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Comparative Analysis of Custard Produced from Selected Cereals (Guinea Corn, Maize, Rice and Millet)

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***Abstract*— This study looked at the proximate and organolleptic qualities of custard powder produced from four different cereals (guinea corn, maize, rice and millet). Proximate result ranged between 9.95-14.05%, 1.20-2.78%, 1.10-2.31%, 4.75-5.50%, 7.96-12.88% and 66.49-70.58% for moisture, ash, crude fiber, fat, protein and carbohydrate content respectively. There was significant difference in all the parameters evaluated. Product from guinea corn and Millet compared favourably with the product produced from the conventional cereal (maize). Also, sensory result revealed the preference of consumers for guinea corn and Millet based custard to the conventional primary raw material. The study established the superiority of custard from guinea corn and millet to that produced from maize.**

***Keywords*— Custard, Maize, Guinea corn, Rice, Millet**

I. INTRODUCTION

Emphasis placed by many Countries on massive food production in feeding the ever-increasing population and provision of raw materials for industrial use has shown positive results. However the situation is different in some Countries especially in Latin America, Africa and South-East Asia with heavy demographic figures {15,11}. These countries continue to experience food deficit.

A nation should be able to feed its population, only then can it occupy a place of pride in the community of nations. Nigeria is a country richly blessed with abundant natural and human resources that if properly harnessed can feed its people and export the surpluses to other countries, yet it is experiencing persistent food crisis both in terms of quantity and quality. Cases of malnutrition and under nutrition are growing by the day. The food intake requirements of majority of Nigerians have fallen far below the international standard. Past effort at improving food supply through agricultural production has not yielded successful results due to high storage losses {5}.

The major crops target in the various food production programmes includes maize, rice, millet, wheat, sorghum, oat and cassava. However some crops have received more attention than other. High demand placed on these crops both by man, livestock and industry with high storage loss makes them unavailable for various utilization. Processing of crops into varied useful forms could aid in improving the shelf-life of these grains thereby improving the nutrition of the populace {5}.

There is a major problem attributed to competition between livestock and man for maize grains; maize is a major feedstuff and it is in high demand for consumption by both humans and livestock. Furthermore, the use of maize in livestock diets, use as food by humans as well as its use as an alternative fuel has increased the demand for maize thereby necessitating the exploration of other energy sources for food {4}. In Nigeria, maize has been widely used as a principal energy source in infant nutrition {8}. However, the keen competition for this ingredient between man, industries and livestock has increased the cost of this ingredient beyond the reach of the average Nigerian {12}.

Custard is a fine textured food product made from corn starch in which salt; flavouring and colouring agents are added with or without the addition of egg yolk solids, vitamins and minerals. The corn starch used for the preparation of custard is basically dense, powdery flour obtained from the endosperm protein of the corn kernel. This custard powder

could serve as supplement for infants feeding, consumed as breakfast meal by many and could be regarded as food of choice for the sick {8}.

For so many years, people living in the urban and rural areas had been so familiar with custard produced from edible corn starch. Attempts has been made to diversify the products of corn since some cereals such as millet is comparable and even superior to major cereals nutritionally with respect to energy value, protein, fat and minerals {14}.

The rationale behind this study is to produce varieties of more valued custards from cereals such as rice, millet and sorghum with improved nutritional value as the use of rice, millet and sorghum in custard would be a good way of diversifying the already monotonous utilization of corn in custard production. These study present different possible raw materials for custard preparations, the nutritional impact as regards to the type of cereal as well as consumer acceptance.

II. MATERIAL AND METHODS

Material

2kg each of maize (*Zea mays)*, guinea corn (*Sorghum bicolum*), rice (*Oriza sativa),* millet (*Eleusine coracana*) and carrots used in this study were obtained from Anyigba Central market of Kogi State, Nigeria. Proximate analysis was carried out using equipments from the Biochemistry laboratory of Prince Abubakar Audu University, Anyigba, Kogi State.

Methods

Preparation of custard powder

Edible starch powder Samples were prepared in accordance with the method described by {8} as shown in fig 2. During preparation, the grains (freed of sand and other debris) were prepared by individually immersion in 3liters of water for 24 hours with occasional change of water at intervals of 6 hours to prevent fermentation. The individual grain type were then rinsed and ground into paste using a Hobart grinding machine. The slurry paste was then sieved using a muslin cloth and the filtrate allowed to stand for one hour for the filtrate to settle. The supernatant was decanted and the sediment collected was dried in the green house at an average temperature of 60^{o}C for 72 hours, after that, the dried starch was milled (attrition mill) and sieved and stored in an airtight container.

