NUTRITIONAL QUALITY AND SENSORY ACCEPTABILITY OF FERMENTED BREADFRUIT – PIGEON PEA BASED CUSTARD

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Abstract
Custard is a yellow food made from extraction of grain-bearing plant with some flavouring added to make a cereal solid food. Custard is majorly an imported food but due to its high cost of importation, there is need for diversification by usage of locally available food crops for replacement to reduce post-harvest losses and improve nutritional condition of Nigerians. Breadfruit is a good source of calcium, copper, iron, potassium, magnesium and has similar levels of protein as many other tropical staple crops and many cultivars produce pro-vitamin A. Fresh breadfruit and wholesome brown pigeon pea was fermented differently at different conditions to produce custard. Proximate composition, anti-nutrients and sensory attributes of the breadfruit- pigeon pea custard in terms of appearance, colour, aroma, taste and overall acceptability were determined. Sensory evaluation results showed that 100% fermented breadfruit at 10ºC was the most preferred while little differences were observed from other samples at 5% significant level. The results obtained indicated that quality custard can be produced from breadfruit-pigeon pea, if more research is done in this area to curtail food insecurity in Nigeria. Also, the acceptability of the formulated products will add value to the produce through livelihood improvement of the growers and thereby increase the existing products.

Keywords: Fermented Breadfruit, Pigeon-pea flour, Custard, Proximate Composition, Anti-nutrients, Sensory Acceptability

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1. INTRODUCTION

Breadfruit is a fleshy fruit that grows best in the tropical regions of the world especially, in the humid climate. Breadfruit is widely cultivated to appreciable extent in South-West States and other Geo-political zones of Nigeria (Omobuwajo, 2003). The tree produces fruit twice a year, from March to June and from July to September with some fruiting throughout the year. It is highly nutritious, cheap and readily available in overwhelming abundance, especially at the peak of the two fruiting seasons in May and August but has for long been under exploited in Nigeria due to its low social esteem (Omobuwajo, 2007). The fruit has been described as an important staple food of a high economic value (Soetjipto and Lubis, 1981). Singh (2009) reported that breadfruit yields in terms of food are superior to other starchy staples such as cassava and yam. It is essentially a carbohydrate source, eaten in Nigeria, almost exclusively around the region where it is produced. The fruit is a valuable food resource on account of its high caloric content (68% starch, 4% protein, 1% fat on dry basis) and significant amounts of certain vitamins and minerals (Graham and De-Bravo, 1981). Breadfruit is seasonal, often so plentiful that it cannot all be eaten fresh; farmers helplessly watch their harvested stored breadfruits rot away because routine methods of processing are inadequate to utilize all the breadfruits harvested.
Pigeon pea (*Cajanus cajan*) is a locally available and affordable grain legume of the tropics and sub-tropics that is underutilized. Pigeon pea varieties have protein content in the range of 23-26% (Onweluzo and Nwabugwu, 2009; ICRISAT, 1986) and it is a rich source of lysine. The protein content is comparable with those in other legumes like cowpea and groundnut. It is rich in minerals and fibre content (Fasoyiro *et al.*, 2009a).
Custard powder is an edible yellow coloured starch, sweetened and flavoured in which when

hot milk is added, the gruel gives the desired colour, taste and aroma (Okoye *et al*., 2007). The thickening of the custard is caused by the combination of egg and cornstarch. Most common custards are used as desserts or desserts sauces with sugar and vanilla. Custard is usually cooked in a double boiler (brain-marie) or heated very gently in a saucepan on a stove, though custard can also be steamed, baked in the oven with or without a water bath or even cooked in a pressure cooker.

It is a convenient food often prepared from 100% corn with added colourants and vitamins. It is usually consumed as a thin porridge served with milk, sugar, coconut, groundnut and so on to complement the taste. However, Nigeria often imports large quantities of corn starch into the country annually which serves as a drain to our hard earned foreign exchange. Therefore, this study was designed to evaluate the suitability of breadfruit-pigeon pea flour in custard production, through combination of fermented breadfruit and pigeon pea flour that are high in carbohydrate, fibre, quality protein and other nutrients. This will thereby increase diversification in food value chain for better livelihoods.

