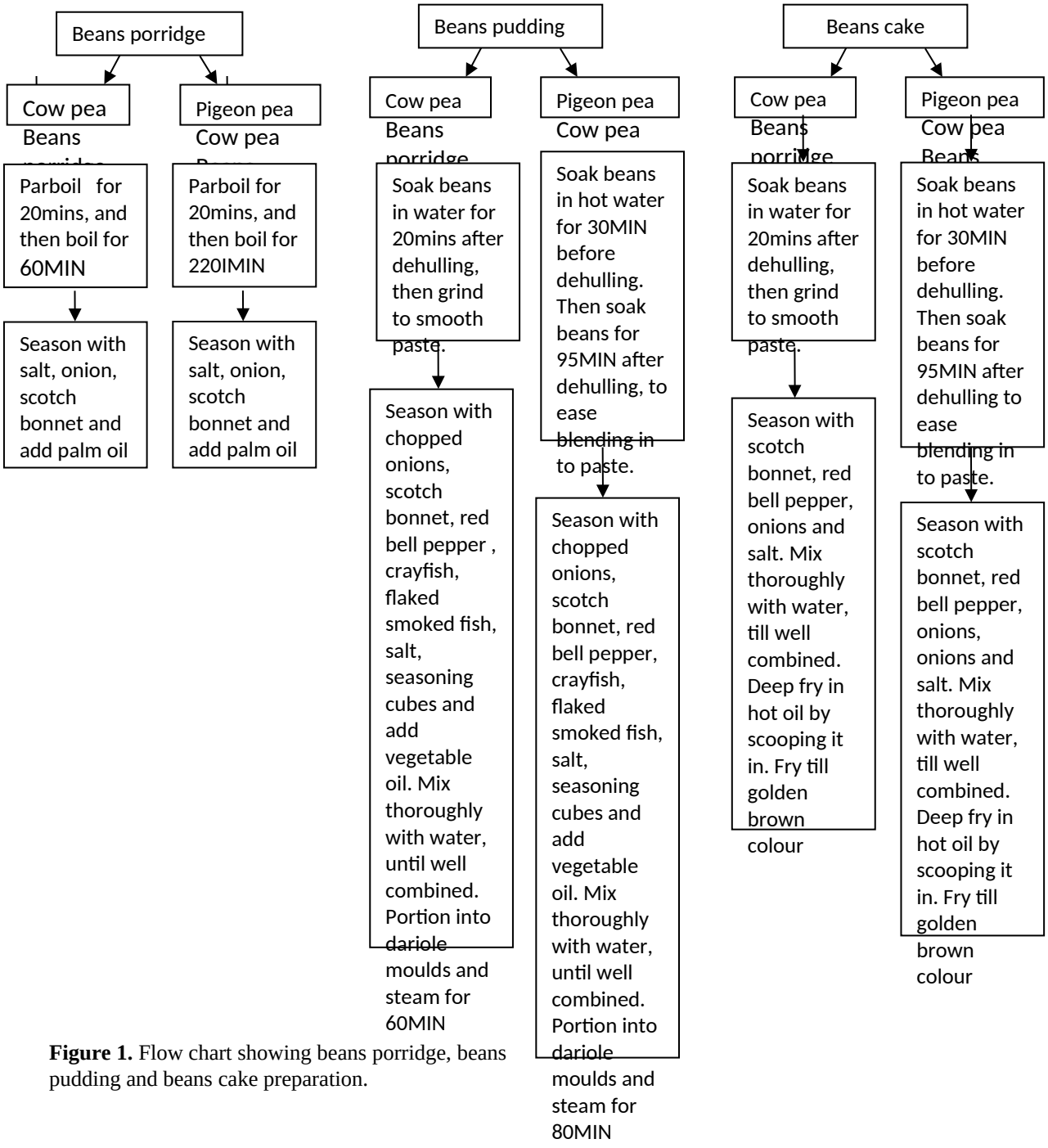

Figure 1. Flow chart showing beans porridge, beans pudding and beans cake preparation.

STUDY DESIGN

Sensory Evaluation

The sensory qualities of all the samples were assessed by 51 trained panelists comprising staff and Higher National Diploma (HND) students of the hospitality management department of the Federal Polytechnic Ilaro, Ogun state. The samples of cow skin were coded and displayed for the panelists to taste.

Personal Observation

Personal observations were made, subject to the dehalling process, preparation and cooking time of the varieties of beans products.