Carrot powder was prepared according to the method described by {7} as shown in Fig1. The carrot sample was first washed then peeled and soaked in warm water for 30 minutes. The carrot was then sliced into thin pieces and spread on a thin tray and placed under the sun to dry for 8days. The carrot slice was grinded into powder on the fifth day and re-dried for three more days. The carrot was re-grinded on the eight-day and sieved then placed in an air-tight jar.

The edible starch powder was blended with the carrot powder in the ratio 95:5% to form the custard powder (see Fig2).

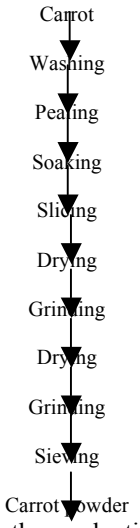

Fig 1: Flow diagram for the production of carrot powder for colouring and flavouring

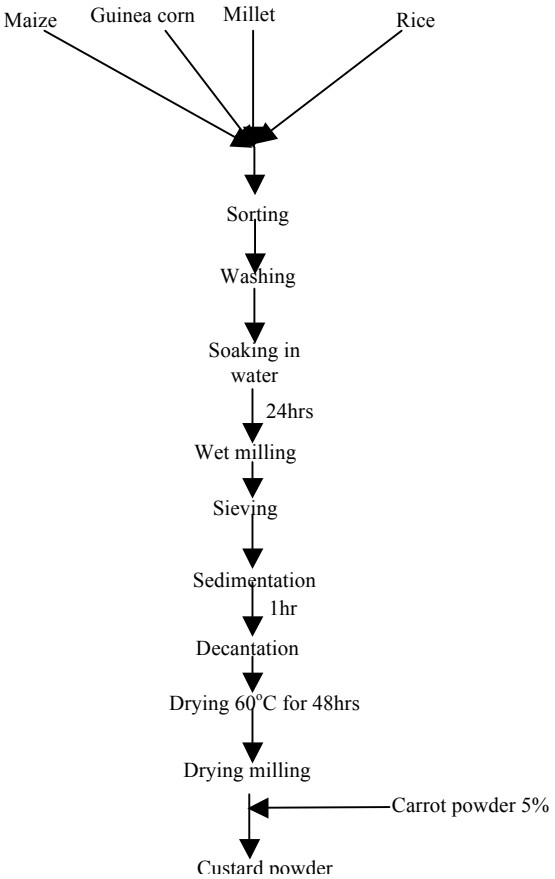

Fig 2: modified Flow Chart for Custard Processing

Analysis of Samples

The Proximate composition of the samples was determined as prescribed by the Association of Official Analytical Chemist {1}. Sensory evaluation was carried out on the custard samples. The samples were encoded in identical containers and displayed. A hedonic scale of seven-points was used. The scale ranged from extreme like (7) to extreme dislike (1). Each of the samples was rated for Taste, Flavour,

Texture, Appearance, Mouth feel and Acceptance as described by {9}.

Using Analysis of variance (ANOVA), all the data collected were subjected to statistical analysis and the means separated using Duncan Multiple range test at 95% confidence level (SPSS version 23 computer software was used).

III. Result and Discussion

TABLE 1: Result of Proximate Analysis of Custard Powder

Compositions(%)	Samples A	B	C	D
Moisture	$12.67^{b}\pm0.42$	$9.95^{c}\pm0.01$	$12.16^{b}\pm0.10$	$14.05^{a}\pm0.07$
Ash	$2.78^{a}\pm0.08$	$1.20^{b}\pm0.04$	$2.55^{a}\pm0.01$	$2.37^{a}\pm0.01$
Crude Fiber	$1.55^{ab}\pm0.03$	$1.10^{b}\pm0.04$	$2.31^{a}\pm0.02$	$1.29^{b}\pm0.01$
Protein	$10.95^{b}\pm0.07$	$12.88^{a}\pm0.03$	$11.27^{a}\pm0.01$	$7.96^{c}\pm0.01$
Fat	$5.50^{a}\pm0.06$	$5.45^{a}\pm0.07$	$5.23^{a}\pm0.03$	$4.75^{b}\pm0.01$
Carbohydrate	$68.17^{b}\pm0.05$	$68.85^{b}\pm0.07$	$66.49^{c}\pm0.06$	$70.58^{a}\pm0.01$

Values are the means of replicated measurements ±SD. Values in the same row with different superscripts were substantially different ($p\leq0.05$)

Where A = Corn Custard,
B = Millet Custard
C = Guinea corn Custard
D= Rice Custard

The result of the proximate composition of the custard powder is presented on Table 1. The average moisture content of the various custard powder ranges from 9.95% - 14.05% with the highest significant value reported for in rice custard powder implying the hydroscopic tendency of rice starch. Value of moisture implies preservation quality as high moisture impedes effective preservation thereby limiting the shelf-life of the product. However the millet showed high tendency for effective preservation.

