JORMAR 7(1&2) 2012, 49-61 ISSN: 1597-3204

Product Development Using Ethanolic Extracts and Ground Spice Mix of Three Local Spices

Enwereuzoh*, R. O. and Ubbaonu [1], C. N.
** Raw Materials Research and Development Council, Imo State Coordinating Office, Owerri, Imo state, Nigeria.*
E-mai: queenrosen@yahoo.com
[1] Department of Food Science and Technology, Federal University of Technology, P.M.B. 1526, Owerri, Imo State, Nigeria.

ABSTRACT
In this study, the use of ethanolic extracts of three local spices to produce acceptable flavours comparable with imported curry in jollof rice and fish peppersoup preparation was investigated. Some freshly harvested fruits of *Tetrapleura tetraptera* (Oshorisho), *Xylopia aethiopica* (Uda) and *Piper nigrum* (Uziza) were processed into ground powders which were used for the spice ethanolic extract preparation. The acceptable threshold for the spice extracts mix was determined by a panel of 5 members. The final product acceptable to the panelists was the ethanolic extract (liquid) form of these spices in the ratio of 1:3:3 (*P. nigrum: X. aethiopica: T. tetraptera*). The sensory evaluation by 15 member panelists showed that the mixed spice ethanolic extract was preferred in jollof rice dish and there was no significant difference ($p \leq 0.05$), when compared with imported curry products, while the ground dried spice mix (powder) in the ratio of 1:3:3 (P . *nigrum: X. aethiopica: T. tetraptera*) was preferred in fresh fish pepper soup.

Keywords: Spices, ethanolic extracts, dried spice mix, product development, sensory evaluation.

INTRODUCTION

Spices have been used since time immemorial. Their uses range from culinary to medicinal. Globally, they are used in food to stimulate appetite, by adding flavour and enhancing aesthetics in visual appeal to meals. Nowadays, food professionals continually search for new and unique spice flavourings because of the growing global demand for authentic ethnic and cross-cultural cuisines. In Roman times, and throughout the middle ages, herbs and spices were as much valued for their health maintaining properties, as well as for their flavour, hence it was rare to find a flavouring used solely for its taste. Edible spices serve many functions in food products. Their primary functions are to flavour food , provide aroma, and colour. Spices also provide secondary effects, such as preservative, nutritional and health functions [1]. It is a common assumption that among the traditional reasons for using spices was their role in disguising food that was well past its best. While this might have been so in medieval cooking, in Roman times, spices and flavourings were used in cuisine as sophisticated and imaginative as any today [2]. Even these days, consumers are seeking for natural foods and natural preservatives for healthier lifestyles and natural ways of preventing ailments. So, spices are also being sought for their medicinal values, as

antioxidants and as antimicrobials, in addition to their flavouring properties [3]. The need for stable and convenient foods have increased along with the demand for exotic products for international cuisines. Within the context of globalization in the food industries, the demand for quality spices and spice types have remarkably expanded. Modern use of spices in cooking offers the chance to prepare exotic, gourmet dishes, or cultural meals and a way to cut or save calories and fat in cooking [4]. However, the food product developer needs creativity in addition to technical know-how to use spices in flavourings. He/she also needs to have some technical information to balance this creativity [1].

Spice crops are usually dried before they are processed into desired forms. These forms could be whole spices, finely ground spices, coarsely ground spices or cracked spices and various sized particulate spices. Still new forms such as spice extracts and their blends in liquid form have been added to the line of spice products [1]. Whole spices provide aroma and most importantly, visual effect. Flavour is intact in the whole spice and is more slowly released than with ground spices. Whole spices add extra delay in their utilization during food preparation, since they must be reduced in particle size of one form or the other for effective flavour impartation. It therefore necessitates the users' additional grinding, and/or further grinding when actually needed for food preparation. However, user grind-and-use operation has been reported to give the "best and freshest" flavour and aroma, in addition to assuring that the mix is unadulterated [1,2]. Ground spices have better dispersability in food products than fresh whole spices, even though whole intact spices are more easily assessed for quality than ground spices [1].