Data Collection

Based on sensory methods and analysis (Iwe, **(**2002), the taste panelist were asked to assess the cow skin for the attributes of; appearance, 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 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.

RESULTS AND DISCUSSION

Results

Table 3: Mean and standard deviation of the sensory properties of the samples

Sample	Appearance	Texture	Taste	Flavour	Aroma	Overall acceptability
DBP	7.67±1.29	8.00±1.22	7.16±2.02	7.53±1.41	8.06±0.99	7.33±1.81
OP	7.98±0.91	7.43±1.55	7.82±1.05	8.10±0.94	6.84±2.16	8.24±0.71
DBM	8.10±1.17	8.24±0.84	7.47±1.65	8.14±1.00	8.35±1.5	7.18±1.75
OM	8.33±1.09	7.31±2.20	7.18±2.0	7.63±1.25	7.94±1.03	7.35±2.06
DBA	7.06±1.63	7.75±0.94	7.45±1.74	7.41±1.27	7.80±1.36	7.35±1.31
OA	7.75±1.23	6.59±1.98	7.47±1.63	7.10±1.65	7.06±1.86	7.39±1.58

Sample DBP =Cowpea porridge, Sample OP = Pigeon pea porridge, Sample DBM =Cowpea steamed beans pudding, Sample OM = Pigeon pea steamed beans pudding, Sample DBA =Cowpea beans cake and Sample OA = Pigeon pea beans cake

Discussion

Based on the appearance characteristics of the beans varieties, it was deduced from table 3 show that there is a difference between the preference of DBP and OP as the mean of DBP is greater than that of the OP

but the Standard Deviation is lesser to DBP (7.67±1.291, 7.98±0.905). As for DBM and OM (8.10±1.171, 8.33±1.630) both mean and standard deviation differs, but cowpea beans cake (DBA) and Pigeon pea beans cake (OA) also have different variation in its mean as OA was very high (mean = 7.75±1.23) compared to DBA (mean = 7.06±1.63) which has high standard variation. This implies that each of the bean varieties were equally rated based on appearance for both porridge and steamed beans pudding but pigeon pea beans cake was given higher preference in terms appearance than cowpea beans cake. This may be due to the attractive dark brown-purplish seed coat.

Based on the texture characteristics of the bean varieties, it was deduced that sample DBP (mean = 8.00±1.217) was very much likened compared to (OP) (mean 7.43 ± 1.552) which was moderately liked because the differences were not much. Taking cowpea steamed beans pudding and pigeon pea steamed beans pudding into consideration, mean response of 8.24± 0.839 and 7.31±2.204 also indicated that DBM was rated higher than its OM counterpart i.e. likeness for DBM is higher than likeness for OM. Same goes for cowpea beans cake (DBA) and pigeon pea cake (OA) as DBA was very much likened (7.75±0.935) compared to OA (mean = 6.59±1.982) which was also moderately liked. Hence, it can generally be said that cowpea is more acceptable than pigeon pea in terms of texture irrespective of the sub-varieties prepared from both varieties. This may be due to the creamy mouth feel texture of cowpea compare to crisp texture of the pigeon pea.

From the taste characteristics of the beans varieties analysis indicated that OP (7.82±1.053) was "very much likened" compared to (DBP) (mean 7.16 ± 2.024) which was moderately liked This may be due to the fact that pigeon peas are nuttier and crispy in taste (Houzz.com,2013). Taking steamed bean pudding into consideration, the mean response of 7.47±1.654 and 7.18±1.997 also indicated that preparation of steamed beans pudding using cowpea was preferred to pigeon pea as regards the taste. However, there is no preference for both varieties of beans when used to prepare beans cake as the sensory qualities are the same (mean response approximately 7.5).

On the flavour characteristics of the bean varieties, it was also evidenced that both bean varieties were rated equally (very much likened) when used to prepare porridge and steamed bean pudding since their average response is approximately 8. But using these varieties to prepare beans cake, average sampled evaluators rated both as moderately liked (mean response approximately 7). This implies that irrespective of the bean varieties, the sensory quality of porridge and steamed beans pudding flavour were found to be superb as bean cake was not also left out.

Based on aroma, the analysis indicated that cowpea porridge (DBP) was very much likened (mean 8.06±0.988) compared to pigeon pea porridge (6.84 ±2.158) which was moderately likened. There is no difference between the likeness of DBM and OM as they were both rated equally (8.35±1.354, 7.94±1.028), as cowpea beans cake was given higher preference (mean 7.8±1.357) compared to pigeon pea cake (mean 7.06±1859). This implies that each of the bean varieties has a minimum score rate of 7 due to its aroma which means that they moderately liked the varieties' characteristics.