2. MATERIALS AND METHODS

Procurement of Raw Materials

Freshly harvested matured and wholesome fruits of breadfruit (*Artocarpus communis*) were purchased from Ajifowobaje Ilode market, Ile-Ife, Osun State, Nigeria. Pigeon-pea was sourced from farmer`s market in Ago-Aare, Oke-ogun area of Oyo State. Egg yolk, sunset yellow, glucose, salt, powdered milk, vanilla flavor, condensed milk flavor and sugar purchased from Bodija market in Ibadan.

Preparation of Fermented Breadfruit Flour

Freshly harvested matured breadfruits were rinsed with potable water, peeled and sliced manually using stainless steel knives. The extraneous matters were also removed. Slices of breadfruit chips were placed in portable water in a ratio of 2:1 (w/v) inside the low density transparent covered bucket for 72h. They were allowed to ferment spontaneously at 10^0C, 37^0C and ambient conditions (28±2°C) respectively. At the end of each fermentation period, the water was decanted. The pulp was drained and then dried in the cabinet dryer at 55^0C for 16h. The pulp was milled into flour and screened through a 0.25 mm British Standard Sieve (Model BS 410) (Giami, 2004). The flour was packaged in thick gauge (0.04mm) low density polyethylene nylon for further use. The flow chart is shown in Figure 1 a.

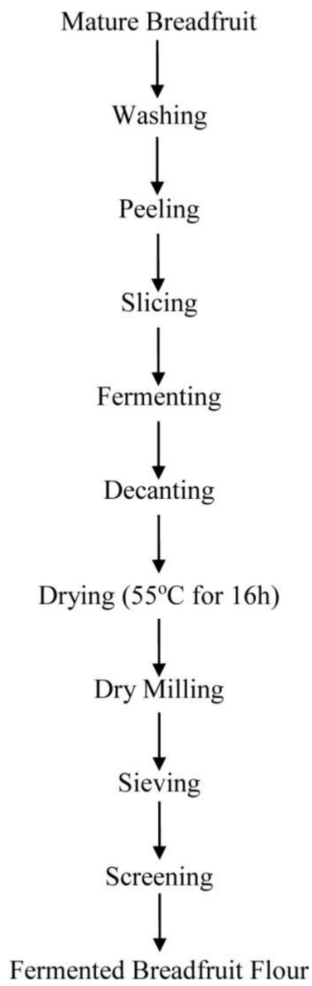

Fig. 1a: Production of Fermented Breadfruit Flour

Preparation of Fermented Pigeon – Pea Flour

Mature healthy light brown seeds of pigeon-pea were picked and cleaned with portable water. The sound, cleaned seeds pigeon peas were poured in portable water in a ratio of 2:1

(w/v) inside the low density transparent covered buckets for 72h. They were allowed to ferment spontaneously at 10^0C, 37^0C and ambient conditions (28±2°C) respectively. At the end of each fermentation period, the fermented pigeon pea seeds were dehulled using electric blender, pestle and mortal. Dehulled peas were then washed, drained and dried in the cabinet dryer at 55°C for 8h. The dried pigeon pea seeds were ground and screened through a 0.25 British Standard Sieve (Model BS 410). The samples were packaged inside the low density polythene nylon for further use. The flow chart is shown in Figure 1b.

