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Evaluation of Complimentary Food Produced from Maize/Orange Fleshed Sweet Potato Blend

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Abstract
Corn jellos (*Agidi*) is a gelatinous starchy food made by boiling a paste of fermented maize meal or flour. It can be substituted with legumes roots, or seeds at different constitutions to boost its nutritional value. The maize and orange-fleshed sweet potato (OFSP) were sourced from a local Market (Ahia eke market Umuahia) and at the National Root Crops Research Institute, Umudike. The maize was processed into maize paste (MP) while the OFSP was prepared into flour, by soaking for 24hs, draining, and sun drying for 48hrs. It was milled to obtain orange-fleshed sweet potato flour (OFSPF). They were used to form blends at the following constitution: 1) at 100 maize, (2) at 90 % maize and 10 %OFSP, (3)80 % maize and 20 % OFSP, (4)70 % maize and 30 %OFSP, and lastly (5)50 % maize and 50 % OFSP to get the following samples MSC1, MSC2, MSC3, MSC4 and MSC 5 respectively. The results showed that the proximate compositions ranged from 15.74% to 16.43%, 0.23% to 0.289, 18.40 to 22.13%, 0.24% to 0.31%, 3.68% to 4.90 % and 56.10% to 60.92% for moisture, ash, fat, fibre, protein, and carbohydrate, respectively. Organoleptic evaluation of the samples with parameters; appearance, taste, flavour, texture, and general acceptability ranged from 6.00 to 8.75, 4.92 to 7.55, 5.42 to 8.00, 4.00 to 7.50, and 6.17to 8.00 respectively. The vitamin A ranged from 151.10µ/100g to 193.50 µ/100g. Substitution of maize with orange-fleshed sweet potato gave better organoleptic properties in terms of appearance, flavour and general acceptability, while there was a progressive increase in all the vitamins evaluated across the samples. The inclusion of OFSP for the preparation of corn jellos is recommended to boost the nutritional content and sensory qualities.
Keywords: Proximate parameters, Moisture content, Ash content, Fat content and Protein content

Introduction

Breast milk is a biofluid which is needed by an infant for nourishment, reduces infantile mortality tenfold (Hennet and Borsig, 2016), and protects against infectious diseases within a specific period while the infant matures (Andreas *et al*., 2015). At birth, a baby needs breast, milk for his growth, breast milk is known to be rich in protein, and micronutrients, that fight against disease in the infant's body. As an infant grows and increases in weight he becomes more active, at this stage breast can't sustain him to maintain his body functions, and he needs extra food. To supplement breast milk he needs semi-solid food made from cereal and grain and enriched with other things. Weaning is the process of introducing a baby to nutrients other than breast milk to boost their intake of wholesome nutrients needed for their growth and development. Adequate weaning food should comprise of highly balanced protein content, high caloric value per unit of food volume, soft texture with low fibre content, adequate vitamin and mineral contents, and absence of ant nutritional factors. In the developed world, mothers utilize commercial weaning food stored in cans, tins, or packaged food which are convenient; however, they are relatively expensive (Sant'Anna and Keszler, 2012).

Orange fleshed sweet potato is easily -digestible and is mainly required for children because of their immature digestive system. Formulation of complementary food is, prepared using a mixture of cereals and legumes which guarantees a proper balance of amino acids to provide a complete protein (Wu and XU, 2019). Corn jellos (Agidi) is a (cereal starch pudding) prepared from maize, millet, or guinea corn by boiling the paste into a thick semi-solid form, usually used as a complementary food. Complementing the expensive baby food with readily available local resources with high nutritional content with be a better alternative hence this research's findings. The Objectives of this study are the evaluation of organoleptic attributes and vitamin A content of the corn jellos.

Material and Methods

Umuspo 3 (Mothers Delight) was sourced from the National Root Crops Research Institute Umudike, while

the maize and other ingredients were sourced from Ahia Eke Market in Umuahia. The maize was sorted, washed and boiled for 20 mins. The water was then drained and wet milled in a milling machine. The slurry was sieved with a muslin cloth, decanted, and pressed using cheesecloth to obtain maize slurry.

Preparation of sweet potato flour

The experimental design used for the analysis was the control design (CD). The orange sweet potato UMUSPO 3 was selected, peeled, washed, and chipped with a chipping machine. The chipped sweet potato was striped in water for 24 hours to remove the sweetness. After it was sun-dried for 12 hours, it was then milled into flour, and this was used to create a paste by adding water. This was used to form a blend with maize for the preparation of maize sweet potato corn jellos. The maize and sweet potato corn jellos were used for the determination of vitamin A.

