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Acceptability and Sensory Evaluation of Maize and Cowpea Products Stored with some Essential Oils

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ABSTRACT
The sensory evaluation and processing qualities of cooked maize paste (pap) and cooked cowpea paste(*moinmoin*) products from treated maize and cowpea grains stored with essential oils of three plant spices (*Eugenia aromatica, Piper guineesis and Monodora myristica*),were investigated. Essential oils were applied at dosage rate of 0, 5, 10, 15 and 20 ml/kg of stored grains for six months. The products were processed, cooked and evaluated for processing and sensory qualities to access the spices and concentration effects of the essential oils extracted with n-hexane. A 9- point hedonic scale was used to evaluate the sensory parameters of taste, aroma and appearance ranging from dislike extremely to like extremely. Panelists were administered well-structured questionnaires to assess the effect of the essential oils, from spices concentration and interaction between spice and concentration on the parameters assessed on the grains. Sensory evaluation data were subjected to 3x5 factorial arrangements. Pap from maize and *moinmoin* (cooked cowpea paste) from cowpea grains stored with dosage rate of 5 -10 ml/kg grains, were significantly accepted and preferred by the panelists. Nutmeg spiced products at 5 ml/kg for the grains products was ranked highest among other spices.
Key words: Sensory evaluation, essential plant oils, Maize, Cowpea and Acceptability

INTRODUCTION
Maize and Cowpea grains are renowned staple crops which are usually processed to pap and *moinmoin* in West Africa. The quality and quantity of these crops are reduced by biotic agents due to improper storage, thereby leading to decayed and contaminated grains during and after field harvest; insect infestations of *Sitophilus zeamais* and *Callosobruchus maculatus are common to* maize and cowpea respectively. Losses of grains during storage, processing and marketing varies and is restricted to be as high as 50%, from harvest to consumption [1,2,3]. Quality processed food from these crops are achieved under proper conditions and controlled environment. [1] Reported that food processing and storage processes involved in food/crop protection against microbes and spoilage agents are ensured for its subsequent use and consumption, stating that a preserved food should possess and retain a palatable flavour, appearance, texture and nutrition values. Previous work on cooked maize and cowpea has revealed that grains stored with some essential oils and processed after some months of storage, possesses organoleptic qualities variation when consumed [1]. Although, spices are known to possess strong aromatic flavour as a result of the presence of the volatile oils used generally as preservative in food preparation, which transform insipid food to palatable form [4].

The essential oils for storage are extracted from three spices (*Eugenia aromatica, Piper guineesis and Monodora myristica*). The essential oils are odorous volatile oils, deposited by plants giving the spices flavour and aroma. Large scale adoption and production of these oils for storage has not been adequately addressed [5]. The main interest for uses of

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essential oils are the availability, potency, price and problems with taint as off – flavours which are imparted to the grains, as oils have been known to leave a persistence odour that can be unpleasant when grains or its' products are consumed [6]. However, the spices are edible and non- toxic to human health. The effect of these essential oils from spices on stored grains in terms of general acceptability in processing, cooking time, taste, aroma, appearance, texture and future utilization were taken into considered in this study.

MATERIALS AND METHODS

The essential oils were extracted from three spices (*E. aromatica, P. guineesis and M. myristica*). These were pulverized with MG 2053 Lexus Optimal stainless-steel mixer / grinder, sieved with 600 µm sieve. Oil extractions were obtained by organic solvent extraction using n – hexane (food grade). The essential oils were applied at dosage rate of 0 (control), 5, 10, 15 and 20 ml/kg of maize and cowpea grains in covered transparent plastic containers and stored for six months.

Processing Characteristics

Treated maize (300 g) were washed and soaked in 200 ml of water for three days to soften, then milled into paste, with MG 2053 Lexus Optimal grinder, the paste was sieved in a clean white muslin cloth to obtain the fine residue which was mixed with boiling water and made to pap inside a hygienic container. Treated cowpea (300 g) was cleaned, washed soaked in 200 ml of water for an hour to soften and de-coated; the clean cotyledons were wet milled into paste and placed in an aluminum foil then steamed for 32 – 37 minutes into *moinmoin*. Inside a stainless kitchen ware.

Sensory Evaluation

The pap produced from maize and the *moinmoin* obtained from cowpea were served to the trained panelist to score the acceptability and effect of oils on these products from treated stored grains, a well-structured questionnaires to assess the sensory parameters of aroma, taste and appearance, using a 9–point hedonic scale ranging from 1 (dislike extremely) to 9 (like extremely) according to [7,8].was administered. The responses of the panelist were analyzed to compare the effect of oils from spices, concentrations and interaction between spice and concentration.

Statistical Analysis

The sensory evaluation data obtained from the administered questionnaires for acceptability were subjected to 3 x 5 factorial arrangements.