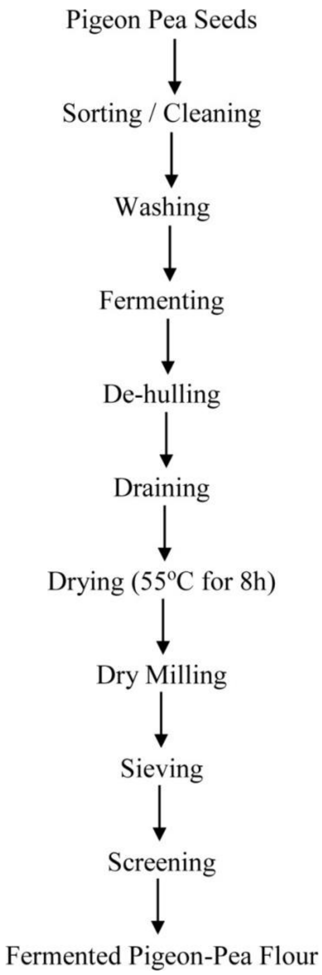

Fig. 1b: Production of Fermented Pigeon-Pea Flour

Formulation and Production of Breadfruit-Pigeon Pea Custard-Like

The breadfruit – pigeon pea custard like samples were in ratios of breadfruit flour: pigeon pea flour 100:0, 95:05, and 90:10. Each mixture was prepared based on flours obtained from raw materials fermented for 72h at 10°C, 37°C and 28±2°C respectively. Breadfruit flour, pigeon-pea flour, egg yolk, sunset yellow, glucose, salt and portable water were weighed and mixed properly. The soft paste was poured inside the boiled water (100°C) and stirred vigorously with a wooden turner until the mixture is cooked to make custard. Then powdered milk, vanilla flavor, condensed milk flavor and sugar were added to complement the taste **(**Tai Situ *et al.*, 2009). The flow chart is as shown in Figure 1c and ingredients proportion is shown in Table 1.

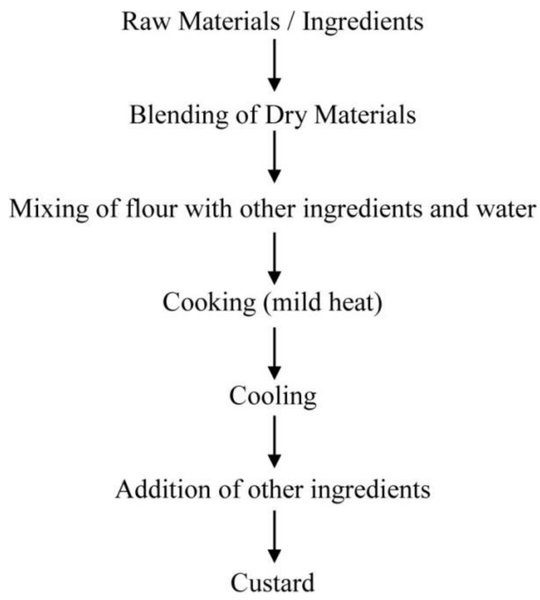

Fig. 1c: Production of Breadfruit-Pigeon Pea Custard Like

Table 1: Ingredients for production of Breadfruit Custard

Ingredients	Quantity
Flour	100g
Sugar	40g
Powdered Milk	40g
Vanilla Flavour	0.2ml
Salt	0.1g
Glucose	0.2ml
Sunset Yellow	0.1g
Condensed milk flavor	5ml
Water	90 – 95ml
Egg Yolk	0.2ml

Analysis
Moisture, protein, fat, ash, crude fibre, carbohydrate, phenolics, flavonoid, phytate and oxalate contents of the breadfruit and pigeon pea were determined using standard methods (AOAC, 1990). The sensory evaluation was determined using untrained 15 panelists. The panelists were requested to examine the custard and score according to their degree of likeness using a 9-point Hedonic scale ranging from 1 (dislike extremely) to (like extremely) (Larmond,1977). The parameters evaluated were the colour, aroma, appearance, taste and overall acceptability.

Statistical Analysis
The data were subjected to one way Analysis of Variance (ANOVA) and a difference was considered to be significant at $p \leq 0.05$. Means were separated using Tukey`s tests through SPSS software (version 21.0).

3. RESULTS AND DISCUSSION

The proximate composition of breadfruit is shown in Table 2.

Table 2: Proximate Composition of Fermented Breadfruit Flour

Sample	Moisture Content %	Protein Content %	Fat Content %	Ash Content %	Crude Fibre %	Carbohydrate % (By difference)
301	9.13 ± 0.15	4.1 ± 0.1	1.03 ± 0.05	3.0 ± 0.1	3.46 ± 0.15	79.26 ± 0.05
302	8.56 ± 0.11	4.1 ± 0.1	0.96 ± 0.05	2.83 ± 0.15	3.46 ± 0.15	80.06 ± 0.15
303	8.13 ± 0.15	3.73 ± 0.15	0.76 ± 0.05	2.73 ± 0.15	3.1 ± 0.1	81.53 ± 0.30
304	8.56 ± 0.05	3.93 ± 0.15	0.96 ± 0.05	2.96 ± 0.15	3.4 ± 0.1	80.16 ± 0.20