Coarse and particulate forms are reported to result in brown or black specks in some spices used for food product formulation, thus creating some organoleptic distractions. Liquid extract forms, even though they may require more skill and knowledge of chemistry to produce, blend easier and give better uniformity in food products especially in instant food formulations. Besides, they have added advantage since the solvents used for extracting and storage protect them from mould or bacterial spoilage [1,5]. Oleoresins are the solvent extract of spices containing both volatile and non-volatile compounds. Spice oleoresins are the concentrated fluid from the spices that reproduce the character of the respective spice fully [6]. They are more stable and can withstand higher cooking temperatures than the essential oils [7]. A large part of pepper products in processed foods is incorporated in the form of oleoresins in which the

active ingredients have been concentrated into gummy oil syrups [2,8,9].

Minor tropical spice products are attracting new attention and Nigeria is yet to take on these challenges and the opportunities opened for her in the international trade market. Recently, the huge importation of processed spices and flavourings as food processing ingredients has drawn the attention of Government to the need to develop this sector of the economy [10].

Local spices constitute a good part of our daily diet considering the frequency of their use in our food [11]. Therefore, they need to be developed in consonance with modern technological requirements.

The purpose of this work, therefore, is to formulate an acceptable local spice extract blend using selected spices that might be comparable to imported curry in jollof rice and fresh fish pepper soup dishes. This, in turn, will make Nigerians to patronize local spices, reduce the volume of spice importation and encourage more farmers to grow spices (taking advantage of the resulting industrial processing demand).

MATERIALS AND METHODS

Some quantity of freshly picked (harvested) ripe fruits of *Piper nigrum* (Uziza), *Xylopia aethopica* (Uda) and *Tetrapteura tetraptera* (Oshorisho) were procured from Ogbaku main market in Mbaitoli Local Government Area of Imo State, and used as materials for this study.

Sample Preparation

These fruit supplies were separately cleaned of stalks, unwholesome fruits and extraneous materials. Each spice supply was placed in a stainless-steel colander, washed briskly in running tap-water and dried on woven nylon cloth in the sun for two days, with minimum of six hours hot sunlight each day. The three spices were each wrapped in transparent polythene bags and frozen overnight to make them brittle for milling and to minimize the loss of volatile components from the spices during milling. The frozen pods of the *T. tetraptera* were chopped into tiny pieces with a sharp stainless steel knife before milling, while the other two spices were milled without pre-chopping. The milling operations were carried out with an electric grinder, and the spice samples were sieved through a mesh of 1 mm diameter. Each sieved sample was thoroughly mixed for homogeneity of the sample. For each spice, duplicate measurements of 10 g, 20 g, 50 g and 60 g portions were weighed out using an "Ohaus" triple beam balance (700/800 series). Each spice was placed in separate sterile glass bottles with airtight covers and used for spice extract preparation.

Preparation of Alcoholic Extract used for Product Development

The AOAC method [12] was modified and used for the preparation of spice extracts.

Duplicate measurements of each spice sample were made in the following order 10 g, 20 g, 50 g and 60 g and placed in already cleaned dried airtight glass bottles. Exactly 200 mm of absolute ethanol (95 %) was measured into each glass bottle containing the spice samples already properly labelled. The mixture was gently shaken to ensure the spice was adequately covered with the alcohol for the extraction. The shaking was carried out at 30 min intervals for 8 h before they were left to rest for 16 h. Extraction was carried out during this period. Thereafter, Whatman filter paper 4 was used to sieve the mixture to recover the spice extracts after making up the ethanol to 200 mm per bottle. The colour changes and the perceived aromas of the spice extracts were observed and recorded.