Formulation of maize / sweet potato corn jellos

The maize and orange sweet potato paste was formed by mixing 400g of maize in 450 ml of water and 100g OFSP of OFSP flour in 110 ml of water separately. From the slurry formed the corn jellos (*Agidi*) were prepared into 5 different batches of maize and sweet potato paste blend in the following proportions of 100%, 90%/10%, 80% /20%, 70%/30% and 50%./50%. Each of the maize and OFSP slurry was poured in 200ml boiling water containing other ingredients to obtain sample MSCI, MSC2, MSC3, MSC4 and MSC5. It was stirred constantly until a thick paste was formed. The resultant pastes were wrapped in leaf, and allowed to cool, which was used for organoleptic tests, and vitamin analysis.

Determination of Proximate Analysis

Proximate composition: moisture, ash, crude fibre, protein and fibrehydrate were determined as described by the Association of Official Analytical Chemists (2012).

Determination of Vitamin A

Vitamin A was determined by the methods as described by Onwuka (2005) and, they were performed in triplicate to give a wider exposure to minimize error.

Organoleptic evaluation

Randomly selected 30 semi-trained panellists, drawn from breast-finding mothers within Umudike, were used to assess the maize and sweet potato corn jellos for appearance, texture (hand feel) taste, flavour and general acceptability. All the selected assessors were familiar with *Agidi* and could discriminate between and describe different qualities of the food. The assessors were taught and requested to examine the samples and score according to their respective degree of likeness in a seven-point Hedonic scale as described by Iwe, (2002). The hedonic scale was 7 = 'like extremely', 6 = 'like very much', 5= 'like much'; 4 = 'neither like nor dislike', 3 = 'dislike much', 2 = 'dislike very much' and 1 = 'dislike extremely'

Statistical Analyses

The data generated were subjected to the statistical package IBM SPSS Programme version 20 to analyze the data. Results were expressed as mean ± standard error of the mean (SEM). One-way analysis of variance (ANOVA) with the Duncan post hoc test was used to evaluate the statistical difference between the different groups. The results were considered significant at ($P > 0.05$). Also, the graph was drawn with the graph pad Prism 5.

Results and Discussion

Table 2 shows the proximate parameter of maize/ sweet potato corn jellos.. The moisture content ranged from 15.74 % to 16.43% with sample MSC5 (50% maize /50% OFSP) having the highest value while sample MSC3 had the most negligible value. The samples differed significantly at $P>0.05$. There was a reduction in the moisture content from 10 % up to 20% inclusion of OFSP but at 30% to 50% inclusion, the moisture content increased progressively this is in line with the findings of Korese *et al*. (2021) that as the Orange flesh sweet potato increases the moisture content increases. Also increase or decrease in moisture content in a food is attributed to an increase or reduction of water activity (Cauvain and Young, 2000). The samples are not storage stable and will not store for a longer time outside suitable storage condition.

The Ash content which reveals the total mineral content in a food sample ranged from 0.24% to 0.29%. Sample MSC3 had the lowest value, while sample MSC4 had the highest value. The samples differed significantly at $P>0.05$. Samples with OFSP inclusion showed no significant difference but scored higher values than the control samples. The increase in the ash content, as evidenced in this research study can be attributed to the OFSP flour samples which have been reported to pose more ash content than maize.

The fat content ranged from 18.40% to 22.13%. The values recorded in this study are higher than the fat content reported by Nwanagba *et al*. (2021) in their study evaluation of the Chemical Composition and Sensory Properties of Soy-agidi, fortified with *Alternanthera brasiliana* Powder. The high value recorded in this study can be attributed to the oil used in preparing the maize and OFSP corn jellos. The high level of fat reported in this study is well needed and in line with the recommendations of FAO/WHO (1998) that vegetable oils be included in foods meant for infants and children, which will not only increase energy density but also be a transport vehicle for fat-soluble vitamins**.** As the amounts of OFSP flour substitution in the blend increase, the amount of fat in the maize/ OFSP corn jellos decreases. The reason may be due to the presence of high fat in maize flour which has been reported to contain more fat than orange-fleshed sweet potato as indicated by Idolo (2012).

The protein content ranged from 3.73 % to 4.90 % with MSC1 having the highest value while MSC4 and MSC5 recorded the least. There was a significant difference in the protein content with a progressive decrease in protein content as the orange-fleshed sweet potato inclusion increased. The protein content reported here is similar to the protein content of 3.25 % to 4.75 % as

reported by There was a progressive decrease in the protein content as the OFSP inclusion increased, this was in line with the finding of Tadesse *et al*. (2015) who reported a decrease in protein content from 8.94% to 7.57% in orange-fleshed sweet potato and maize blend flatbread.

The carbohydrate content ranged from 56.10% to 60.93%, the carbohydrate showed a significant difference at P>0.05 with sample MSC1 having the least while sample MSC5 had the highest value. There was a progressive increase in the orange-fleshed sweet potato substituted samples this increase can be linked to the OFSP flour.