RESULTS

Effects of plant oils on sensory evaluation

The sensory evaluations of maize and cowpea products prepared after six months of storage are presented in Tables1 and 2. Table 1 showed that there were significant differences in spice and concentration effects, but spices have no significant effect on taste ($p > 0.05$). The concentration effect of spices on taste was significantly higher (p, 0.001) in 5 ml, than 10 – 20 ml of spices. However, there was no significant difference between 5 ml

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of spice and control. The aroma scores showed on Table 1 were significant for spice ($p< 0.05$) and concentration ($p< 0.001$). The mean separation of spices effect on aroma showed that *M. myristica* spice was significantly higher than other two spices. The concentration effects on aroma showed on Table 2, that there were no significant differences between the 0, 5 and 10 ml, but significantly different from 15 and 20 ml.

The appearance of pap showed on Table 1 reveals significant effect on spice and concentration ($p< 0.05$). Also mean separation of spice effect on pap showed the appearance in *E. aromatica* and *P. guineesis were* not significantly different, but *E. aromatica* was significantly higher than *M. myristica* spice. The concentration effect on appearance of spice on pap (Table 2) showed no significant difference between control and 5 – 15 ml, concentration at 20 ml had lowest values which was significantly different ($p< 0.05$) from control. There was no significant difference ($p> 0.05$) between interaction and concentration. There was significant difference ($p<0.001$) on taste of *moinmoin* spiced with *M. myristica,* due to spice and concentration effects as shown on Table 3. Mean separation of spices effect on taste showed that *M. myristica was* significantly higher than *P. guineesis* and *E. aromatica spices*. The concentration effect of spices in *moinmoin* (Table 4) showed no significance between control and 5 ml. Table 3 showed that the spice and concentration effects on aroma are significant ($p< 0.001$). The spice effect of *M. myristica* on aroma was significantly higher than *E. aromatica* and *P. guineesis.* The concentration effect of spices on aroma while Table 4 showed there was no significant difference between control and 5 ml, but 5ml was significantly higher than values of 10 – 20 ml. The effect of spices on appearance of *moinmoin* (Table 2a) was significant ($p< 0.001$). The mean separation of spice effect on appearance showed that *M. myristica and P. guineesis* spices had higher significant values than *E. aromatica* spice. The concentration effect on appearance however, was not significant ($p> 0.05$). Table 4 showed that control had highest values and followed by 5ml. The interaction between spice and concentration was not significant ($p> 0.05$).

Table 1. Sensory parameters of pap produced from maize grains treated with different concentrations of plant oils and stored for six months

Spice	Concentration	Taste	Aroma	Appearance
E aromatica	Control 0 ml	7.10±1.20	6.60±1.65	7.40±0.52
	5 ml	5.00±0.94	5.90±1.29	7.40±0.52
	10 ml	3.50±1.43	4.80±1.62	7.40±0.70
	15 ml	3.20±1.48	4.70±1.16	7.00±0.82
	20 ml	3.10±1.37	4.00±1.89	7.10±0.57
	Mean	4.38±1.98	5.20±1.75[a]	7.26±0.63[b]
P. *guineesis*	Control 0 ml	6.70±1.64	5.80±2.70	7.40±1.27
	5 ml	6.50±1.72	7.00±1.49	7.30±0.82
	10 ml	4.50±1.90	5.50±1.72	7.00±1.05
	15 ml	2.70±1.25	4.20±1.87	7.00±0.94
	20 ml	2.30±1.77	3.40±2.27	6.00±2.00
	Mean	4.54±2.45	5.18±2.35[a]	6.94±1.33[ab]
M. myristica	Control 0 ml	6.30±2.45	6.90±1.60	7.10±0.74
	5 ml	5.40±1.90	6.50±1.58	6.90±0.88

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	10 ml	4.80±1.87	5.80±1.62	6.30±0.95
	15 ml	4.30±1.83	5.70±1.95	6.20±0.92
	20 ml	3.70±1.89	5.50±2.12	6.30±1.06
	Mean	4.90±2.12	6.08±1.79^{b}	6.56±0.95^{a}
LSD	Spice	NS	*	**
	Concentration	***	***	**
	Spice × Concentration	NS	NS	NS

NS = Not Significant (p>0.05); * = p<0.05; ** = p<0.01; *** =p<0.001

Table 2. Spice concentration effect on acceptability of pap produced from maize grains treated with plant oils and stored for six months.

Concentration	Taste	Aroma	Appearance
0 ml	6.70±1.80^{c}	6.43±2.03^{c}	7.30±0.88^{b}
5 ml	5.63±1.65^{c}	6.47±1.48^{c}	7.20±0.76^{b}
10 ml	4.27±1.78^{b}	5.37±1.65^{c}	6.90±1.00^{ab}
15 ml	3.40±1.63^{a}	4.87±1.76^{ab}	6.73±0.94^{ab}
20 ml	3.03±1.73^{a}	4.30±2.22^{a}	6.47±1.38^{a}

Means with different superscripts within the same column and for the same parameter are significantly different (p<0.05).