The ash value ranges from 1.20 to 2.78%. Significantly higher value was obtained in custard from maize (2.79%), guinea corn (2.55%) and rice (2.37%). This implies more vitamin content present in the cereals custard than that of the millet. {2}, reported that rice contained vitamin-B-complex and iron; {12}, reported that guinea corn was found to be rich in β-carotene and ascorbic acid, while {14}, reported that Maize provides many of the B vitamins and essential minerals along with fiber. These could account for the higher significant ash content of their custard powder.

The average fibre content ranges from 1.29% - 2.31%. The significant higher value obtained for the guinea corn could imply better bowel movement. However value ranges in this experiment is similar to findings of {10} for millet.

Fat value ranges from 4.75% - 5.50%. No significant difference ($p\leq0.05$) was obtained for maize, millet and guinea corn. They were however significantly higher ($p\leq0.05$) as compared to rice in the fat content. This is in line with reports by {3}, where he reported that rice is low in sodium and fat and is free of cholesterol, serves as an aid in preventing hypertension. This also implies that the metabolizable energy derived from the consumption of the custard from rice would be lower than that of the rest cereals.

The average protein content of the various custard powder ranges from 7.96% - 12.66% which is within ranges of values reported by {10} for cereal grains. Protein content value for custard powder from millet and guinea corn were significantly higher than maize. However the least significant value was obtained in rice. This implies more protein nourishment with healthy growth, tissue development and repair with consumption of millet and guinea corn custard.

Average range of carbohydrate was 66.49% - 70.58%. Simple Sugars, starches (found in grains) are the carbohydrates that are converted into volatile fatty acids (energy) in the GIT of man. Significantly higher carbohydrate values recorded in this present study for rice could be justified by reports of {6}, that rice flour is nearly pure starch and free from allergens, which is a main constituent of infant formulas serving also as a substitute for glucose in oral rehydration solution for infants suffering from diarrhea. This could imply a higher metabolizable energy content of the custard from carbohydrate thereby improving the energy content of the rice custard.

TABLE 2: Sensory Analysis of Custard Powders

Sensory Parameters	Samples A	B	C	D
Appearance	$6.36^{a}\pm0.67$	$4.80^{b}\pm0.78$	$6.40^{a}\pm0.70$	$4.78^{b}\pm0.83$
Aroma	$6.18^{b}\pm0.40$	$6.80^{a}\pm0.42$	$6.10^{b}\pm0.57$	$5.44^{c}\pm0.73$
Texture	$6.55^{a}\pm0.52$	$6.40^{a}\pm0.52$	$6.50^{a}\pm0.71$	$5.67^{b}\pm0.50$
Taste	$5.73^{ab}\pm1.00$	$6.50^{a}\pm0.84$	$5.90^{ab}\pm0.88$	$5.44^{b}\pm0.88$
Flavour	$6.45^{ab}\pm0.69$	$6.80^{a}\pm0.42$	$5.90^{b}\pm0.99$	$5.00^{c}\pm0.70$

Where A = Corn Custard,
B = Millet Custard
C = Guinea corn Custard
D= Rice Custard

The scores of the sensory evaluation performed on samples of custard gruel prepared from corn, millet, rice and guinea corn based flour is as shown in Table 2. The results of the appearance, taste, flavour, texture and aroma ranged from 4.78–6.36, 5.44–6.50, 5.00–6.80, 5.67-6.50, and 5.44-6.80 respectively. Millet had significantly higher value for most of the parameters measured except for appearance, where it was lower significantly compared with corn and guinea corn. Corn and guinea corn had highest rating for appearance with values of 6.33 and 6.40 respectively. However, the least significant value was obtained with the rice flour which was significantly lower than the rest of the custard products. The variation in appearance acceptability may be due to the colour of the grains which tend to appeal differently to the consumers. Taste however can be attributed to the simple suger been released by

the grain flour in the gruel; as millet have more carbohydrate than the rest grain. The high consistency obtained in the corn flour gruel can be attributed to the long chain polysaccharide in maize as reported by {14}. This therefore proves that of all the custard gruel accessed the millet flour gruel had the best overall acceptability.

IV. CONCLUSION

This research revealed that the utilization of maize, millet, guinea corn and rice in production of custard powder will help in the provision of nourishment both to adult and children. An indication of this research is that the various carrot coloured custard powders showed nutritious capabilities because of their protein, carbohydrate, fat and fiber content; which are beneficial constituents as a staple food thereby enhancing their consumption in households. The sensory attributes showed significant variation; these factors tend to influence the consumers acceptability of the food product. The results of this research have clearly proved that carrot coloured custard powder from millet and guinea corn can effectively replace maize in custard preparation as a means of enhanced nutrition in developing countries.

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