Production Guidance Panel

The spice extracts produced from 60 g of spices in 200 ml ethanol was used for the production guidance panel. Four clean transparent tumblers were selected for the experiment. A clean beaker was used to measure 200 mls of potable drinking water into each tumbler. Separate 2 ml sterile re-usable syringes were used to measure 0.5 ml of each spice extract into each cup containing measured potable water. The fourth cup of water had no spice extract added, which served as the control. The content of each cup sample was tested using separate tea spoons for separate spices. Each taster was provided with a plain sheet of paper for recording the individual's observations. Based on the observations of the tasters, only *Piper nigrum* (Uziza) was significant at 0.5ml. The other two spices, *Xylopia aethiopica* (Uda) and *Tetrapleura tetraptera* (Oshorisho) became significant at 1.5ml each. The next stage involved the blending of the different spices with the one that has the lowest threshold level (*Piper nigrum*). Four different blends were achieved and the results recorded.

Evaluation of Sensory Quality Attributes

The evaluation was carried out on rice and fish samples cooked with imported spice powders, experimental spice powders and spice ethanol extract mix. A fifteen (15) member panel was used for the sensory evaluation and analysis of variance (ANOVA) carried out on the scores. The result of the evaluation was used to determine samples preferred by the panelists and also whether there were significant differences between the samples. The panelists scored for appearance, flavour, aroma and general acceptability based on a 9-point hedonic scale. The F-LSD was used to separate the means as described [13].

Statistical Analysis

Statistical analysis was done using a complete randomized block design as experimental design. The experiment was a factorial treatment with 5

sources of variation, and a total of 72 observations. Analysis of Variance (ANOVA) was computed using SAS program on windows 2007.

RESULTS AND DISCUSSION

The ethanolic extracts of the different spices produced had varying degrees of colour and flavour intensities (Table 1).

For *Tetrapleura tetraptera* (Oshorisho), 30% spice powder in ethanol produced extract with deep brown colour, 25% concentration produced an extract which was brownish in colour, 10% concentration produced extract with golden brown colour and 5% concentration produced golden coloured extract .

Piper nigrum (uziza) at 30% concentration of spice powder in ethanol gave extract that was deep brownish in colour, 25% concentration produced extract that was brownish in colour, 10% concentration gave extract which was light brown and 5% concentration produced golden brown extract.

Xylopia aethiopica (uda) at 30% concentration of spice powder in ethanol produced extract which was yellowish black in colour, 25% concentration produced extract which was coffee brown in colour, 10% concentration produced a deep brown extract, and 5% concentration produced yellowish brown extract. While there were varying colours for different concentrations of the same spice, what was perceived as common to each and every one of them was the aroma of the volatile oils. This confirmed early studies [1] that spice extractives, which were highly concentrated form of spice containing the volatile and non-volatile oils that gave rise to their characteristic flavour. The volatile portions of the spice extractives, also referred to as essential oils, typified the particular aroma of the spice.

The production guidance assessment was carried out by a team of five panelists, using the 30% concentration of spice extracts. The findings were summarized in Table 1. Expectedly, the 60 g/200 ml solvent, which was otherwise 30 g/100ml solvent (30%) had the deepest colour for every spice species studied. The production guidance panel reported that for *T. tetraptera (Oshorisho)*, the 30% extract had very sweet fruity flavour, while the corresponding (30%) extracts for *P. nigrum (Uziza)* had strong pungency and that of *X. aethiopica (Uda)* had a mild pungency. Using the production guidance panel, it was observed that the thresh-hold level for flavour perception for extracts in plain potable 200 ml H_2O was 5.0 ml for *P. nigrum*, 1.5 ml for *X. aethiopica* and *T. tetraptera,* respectively.

Spice Product Formulation

In the development of the final (finished) spice product, a 5-member production guidance panel used during the final production runs, recommended mixed products of the three spices, in a ratio of 1:3:3 *(P. nigrum: X. aethiopica: T. tetraptera*) as the most preferred with regards to its

perceived aroma and taste in plain potable boiled, but cooled warm water. All the panelists recognized water as the control (no changes in taste and colour). The set-up of the experiment was shown in Plate 1.

