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QUALITY EVALUATION OF MILLET (*PANICUM MILLIACEUM L.*) AND GROUNDNUT (*ARACHIS HYPOGAEA*) BASED DAMBU SUPPLEMENTED WITH CARROT (*DAUCUS CAROTA*)FLOUR.

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Abstract: Dambu (Couscous) is a traditional West African snacks, holds cultural and nutritional significance in many communities across the region. Dambu is valued not only for its ttaste but also for its contribution to local diets, providing essential nutrients and serving as a symbol of cultural identity. The study is aimed at developing and supplementing food formulated from locally available materials such as carrots, groundnut and millet based dambu. The preliminary work in determining the most prefered milllet;groundnut ratio was carried out by subtituting groundnut into millet at varied proportions (100:0, 95:5, 90:10, 85:15, 80:20, 75:25, 70:30). The most prefered ratio was used for the main work. The functional properties, chemical composition in (proximate, minerals, and vitamins) and sensory quality of the carrot supplemented samples were determined. The bulk density and oil absorption increased from 0.288 to 0.319 and 0.62 to 0.82 while water absorption, foam capacity and swelling capacity decreased from 47.53 to 23.76, 8.05 to 6.85 and 0.90 to 0.03..MD and crude lipid decreased from 20.09 to 16.24 and 3.07 to 2.07 while crude fibre, Ash and crude protein increased from 5.09 to 5.94 , 0.63 to 1.75 and 10.94 to 14.81 with control and sample G having the same crude fibre value. Vitamin B1, vitamin B2, vitamin E increased dramatically with the mean score of 447.24 to 747. 72, 543.85 to 800.25 and 1.64 to 2.65mg/100 due to increased in carrots content because carrots is a good source of vitamin A. Iron, calcium and potassium increases with increased in the composition of carrot with the following mean score of 1.62 to 1.80, 2.48 to 3.95, 9.41 to 9.94, respectively. The average mean scoresof the taste, aroma, colour, appearance, texture, mouth feel, overall acceptability increased from 6.75b to 7.45, 6.50 to 6.80, 6.30b to 6.50, 6.15 to 6.25, 5.20 to 6.45, 5.65 to 6.40 and 5.65 to 5.95,respectively, with the added carrot. The most acceptable and prefered product is that conatining 90% millet-groundnut blend and 10% carrot flour with average means scores of 6.30. This study had showed that carrot and groundnut can be blended with millet to produce acceptable dambu.
Keywords: Quality, Millet, Groundnut, Carrot, Dambu

Introduction

Dambu (***Couscous***) is a traditional West African snack, that holds cultural and nutritional significance in many communities across the region. Dambu is valued for its taste and contribution to local diets, providing essential nutrients and serving as a symbol of cultural identity. Despite its importance, there is limited research comparing the production of Dambu nono from different grains. The study seeks to fill this gap by conducting a comparative analysis of Dambu production from various grains to understand better their nutritional composition, sensory attributes, and potential health benefits. Dambu is a staple food for Fulanis and Hausas. Dambu has been produced with different grain types and pearl millet was rated high on aroma, texture, and overall acceptability (Agu *et. al.,* 2007). In tropical Africa, cereals grains are milled and used to produce different types of food which are known by various names in different parts of the African continent as thin porridge (Ogi) (Apena *et. al.,* 2006), thick porridge fura (Jideani *et. al.,* 2002), baked or fried fermented bread such as more (Hounhouigan *et. al.,* 1993), Masa (Ayo *et. al*., 2008). It is known as dambu among the Hausas, while among the Fulanis is known as Decarey (Haruna *et. al.,* 2003).

Dambu is produced mainly from moistened pearl millet flour, blended with spices, and steamed for 20 minutes. Using a folding system, which involves pouring the mixed flour with spices into a sieve and places on an open pot that contains little water. Care should be taken while sieving not to touch the water in the pot boils.