Values are means± standard deviation of triplicate determinations
Key:
301 – Unfermented breadfruit
302 – Breadfruit fermented for 72hr at 10 °C
303 – Breadfruit fermented for 72hr at 37 °C
304 – Breadfruit fermented for 72hr at ambient Temperature

Moisture content of the breadfruit flour ranged from 9.13 to 8.13%. This moisture content observation compares well with the findings of Appiah (2011) as well as Adepeju *et al.*, (2015) but the values were slightly lower than the values obtained by Ojokoh *et al.*, 2013. The moisture contents are within the limit (13%) stipulated by CIAT (Centro international de Agricultural Tropical, 2001) and CODEX Alimentarius Commission (1995). The low moisture content of breadfruit flour would enhance its storage stability by avoiding mould growth and other biochemical reactions (Onimawo and Akubor, 2012).
The protein content was between 4.1 – 3.73 %, protein content of the unfermented sample agrees with the work of Amusa *et al.*, (2002), while for fermented samples it was a bit lower than that of control probably due to the different treatment conditions. It could be as a result of leaching of the nutrient into the water during the fermentation process. This is in line with Okaka (2005), who reported reduction in nutrient of some roots and tubers samples during processing. The fat content values (1.08 – 0.76%) obtained in this study were in consistent with the work of Adepeju *et al.*, (2011). The decrease in fat content during the fermentation could be the result of fermentation period with different temperature treatment applied. Also, the decrease might be due to the presence of lipolytic enzymes that could have hydrolyzed fat to glycerol and fatty acids (Oyarekua, 2011).
The ash content values of fermented breadfruit obtained (3.0 – 2.73%) were higher than 2.37% reported by Appiah (2011). These values suggest that breadfruit is high in minerals. The

ash content slightly decreases with increase in fermentation period as well as temperature condition applied. A previous study carried out by Obizoba and Atii (1991) showed that soaking decreased ash content in sorghum. This suggests that the flour could be important source of minerals to the dietary intake of consumers or serve as special diet.

The crude fibre obtained ranged from 3.4 to 3.1%; there was marginal decrease in crude fibre of the flour as a result of fermentation treatments. Crude fibre is known to aid the digestive system of human (Ihekoronye and Ngoddy, 1985).This indicates that breadfruit could attract good acceptability by many people as well as health Organization. The carbohydrate content of the fermented breadfruit was slightly higher than control sample (81.53 – 79.26%). This might be as a result of the treatment conditions. The value obtained for the control was similar to the report of Ijarotimi and Aroge (2005).The high carbohydrate content suggests that the flour could be a good source of energy as explains its use as a staple in the Caribbean (Roberts-Nkrumah, 2005).

The results obtained from the proximate analysis of the pigeon pea flour investigated are shown in Table 3. The moisture content of the flour ranged between 9.06 – 8.70% for 10^0C, 37^0C and ambient temperature respectively. Moisture content of the flour sample increases slightly at ambient condition during the fermentation. The results are in agreement with previous reports of Fasoyiro *et al*., (2013). However, the observed moisture content values are of advantage, the lower moisture content is a desirable phenomenon as it will enhance the keeping quality of flour since water for activity is low (Iwe, 2002).

Table 3: Proximate Composition of Fermented Pigeon Pea Flour

Sample	Moisture Content %	Protein %	Ether Extract %	Ash %	Crude Fibre %	Carbohydrate % (By difference)
200	8.83 ± 0.05	24.76 ± 0.15	1.43 ± 0.15	1.4 ± 0.1	3.66 ± 0.05	59.9 ± 0.34
201	8.91 ±0.39	14.36 ± 0.15	3.2 ± 0.1	0.96 ± 0.15	0.95 ± 0.02	71.59 ± 0.50
202	8.7 ± 1.19	11.76 ± 0.15	4.63 ± 0.20	1.5 ± 0.1	1.26 ± 0.06	72.14 ± 0.96
203	9.06 ± 0.15	23.8 ± 0.1	2.76 ± 0.05	1.53 ± 0.11	3.8 ± 0.1	59.03 ± 0.28

Values are means± standard deviation of triplicate determinations
Key:
200 **-** Unfermented pigeon pea flour
201 – Pigeon pea fermented for 72hr at 10 ºC
202 – Pigeon pea fermented for 72hr at 37 ºC
203 – Pigeon pea fermented for 72hr at ambient Temp.