The threshold level of each spice was established with the *Piper nigrum* (Uziza) at 5.0ml in 200ml portable water which turned the water "cloudy". *Xylopia aethiopica* (Uda) became significant at 15 ml in 200ml water, which turned the water "very cloudy". *Tetrapleura tetraptera* (Oshorisho) became significant at 15ml of extract in 200 ml water. The colour of the water was "light golden" with very nice aroma suitable for wine blending. The next stage of product development involved the addition of 5.0 ml of *Piper nigrum* (Uziza) extract in 200 ml water, since it presented the least threshold and four different samples were produced by the addition of the other two spices at varying concentrations (i.e., 5.0 ml, 10 ml, 15 ml and 20 ml).

Sample 1 was made up of 5.0 ml each of the 3 spices in 200 ml water. The product was generally accepted by all the panelists. Sample 2 was made up of 5.0 ml *Piper nigrum* and 10 ml each of *Tetrapleura tetraptera* and *Xylopia aethiopica* in 200 ml water. The product had a bitter after- taste and was not acceptable to the panelists.

Sample 3 was made up of 5.0 ml of *Piper nigrum* and 15 ml each of *Tetrapleura tetraptera* and *Xylopia aethiopica* in 200 ml water. The product was most acceptable, though it was slightly pungent. Sample 4 was made up of 5.0 ml *Piper nigrum* and 20 ml each of *Tetrapleura tetraptera* and *Xylopia aethiopica*. The resulting product was found to be too concentrated, hence not acceptable to the panelists.

Therefore, the final products were in ground forms and ethanolic extract forms of these spices in the ratios 1:3:3 *(P. nigrum: X. aethiopica:T. tetraptera).* For those who did not like hot or peppery notes, sample 1 was recommended; whereas sample 3 was recommended for those who tolerated hot or peppery notes. Sample 3 with the ratio of 1:3:3 *(P. nigrum: X. aethiopica: T. tetraptera)* was therefore used to formulate the extracts for preparation of rice and fresh fish dishes during sensory evaluation. The same ratio of dried spice powders 1:3:3 *(P. nigrum: X. aethiopica: T. tetraptera*) was used to prepare the dry powder mix.

Sensory Quality of Jollof Rice and Fresh Fish Pepper Soup Spice Products

The jollof rice prepared with mixed ground dried spice *(P. nigrum: X. aethiopica: T. tetraptera* in the ratio of 1:3:3) had the lowest scores in all the attributes evaluated (Table II). Samples from that treatment were slightly disliked (score ≡ 3.6) for appearance, neither like nor dislike (score ≡ 4.5) for flavour, aroma (score≡ 5.4) and general acceptability (score ≡ 4.5) by the panel. Specifically, the panel members made remarks ranging from

"strong flavour", through "brownish colour", "better used for pepper soup" and "better suited for noodles/sphaghetti/macaroni". Thus, the sample from this treatment was not suitable for jollof rice. Jollof rice prepared with mixed spice extracts (*P. nigrum: X. aethiopica: T. tetraptera* in the ratio 1:3:3) "like very much" (score ≡ 8.0) for appearance, liked moderately for flavour and aroma (score ≡ 7.0), and general acceptability (score ≡ 7.3).

Specifically, some panelists remarked that the spice gave the dish an "excellent and attractive appearance". Such comments as "more appropriate", "better applied to soup and sauce than rice or yam porridge" were also recorded, though by two of the panelists. The extract imparted a reddish pink colour on the jollof rice which improved its aesthetics, hence, the "like very much" rating from the panelists. They also observed that the flavour and aroma could be enhanced by "stepping up" the quantity of the extract used in the cooking. A moderate liking for general acceptability (score ≡ 7.3) implied that it was acceptable for the dish. However, the panelists suggested that it might be better applied to soups and sauces, as well as spicing for noodles, spaghetti and macaroni. There were no significant differences ($p \leq 0.05$) between the panel scores for jollof rice prepared with the liquid extract and the imported curry spice (Table II). In terms of appearance, the imported curry was comparatively less liked (score ≡ 7.1) as compared to very much liked (score ≡ 8.0) for the test product, liked moderately for flavour (score ≡ 7.4), aroma (score ≡ 7.0) and general acceptability (score ≡ 7.4). In all other attributes studied, both samples were moderately liked (score≡7.0). In effect, the spice extract developed from this study compared favourably with imported curry for jollof rice in terms of aroma and general acceptability. While the flavour of the imported curry might have been better preferred by the panelists, they rated the appearance of the rice prepared with the spice extract higher. Consequently, the mixed spice extract could be used to prepare jollof rice, but the concentration may be increased (from 1.0 tablespoon of extract for 5 cups of rice to 1.5 tablespoon) to achieve an acceptable flavour note for consumers. For fresh fish pepper soup dishes, the sample prepared with mixed spice extract (*P. nigrum: X. aethiopica: T. tetraptera* in the ratio of 1:3:3) was liked moderately in terms of flavour (score ≡ 6.8) and general acceptability (score ≡ 6.9), which represented the same level of likeness for jollof rice prepared with the mixed spice extracts.