Table 3 shows the sensory evaluation of the maize sweet potato corn jellos blend. The appearance ranged from 6.00 to 8.75, being like to like moderately in the sensory score. The result showed that there was a significant difference in the appearance content across the samples however, there was no significant difference between sample MSC4 and sample MSC5, also sample MSC2 and MSC3 showed no significant difference. Sample MSC4, MSC5 MSC3 and MSC2 being samples with the inclusion of sweet potato recorded the highest value, this indicates that the values increase as the sweet potato inclusion increases. This can be attributed to the beta-carotene content of orange sweet potato which gives vegetables their bright colour (Faber *et al*., 2013). The appearance of the sample blend was brighter than that of the control sample. The value for the taste ranged from 4.92 to 7.55, showing that there was no significant difference across the samples except in sample MSC5 which has the lowest value. This indicates that the inclusion of sweet potatoes at 10%, 20% 30% and 50% caused a decrease in taste of the samples. However, sample MSC3 was preferred across all samples substituted with a sweet potato while sample MSC5 had the least value. The high concentration of the sweet potato must have affected the taste of the corn jellos. The flavour ranged from 5.42 to 8.00, with the control sample MSC1 having the highest score while sample MSC5 had the lowest values. The sweet potato inclusion caused a decrease in the flavour. Among the sweet potato substituted samples, sample MSC2 had the highest while sample MSC5 had the least in terms of flavor.

The vitamin A of the samples (maize sweet potato corn jellos (*Agidi*) are shown in Figure 2. The vitamin A content ranged from 151.10µ/100g to 193.50 µ/100g. The control sample had the lowest value of 151.10 µ/100g while sample MSC5 (50% maize and 50% OFSP) had the highest value of 193.50 µ/100g. As the orange-fleshed sweet potato flour inclusion increased there was a progressive increase in the vitamin A content this is probably because OFSP has a higher vitamin A content. This can be supported by the finding of Faber and Laurie (2011) who reported that orange sweet potato increased the dietary intake and status of vitamin A. This can interpret the progressive increase of vitamin A across the OFSP substituted samples as reported in this research findings. Orange sweet potato is rich in beta carotene which is a precursor of vitamin A that can eliminate vitamin A deficiency to prevent night blindness in developing Countries (Haskell *et al*., 2016). The value of Vitamin A recorded in the samples substituted with OFSP is higher than the recommended daily allowance of 178 µ/100g to 185 µ/100g and 127 to 132 which are required for a child between 7 to 12 months of age and for adult females respectively as reported by Faber and Laurie (2013). So the use of the maize and sweet potato corn jellos is recommended as a complementary food to boost the vitamin A requirement of an infant, which is turn needed for the functioning of the visual system, the maintenance of cell function for growth, epithelial cellular integrity, and immune function.

Conclusion

Based on the results generated from this study, it is, therefore, concluded that there are significant changes in the organoleptic parameters of the maize/ sweet potato corn jellos evaluated. The sensory Panelists preferred the appearance of the sweet potato substituted samples to the control sample which is 100% maize. There was no significant difference in the taste across all samples evaluated. The general acceptability was rated high by the sensory panellists across all samples except sample MSC5. The vitamin A content of the samples had a progressive increase as the OFSP inclusion increased with the control sample having the least value. This makes the product a good source of vitamin A thereby, complementing vitamin A from other sources for a weaning infant.

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Maize / Sweet Potato Blend

Table 1: Maize /Orange Fleshed Sweet Potato Blends

Samples	Maize paste	Orange fleshed sweet potato paste
MSC1	100%	0%
MSC2	90%	10%
MSC3	80%	20%
MSC4	70%	30%
MSC5	50%	50%

PLATE1 (100maize&0% OFSP)

PLATE 2 (90%maize&10% OFSP)

PLATE 5 (0%maize&50% OFSP)

PLATE 3(80% maize &20% OFSP)

PLATE 4 70% maize &30%

Fig. 1: Maize /Orange Fleshed Sweet Potato Blends

Table 2: Proximate Composition of Maize/Orange Fleshed Sweet Potato Corn Jellos

Sample	MC	ASH	FAT	FIBER	PRO	CHN
MSC1	16.33±0.01^{c}	0.23±0.01^{b}	22.13±0.14^{a}	0.31±0.01^{a}	4.90±0.01^{a}	56.10±0.18^{d}
MSC2	15.97±0.01^{d}	0.28±0.01^{a}	20.90±0.14^{a}	0.28±0.01^{b}	4.88±0.02^{a}	57.29±0.15^{c}
MSC3	15.74±0.01^{e}	0.28±0.02^{a}	20.55±0.21^{b}	0.24±0.01^{b}	4.04±0.02^{b}	59.38±0.01^{b}
MSC4	16.37±0.03^{b}	0.29±0.01^{a}	19.75±0.35^{d}	0.27±0.02^{b}	3.68±0.04^{c}	59.66±0.30^{b}
MSC5	16.43±0.04^{a}	0.28±0.01^{a}	18.40±0.14^{e}	0.26±0.02^{b}	3.73±0.01^{c}	60.92±0.15^{a}