The protein content of the pigeon pea samples ranges from 23.80 to 11.76%. Granito *et al*., (2002) found a decrease in total protein content of *P.* V*ulgaris* flours, and they showed a relationship between the protein reduction and the water volume used during fermentation. A similar observation has been reported by Akande *et al*., 2010. The protein content in pigeon pea flour makes it a good supplement to breadfruit flour. It has been shown that when legume proteins supplement other food, a protein quality equal to or better than those of animal could be obtained (Mensah and Tomkins, 2003).

The fat content of the pigeon-pea flour at 10^0C and ambient temperature were slightly close (3.20%, 2.76%) while that of 37^0C temperature condition was higher (4.60%). The values obtained were similar to the findings of Saxena *et al*., (2010). The ash contents of pigeon pea flour obtained in this study (1.50 – 0.96%) agrees with the work of Fasoyiro *et al*., (2013).

Ash content is an indicative of the amount of minerals contained in any food sample.

Fibre contents of the flour samples ranged from 3.80 to 0.95 %. Aziah *et al*., (2012) reported crude fibre content of 2.85% and 3.70% for chickpea and mungbean flour respectively. Pigeon pea has relatively higher crude fibre than breadfruit (Adepeju *et al*., 2015). Intake of dietary fibre has potential to protect against cardiovascular diseases, diabetes, obesity, colon cancer and other diverticular diseases (McPherson, 1992).

The carbohydrate content in this study ranged between 72.00 – 59.03 %. Flour sample fermented at ambient temperature has the least value. Similar types of results were noted by Oyarekua (2011) and Ghadge *et al.*, (2008). The high carbohydrate contents of these flour samples suggest that these flour samples could be used in managing protein-energy malnutrition since there is enough quantity of carbohydrate to derive energy from, in order to spare protein so that protein can be used for its primary function of building the body and repairing worn out tissues rather than as a source of energy (David Oppong, 2015).

Table 4 shows the nutritional and anti-nutritional composition of fermented breadfruit at 10^0C, 37^0C and ambient temperature respectively. Phenolic contents of the fermented breadfruit ranged between 3.32 to 1.92 mg/g. After the fermentation period (72h), the phenolic contents in breadfruits were greatly reduced as revealed in Table below. That is, there was decrease in phenolic contents of all the samples as the fermentation condition differs. The unfermented sample (control) has the highest value while the fermented sample at 72h has the least. These observations are in agreement with earlier studies by Ojokoh *et al.* (2013) during the breadfruit fermentation. Dietary phenolics have been classified as human nutrients that play important roles in human health and therefore called nutraceuticals (Yu *et al*., 2014). Phenolics have been suggested to exert chemo-preventive (Dragsted *et al*., 1993) and cardio-protective effects, as well as protecting the human body against oxidative damage by free radicals (Halliwell, 1997).

Table 4: Phytochemical and Anti-Nutrient Compositions of Fermented Breadfruit Flour

Sample	301	302	303	304
Phenolic (mg/g)	3.32 ± 0.35	2.08 ± 0.2	1.92 ± 0.19	2.26 ± 0.21
Flavonoid (mg/g)	1.52 ± 0.08	1.07 ± 0.10	1.6 ± 0.04	1.2 ± 0.07
Phytate (mg/g)	0.47 ± 0.10	0.38 ± 0.12	0.3 ± 0.04	0.27 ± 0.04
Oxalate (mg/g)	0.35 ± 0.00	0.22 ± 0.00	0.29 ± 0.00	0.27 ± 0.01

Values are means± standard deviation of triplicate determinations
Key:
301 – Unfermented breadfruit flour
302 – Breadfruit fermented for 72hr at 10 ^{0}C
303 – Breadfruit fermented for 72hr at 37 ^{0}C
304 – Breadfruit fermented for 72hr at ambient Temp.