The fresh fish pepper soup prepared with imported curry spice was liked very much for appearance (score ≡ 7.8), moderately liked for flavour (score ≡ 7.3), aroma (score ≡ 7.1) and general acceptability (score ≡ 7.4). Fresh fish pepper soup sample prepared with the mixed ground dried spice (*P. nigrum: X. aethiopica: T. tetraptera*) in the ratio

1:3:3 was liked moderately for appearance (score ≡ 6.8) and aroma (score ≡ 7.4), but it was liked very much by the panelists for flavour (score ≡ 7.7) and general acceptability (score ≡ 7.8). Comparatively, the fresh fish pepper soup sample prepared with the mixed dried spice was ranked higher than the sample prepared with imported curry in terms of flavour, aroma and general acceptability; while the colour was ranked a little lower (Table II). It would be recalled that in traditional Igbo communities, *P. nigrum* (uziza) and *X. aethiopica* (uda) seeds (whole) are used to prepare soups for post natal mothers. Thus, the preference for this particular spice form (ground) might have been influenced by the saying, "the old is better".

There is no significant difference ($p \leq 0.05$) between the panel scores for flavour, aroma and general acceptability for fresh fish pepper soup samples prepared with imported curry spice and the mixed ground dried spice, hence, the mixed dried spice developed in this study is strongly recommended for the preparation of fish pepper soup. These findings confirmed the report [1] that coarse and particulate forms of dry spice powders result in brown or black specks of some spices in food product formulation, thus, creating some organoleptic distractions. The liquid extract forms, though required more skill and knowledge of chemistry to produce, they blend easier and give better uniformity in food products, especially in instant food formulations.

CONCLUSION

The incorporation of the mixed spices in foods might offer consumers benefits derivable from spices such as antimicrobial, antioxidant, preservation and some medicinal values together with the flavour /aroma it imparts. In sensory evaluation, the mixed extract was more preferred in jollof rice and compared favourably with imported curry products; while the ground spice mix was preferred in fresh fish pepper soup. The level of application of the spice extracts in foods will depend on individual preferences.