Values are mean± SD of 3 replications. Means within a column with the same superscripts were not significantly different (P>0.05). Key: MSC1 (maize 100%), MSC2 (maize 90% and 10% sweet potato), MSC3 (maize 80% and sweet potato 20%), MSC4 (maize 70% and sweet potato 30%) and MSC5 (maize 50% and sweet potato 50)

Table 3: Organoleptic Evaluation of Maize/ Sweet Potato Corn Jallos (*Agidi*)

Sample	Appearance	Taste	Flavor	Texture	General acceptability
MSC1	**6.00±2.45^{c}**	**7.75±1.14^{a}**	**8.00±1.28^{a}**	**7.50±0.90^{a}**	**8.00±1.28^{a}**
MSC2	**7.25±0.87^{b}**	**7.25±1.54^{a}**	**7.25±1.14^{ab}**	**7.00±0.74^{ab}**	**7.75±0.87^{a}**
MSC3	**7.50±1.17^{b}**	**7.50±1.17^{a}**	**7.00±1.28^{ab}**	**6.50±1.73^{bc}**	**8.00±0.74^{a}**
MSC4	**8.75±0.45^{a}**	**7.25±1.36^{a}**	**6.25±1.36^{bc}**	**6.25±0.87^{b}**	**7.50±0.52^{a}**
MSC5	**8.75±0.45^{a}**	**4.92±1.08^{b}**	**5.42±1.38^{c}**	**4.00±2.17^{c}**	**6.17±0.83^{b}**

Values are mean± SD of 3 replications. Means within a column with the same superscripts were not significantly different (P>0.05). Key: MSC1 (maize 100%), MSC2 (maize 90% and 10% sweet potato), MSC3 (maize 80% and sweet potato 20%), MSC4 (maize 70% and sweet potato 30%) and MSC5 (maize 50% and sweet potato 50)

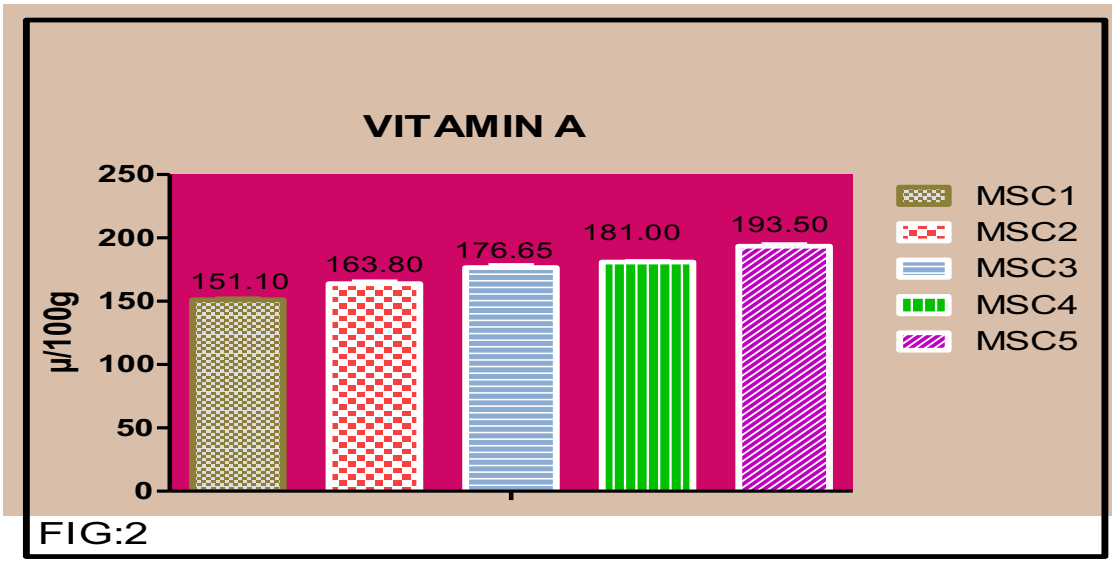

Fig. 2: Vitamin A content of the samples (maize sweet potato corn jellos (Agidi)
Key: MSC1 (maize 100%), MSC2 (maize 90% and 10% sweet potato), MSC3 (maize 80% and sweet potato 20%), MSC4 (maize 70% and sweet potato 30%) and MSC5 (maize 50% and sweet potato 50)