Flavonoid contents of the fermented breadfruit ranged between 1.60 – 1.0mg/g. There was reduction in flavonoid contents in the flour as the fermentation increased in all the three treatments. Plant flavonoids have attracted attention as potentially important dietary cancer chemo-protective agents (Hertog *et al*., 1993) and anti-tumor action (Kandaswami *et al*., 1993 and Elangovan *et al*., 1994). Thus, consumption of breadfruit may be good for the body.

Phytate contents of the fermented breadfruit ranged between 0.47 to 0.27 mg/g. This conforms to the previous study carried out by

Abiodun *et al*., (2016) on cassava in which phytic acids values decreased with fermentation periods. Reduction in anti-nutritional contents may be as a result of leaching of the anti-nutrients into the medium during fermentation and dewatering process. Obasi and Wogu (2008) reported that phytate get reduced in yellow maize during soaking. The presence is also beneficial because it may have a positive nutritional role as an antioxidant and anti-cancer agent (Turner *et al*., 2002).

Oxalate contents of the fermented breadfruit varied from 0.35 to 0.22 mg/g. The decrease in oxalate in the fermented samples may be due to the processing coupled with activities of the microorganisms. This study agrees with Obasi and Wogu (2008) during soaking of yellow maize (1.26mg/g – 0.83mg/g). Hence, reduction in oxalate content in fermentation could have positive impact on the health of consumers, particularly in enhancing the bioavailability of essential dietary minerals as well as reduced risk of kidney stones occurring among consumers (Bhandari and Kawabata, 2006).

Table 5 shows anti-nutrient compositions determined in fermented pigeon pea flour at 10^0C, 37^0C and ambient temperature. The phenolic contents of the fermented pigeon pea flour ranged between 2.41 to 0.31 mg/g. This means, there was decreased in values of phenolic contents of all the fermented samples. This study is in agreement with reports by Adetuyi and Ibrahim (2014), the results showed that as fermentation period increased, the phenolic content of the okra seeds decreased.

Table 5: Phytochemical and Anti-Nutrient Compositions of Fermented Pigeon Pea

Sample	201	202	203	204
Phenolic(mg/g)	0.86 ± 0.08	2.41 ± 0.08	0.65 ± 0.03	0.31 ± 0.00
Flavonoid(mg/g)	0.58 ± 0.05	1.07 ± 0.17	0.70 ± 0.02	0.28 ± 0.02
Phytate(mg/g)	0.45 ± 0.01	0.35 ± 0.01	0.35 ± 0.02	0.15 ± 0.00
Oxalate(mg/g)	0.14 ± 0.0	0.59 ± 0.00	0.29 ± 0.00	0.10 ± 0.00

Values are means± standard deviation of triplicate determinations
Key:
201 – Unfermented pigeon pea flour
202 – Pigeon pea fermented for 72hr at 10 ^{0}C
203 – Pigeon pea fermented for 72hr at 37 ^{0}C
204 – Pigeon pea fermented for 72hr at ambient Temp

Flavonoid contents of the fermented pigeon pea flour ranged between 1.0 – 0.28mg/g. There was also, decrease in flavonoid contents of the samples at ambient temperature with increase in fermentation period while increased in values were observed for samples at 37°C and 10°C respectively. The increased in values observed in samples is in agreement with the observation of Ademiluyi and Oboh (2011) reported an increase in the total flavonoid and non-flavonoid content of fermented legumes. The increase in flavonoid content of pigeon pea seeds as a result of fermentation may be due to the increase in acidic value during fermentation that is liberating bound flavonoid components and making it more bio-available.