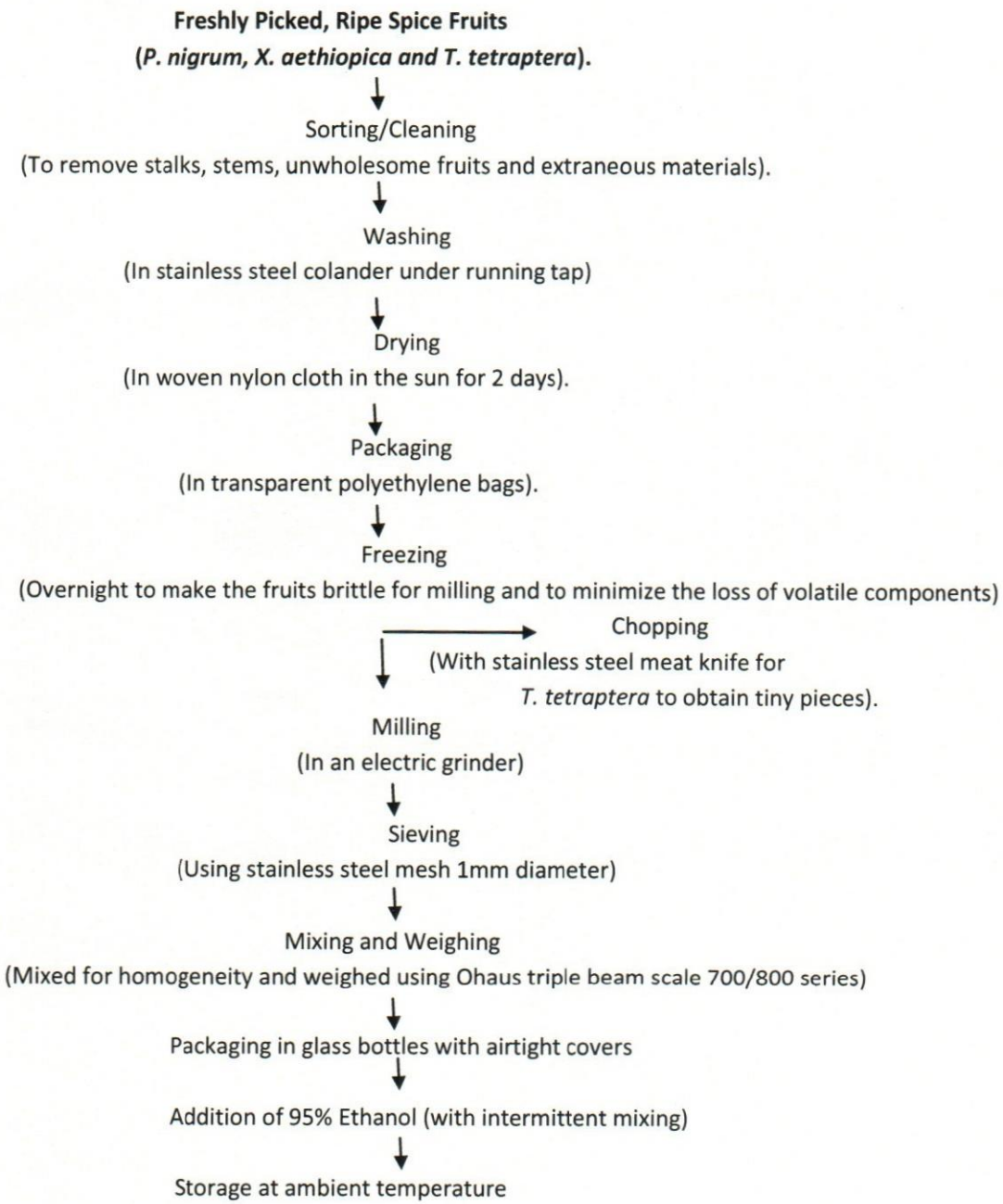

Fig. 1: Flow Diagram of Sample Preparation

Plate 1: Set -Up of Production Guidance Panel.

Table I: Colour changes Observed in the Spices after Extraction with 200 ml Ethanol (95 %).

Type of Spice	Quantity of Spice Powder	Colours of Extracts	Flavour/Aroma Intensity Perception
Tetrapleura tetraptera (Oshorisho)	60g 50g 20g 10g	Deep Brown Brown Golden Brown Golden	Very Sweet/Fruity
Piper nigrum (Uziza)	60g 50g 20g 10g	Deep Brown Brown Light Brown Golden	Strongly Pungent
Xylopia aethiopica (Uda)	60g 50g 20g 10g	Yellowish Black Coffee Brown Deep Brown Yellowish Brown.	Mildly Pungent

Table II: Means Sensory Quality Attribute Scores For Dish Samples Prepared With Spice Products