The overall acceptability of the sensory quality report depicts the descriptive statistics of the bean varieties. Analysis also indicated that pigeon pea porridge (OP) (mean = 8.24 ±0.710) has higher acceptability than cowpea porridge (DBP) (mean =7.33 ±1.807). However, DBM, OM, DBA and OA were equally acceptable on approximate mean response rate of 7. The implication of this is that, pigeon pea porridge is more acceptable compared to other varieties.

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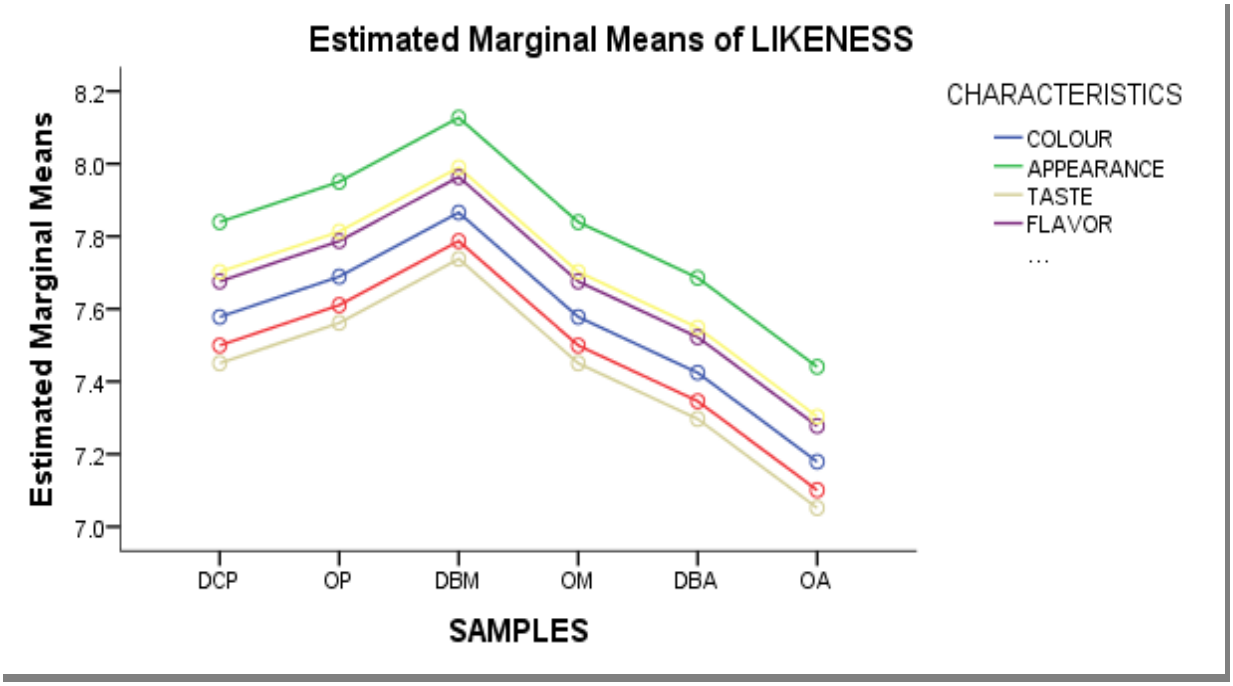

Figure 2: Bar Plot of Marginal Means Likeness code of beans varieties based on special characteristics

Figure 2, shows the line plot of marginal means of likeness codes of the beans varieties. It can also be deduced from the plot that DBM has the highest marginal mean based on colour, appearance, taste and flavour. This was followed by pigeon pea porridge as pigeon pea beans cake was rated minimally amongst other varieties.