Phytate contents of the fermented pigeon pea flour varied from 0.45 to 0.15mg/g. The results of this study are in agreement with those reported by Makokha (2002) who stated that fermentation of sorghum produces significant loss in phytate. Igbedioh *et al*., (1994) reported that soaked pigeon pea seeds boiled showed reduction in phytate constituents. Lower phytate content in pigeon pea flour samples indicate that the nutritional values of the processed flour would be beneficial. This decrease may be attributed to insoluble

complex being formed amid phytates and other component (Vijayakumari *et al*., 1996).
Oxalate contents of the fermented pigeon pea varied from 0.59 to 0.10 mg/g. The decrease in the value of the oxalate contents of the processed pigeon pea samples could be attributed to the leaching out of oxalate in the processing water. This agrees with the reports by Ajayi *et al*., (2011) who observed decreased in oxalate content during processing of pigeon pea, lima bean and jack bean. Oke (1969) reported that low levels of oxalates (4-5mg/g) are known to cause no irritation in the mouth or interfere with iron or calcium absorption.
Table 6 showed the sensory evaluation of fermented breadfruit-pigeon pea custard at different temperature with the same fermentation periods. Sample B (100% fermented breadfruit at 10°C) was the most preferred sample to other samples in terms of appearance, colour, aroma and taste while sample E (100% fermented breadfruit at 37°C) assessed least. However, there was no significant difference ($p \leq 0.05$) in terms of appearance, colour, aroma and taste between sample A and B. Though, little differences were observed from other samples at 5% significant level. Thus, this observation suggests that fermented breadfruit-pigeon pea based custard could be useful in food formulations and may be desirable for making thinner gruels (Sandhu *et al.,* 2004). Custard powder enriched with fermented pigeon pea flour observed in this study is in agreement with the improvement in nutritional quality of Ogi produced by soybeans fortification (Oluwamukomi *et al*., 2005; Adeleke and Oyewole, 2010). Olatidoye *et al*., (2010) also reported nutritional improvement in the end product of a food enriched with soybean flour. Therefore, the high protein content of breadfruit-pigeon pea custard to combat malnutrition would be of nutritional importance in most developing countries like Nigeria where the cost of obtaining high protein food is high.

Table 6: Mean Scores for Sensory Evaluation of Breadfruit – Pigeon Pea Custard

Samples	Appearance	Colour	Aroma	Taste	Overall Acceptability
A	6.6^{a}	6.6^{a}	6.2^{a}	6.7^{a}	7.1^{a}
B	6.6^{a}	6.6^{a}	6.5^{a}	6.8^{a}	7.2^{a}
C	6.0^{ab}	6.3^{a}	6.5^{a}	6.6^{ab}	6.8^{ab}
D	6.2^{ab}	6.7^{a}	6.0^{ab}	6.4^{ab}	6.7^{ab}
E	4.3^{c}	4.4^{d}	4.1^{c}	4.8^{c}	4.8^{d}
F	4.4^{c}	5.0^{bcd}	4.8^{bc}	5.0^{c}	5.8^{bcd}
G	5.0^{bc}	4.9^{cd}	4.7^{bc}	5.5^{bc}	5.2^{cd}
H	5.4^{abc}	5.6^{abc}	5.4^{ab}	5.7^{abc}	6.0^{abc}
I	5.9^{ab}	6.0^{ab}	5.6^{ab}	5.7^{abc}	6.0^{abc}
J	6.2^{ab}	6.2^{a}	5.9^{ab}	6.0^{abc}	6.5^{ab}

Mean values followed by different alphabet within a column are significantly different ($p \leq 0.05$)
Values are means of triplicate samples
Key:
A – Unfermented Breadfruit flour
B – 100% Fermented Breadfruit flour at 10^{0}C for 72h.
C – 95% breadfruit flour and 5% pigeon pea flour, each fermented at 10^{0}C for 72h
D – 90% breadfruit flour and 10% pigeon pea flour, each fermented at 10^{0}C for 72h
E – 100% Fermented Breadfruit flour at 37^{0}C for 72h.
F – 95% breadfruit flour and 5% pigeon pea flour, each fermented at 37^{0}C for 72h
G – 90% breadfruit flour and 10% pigeon pea flour, each fermented at 37^{0}C for 72h
H – 100% Fermented Breadfruit flour at Ambient Temp. for 72h.
I – 95% breadfruit flour and 5% pigeon pea flour, each fermented at Ambient Temp. for 72h
J - 90% breadfruit flour and 10% pigeon pea flour, each fermented at Ambient Temp. for 72h

4. CONCLUSION

This study can be concluded that fermented breadfruit flour complemented with fermented pigeon pea flour to make custard could be good in reduction of protein energy malnutrition in the developing countries and can also increase food varieties.

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