Table 3. Sensory parameters on m*oinmoin* produced from cowpea grains treated with different concentrations of plant oils and stored for six months.

Spice	Concentration	Taste	Aroma	Appearance
E. aromatic	Control 0 ml	6.80±1.32	6.70±1.25	6.20±2.53
	5 ml	5.80±2.20	5.80±1.75	6.40±1.58
	10 ml	6.00±1.56	5.10±2.23	5.50±1.65
	15 ml	4.60±1.65	4.40±1.96	6.10±1.20
	20 ml	3.40±2.07	4.80±1.23	5.70±2.50
	Mean	5.32±2.09^{a}	5.36±1.85^{a}	5.98±1.91^{a}
P. guineesis	Control 0 ml	6.90±2.18	7.30±1.25	7.50±1.58
	5 ml	5.90±1.20	6.50±1.08	7.20±0.92
	10 ml	4.10±1.73	5.00±1.25	7.10±0.88
	15 ml	3.90±1.85	5.10±1.37	6.80±1.55
	20 ml	4.40±2.07	4.30±1.64	4.90±1.91
	Mean	4.82±2.27^{a}	5.60±1.80^{a}	6.98±1.45^{b}
M. myristica	Control 0 ml	8.20±0.92	7.60±1.17	7.60±0.84
	5 ml	7.30±0.82	7.30±0.68	7.50±0.53
	10 ml	7.00±0.82	6.70±1.06	7.30±0.68
	15 ml	6.60±1.58	6.40±1.08	7.10±0.57
	20 ml	6.00±1.94	6.10±1.37	7.10±0.74
	Mean	7.02±1.45^{b}	6.82±1.19^{b}	7.32±0.68^{b}
LSD (0.05)	Spice	***	***	***
	Concentration	***	***	NS
	Spice × Concentration	NS	NS	NS

NS =Not Significant (p>0.05); *** =p<0.001

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Table 4. Spice concentration effect on *moinmoin* produced from cowpea grains treated with plant oils and stored for six months.

Concentration	Taste	Aroma	Appearance
0 ml	7.30 ± 1.64^{d}	7.20 ± 1.24^{b}	7.10 ± 1.85
5 ml	6.33 ± 1.63^{cd}	6.53 ± 1.36^{b}	7.03 ± 1.16
10 ml	5.70 ± 1.84^{bc}	5.60 ± 1.73^{a}	6.63 ± 1.38
15 ml	5.03 ± 2.01^{ab}	5.30 ± 1.69^{a}	6.67 ± 1.21
20 ml	4.23 ± 2.39^{a}	5.00 ± 1.74^{a}	6.37 ± 1.92

Means with different superscripts within the same column and for the same parameter are significantly different ($p<0.05$).

DISCUSSION

As spices do not contribute significantly to diet, they are required to be used in small quantities. It has been previously reported that the toxicity effects of essential oils on stored grains affected the quality of grains in storage and during processing [3]. Processed maize (pap) and cowpea (*moinmoin*) obtained from treated grains with essential oils significantly showed variations at different dosage rates / concentrations and spices.
This reveals that the taste, aroma and appearance of maize and cowpea products treated at 5 – 10 ml appear to be more acceptable to the panelists. Actually there was no significant difference in appearance due to concentration of spice in *moinmoin*, as compared to that in pap with variation in significance. The aroma of pap showed no significant difference between the control, 5 and 10 ml, similarly between the control, 5 ml as well as 10 – 20 ml in *moinmoin*. However, reduction of concentration of the spices must have been washed off during soaking, fermentation and rinsing periods of processed products particularly in the pap.

Although, the toxic compound myristicine found in *M. myristica* oil, has a narcotic effect which may be linked with severed liver disorders, if ingested in too great quantity [8] (Borget 1993). However, *M. myristica* spiced products are more accepted than other spices. Effects of oils as regards taste, aroma and appearance ranks *M. myristica* to be highly accepted and preferred. Although, taint – off colour, imparted on grains in storage affected the colour / appearance of the pap, is due to the variations with concentration and spice in appearance. *M. myristica* is associated with very strong aroma and taste, unlike *E. aromatica* which has a very powerful taste attributable to the extremely high essential oil content. While *P. guineesis* has a sharp bitterness, which adds warm strong pungent aroma and piquant taste to foods, due to the chavicine isomer of Piperine. Grains treated with oils at 5 -10 ml concentration, were accepted for consumption and processing to other edible diets and products.

CONCLUSION

Low dosage rate of 5 -10 ml/kg grains, were significantly accepted and preferred by the panelists according to the 9-point hedonic scale. *M. myristica* (Nutmeg) spiced products at 5 ml/kg for the grains products was ranked highest among other spices

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