Samples	Quality Attributes Appearance	Flavour	Aroma	General Acceptability
Jollof Rice with imported Curry spice. (A_1)	7.1^{ab}	7.4$^{a\,b}$	7.0^{a}	7.4$^{a\,b}$
Jollof Rice with mixed spice extracts (Uziza: Uda: Oshorisho 1:3:3 ratio)(A_2)	8.0^{a}	7.0^{ab}	7.0^{a}	7.3$^{a\,b}$
Jollof Rice with mixed ground dried spice (Uziza: Uda: Oshorisho 1:3:3 ratio)(A_3)	3.6^{c}	4.5^{c}	5.4^{b}	4.5^{c}
Fresh Fish Pepper soup with imported Curry spice (B_1)	7.8^{a}	7.3$^{a\,b}$	7.1^{a}	7.4$^{a\,b}$
Fresh Fish Pepper soup with mixed spice extract (Uziza: Uda: Oshorisho 1:3:3 ratio) (B_2)	7.2$^{a\,b}$	6.8^{b}	6.6^{a}	6.9^{b}
Fresh Fish Pepper soup with mixed ground dried spice 1:3:3) ($B_{3)}$	6.8^{b}	7.7^{a}	7.4^{a}	7.8^{a}
LSD	0.93	0.88	1.01	0.89

Note: ***P. nigrum*** **(uziza),** ***X. aethiopica*** **(uda),** ***T. tetraptera*** **(oshorisho)**

Means down the column with the same superscript are not significantly different at 5% level of significance ($p \geq 0.05$).Results are based on 9 point hedonic scale.

9	=	Excellent	4	=	Dislike slightly
8	=	Like very much	3	=	Dislike moderately
7	=	Like moderately	2	=	Dislike very much
6	=	Like slightly	1	=	Dislike extremely
5	=	Neither like nor dislike			

References

1. Susheela Raghavan U.H.L (2000). *Handbook of Spices, Seasonings andFlavourings*. Technomic publishing company Inc.851, New Holland Avenue, Box 3535, Lancaster, Pensylvania 17604, U.S.A Pp 23-57.
2. Mulherin, J. (1994). *Spices and Natural Flavourings*. Tiger Books International. London. Pp. 105-120.
3. Peter, K. V., Ravindran, P.N., Nirmal, B. K and Divakaram, M. (2007). Horticulture Vegetable Science (Vegetables, Tubers, Spice Crops). ICAR Project Report. *Indian Institute of Spices Research*, Calicut, Kerala, India. Pp. 2- 17
4. Hertzler, A.A. (1997). *Herbs and Spices*. Virginia Co-operative Extension. http://www.ext.vt.edu/pubs/foods/348-907.html. Retrieved on 07/01/2008.
5. Ravindran, P. N. and Kallupurackal, J. A. (2001). *Hand book of Herbs and Spices*. (Ed. Peter, K. V.). Woodhead Publishing Ltd. Cambridge, England.
6. NRDC (2003). Spice oil and oleoresin. *http://www.nrdcindia.com/pages/oleores.htm. Retrieved on 05/08/2003.*
7. Giese, J (1994). Spices and Seasoning Blends: A taste for seasons. *Journal of Food. Technology:* 48: (4); 88 – 98.
8. Lawless, H (1984). Oral Chemical Initiation: Psychophysical properties. *Chemical Science Journal:* 9: 143 – 144.
9. Lawless, H., Rozim, P and Shenker, J. (1985). Effect of oral capciasin on olfactory and irritant sensation and flavour identification in humans who regularly or rarely consume Chilli pepper. *Chemical Science Journal:* 10: 579.
10. RMRDC (2003). *Spices, flavourings and colouring agents*. Report of the Techno-Economic Survey of the Multi-Disciplinary Committee on Food,

JORMAR 7(1&2) 2012, 49-61 ISSN: 1597-3204

Beverage and Tobacco Sector. 4th Update. Pp 23-25.

11. Ajayi, I. A, Adebowale, K.O, Dawodu, F.O and Oderinde, R.A (2004). A study of the oil content of Nigerian grown *Monodora myristica* seeds for its nutritional and industrial applications. *Pakistan Journal of Scientific and Industrial Research*. 47: (1): 60-65.
12. AOAC (1990). *Official Method of Analysis* (15th ed.) Association of Official Analytical Chemists Washington D.C.
13. Ihekoronye, A.I and Ngoddy, P. O (1985). *Integrated Food Science and Technology for the Tropics*. Macmillan Publishers, London