Sampled Beans Varieties and Characteristics Test of significance

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

Source	Sum of Squares	Df	Mean Square	F	Sig.
Beans varieties	83.741	5	16.748	7.223	.000
Characteristics	31.493	5	6.299	2.716	.019
Error	4231.922	1825	2.319		
Total	110355.000	1836			

a. R Squared = .027 (Adjusted R Squared = .021)

The test of significance in table 4 above, indicated a significant difference in the mean response of the beans varieties evaluated since F-value of 7.223 with associated p-value 0.00<0.05 level of significance. This implies that there is variation in the extent of likeness per each of the varieties by the evaluators. In addition, the result of the ANOVA test as indicated from the table 4 showed that comparative analysis of the beans varieties were found to be significant as there exist variations from one variety to another as regards the food types prepared from each. Characteristics of these properties such as colour, appearance, flavour, taste, aroma and overall acceptability were also found to be different from one variety to the other since F-value of 2.716 which associated p-value 0.019 < 0.05 level of significance. So therefore, there are significant variation characteristics such as colour, appearance, flavour, taste, aroma.

Table 5: Duncan Multiple Range Tests on Homogeneous Subsets Based on Beans varieties

Samples Varieties	**N**	**Subset**			
		1	**2**	**3**	**4**
DBP	306	7.23			
OP	306		7.47		
DBM	306		7.62	7.62	
OM	306		7.62	7.62	
DBA	306			7.74	7.74
OA	306				7.91
Sig.		1.000	.242	.399	.152

b. Alpha = .05.

On the homogenous subsets list of bean varieties in table 5, this indicated the Duncan Post Hoc test that does provide homogenous subset results as the groups are listed in order of ascending means. The means that are listed under each subset comprise a set of means that are not significantly different from

each other. From subset 1, difference in mean of responses from the bean varieties indicated that DBP is significantly different from other varieties. Subset 2 also showed that OP, DBM and OM were not significantly different from each other as they possess the same characteristics. In addition, DBM, OM and DBA were also found to have the same traits based on characteristics as evidenced from subset 3. Subset 4 of the table also indicated that DBA and OA are not different from each other, but OA and DBA was found to have the same characteristics.

Table 6: Duncan Multiple Range Tests on Homogeneous Subsets Based on Characteristics

Characteristics	**N**	**Subset**	
		1	**2**
Taste	306	7.42	
Overall acceptability	306	7.47	
Colour	306	7.55	7.55
Flavour	306	7.65	7.65
Aroma	306	7.68	7.68
Appearance	306		7.81
Sig.		.068	.051

On the homogenous subsets list of characteristics varieties in table 6, this indicated the Duncan post hoc test that does provide homogenous subset results as the groups are listed in order of ascending means. The means that are listed under each subset comprise a set of means that are not significantly different from each other. From subset 1, difference in mean of responses from the characteristics varieties indicated that taste is significantly different from other varieties. While in subset 1 as well overall acceptability is also different from other varieties with little variance from taste of 0.05. Subset 1 and 2 respectively also showed that colour, flavour and Aroma were not significantly different from each other as they possess the same characteristics both in subset 1 and 2.It can also be seen from subset 2 above that mean response from the appearance of the characteristics varieties was found to be highest among other characteristics of flavour, taste, colour, aroma and overall acceptability.

Comparison of processing methods, preparation and cooking time

Observation based on processing and the cooking time of pigeon pea and cowpea made it known that the pigeon pea takes longer time to be processed and cooked than the cowpea. Pigeon pea porridge took about 4 hours to be cooked while cowpea porridge was prepared within 1hour 30minutes. Likewise, for steamed beans pudding and beans cake.

To dehull the pigeon pea, must be soaked in water (at room temperature) for 30 minutes and to soften the beans for it to be easily blended it was soaked for another 1hr 35min while cowpea does not require soaking before dehulling and only soaked for 20min before it was blended into paste. It was also observed

that pigeon pea beans varieties required more ingredients including more water for recipe.

CONCLUSION

This research work revealed that there is significant difference between the processing, preparation and cooking time of dishes prepared from cowpea and pigeon pea. The cooking time of pigeon peas and cowpea were determined. Pigeon pea takes 4 hours to cook while cow pea takes 1hr30min to cook. Pigeon pea required soaking before dehulling and it was soaked for 1hr 35min before it was blended.

Cowpea was found to be rated higher when used to prepare steamed bean pudding compared to pigeon pea irrespective of its appearance, texture, taste, aroma, flavour and overall acceptability. Results also indicated that these beans varieties have variability when used to prepare beans cake, beans porridge and steamed beans pudding.

Preference for pigeon pea porridge is higher than cowpea porridge taking the taste into consideration. But there is no significant difference in the mean response of these two varieties of beans due to their flavours. In general, the appearances are different including their texture as both are generally accepted on the same scale except for pigeon pea porridge which was found to be preferred more than other sub-varieties.

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