Dambu nono contains an energy of 257 kcal, moisture of 37%, ash 1.1%, crude protein 10.7%, fat 3.4%, crude fibre 2.0% and carbohydrate 45.9% per 100g. it also contains essential and non-essential amino acids with major and minor mineral element (Agu *et. al.,* 2007). Dambu nono has been produced with different grain types and pearl-millet was rated high on aroma, texture, and overall acceptability (Agu *et. al.,* 2007). Nutritionally, millet contan 8-12% protein, 2-5% crude fiber, 65-75% canbohydrate and enaergy contants of 378 kcal (Jones, 2020). Millet is a rich source of essential nutrients, making it a valuable addition to a balanced diet. (Jones, 2020).

Groundnut *(Arachis hypogaea)*, also known as peanut, is a legume crop widely grown for its edible seeds. Nutritionally, groundnuts contain 25-30% protein, 40-50% fats, 10-20% carbohydrate, and 6-9% moisture content (smith, 2020).

Carrots (*Daucus carota*) are root vegetables known for their vibrant orange color and sweet taste. They are not only delicious but also packed with essential nutrients. The carrot (Daucus carota) is a root vegetable often claimed to be the perfect health food having nutritional content of calories:41%, Water:8.8%, Protein: 0.9%, grams Carbs: 9.6%, grams Sugar: 4.7% grams Fiber:2.8%, grams Fat: 0.2%, (Okoro, 2017).

Fiber: Carrots are an excellent source of dietary fiber, providing around 2.8 grams per 100 grams. this fiber supports digestive health, helps maintain stable blood sugar levels, and can contribute to heart health by helping to lower cholesterol levels. carrot is highly nutritious particularly rich in vitamin A, primarily in the form of beta-carotene. per100 grams of raw carrot, they provide about 835 micrograms of retinol activity equivalent (RAE), which is approximately 93%of the recommended daily allowance (RDA)for adults. They also offer around 13.2 micrograms of vitamin K (11-15%of the RDA), milligrams of vitamin C(7% of the RDA) and 0.1 milligrams of vitamin B6(6%of the RDA). These vitamins are essential for maintaining good vision, and supporting immune function, The contains about 9.6 grams of carbohydrates per 100 grams primarily in the form of sugar (including glucose, fructose, and sucrose) and starch. However, they are still considered a low-glycemic index food. (Ibrahim, 2017).

Despite the nutritional benefits of millet-based dambu nono, there is a lack of research on the effect of carrot supplementation on its quality. The knowledge poses a challenge for food scientists, nutritionists, and food processors seeking to optimize the nutritional content, sensory attributes, and consumer acceptance of dambu nono products. The aim of this study was to determine the effects of supplementation of carrots on the quality of groundnut, millet based dambu nono.

Materials and Methods

Materials

The ingredients for this study include millet (*Panicum miliaceum L*), groundnut (peanut), (*Panicum miliaceum L*), and carrot (*Daucus carota*). These materials were sourced from local markets known for their fresh and high-quality produce. The following materials were collected: ginger and salt were procured from Lafia.

Production of millet flour

To clean millet and prepare dambu nono, begin by placing 1 cup of millet in a fine-mesh sieve and rinsing it under cold running water to remove any debris or dust. Then, transfer the rinsed millet to a bowl and cover it with 2 cups of water, allowing it to soak for at least 30 minutes or up to overnight, which helps to improve digestibility and reduce cooking time. Meanwhile, prepare the dambu nono by mixing 1/4 cup of groundnut powder, 1 teaspoon of spices (such as chili powder, garlic powder, and salt), and 2 tablespoons of oil in a bowl to form a paste-like consistency. After soaking, drain the millet using a sieve or colander, discarding the soaking water. Spread the drained millet evenly on a clean kitchen towel or paper towels to dry, gently patting them to remove excess moisture. Once dried, mix the millet with the prepared dambu nono paste, ensuring the grains are evenly coated. The dambu nono-coated millet can be enjoyed as a nutritious snack or side dish. (Haruna, 2013).

Product of groundnuts and carrot flour

To prepare groundnuts flour, begin by sundrying of the from one to two days until it dries well. For peeling, rub the groundnuts in a clean towel or shake them in a bowl to loosen the skins, then separate the skins using a fan or gentle blowing. The cleared groundnuts or millet into flour and stored of room teaprature (38%) (John, 2010).

To prepare carrots, start by thoroughly washing them under running water to remove any dirt. Peel the carrots using a vegetable peeler, removing the outer skin. After peeling, rinse the carrots again to ensure they are clean. Sun dry the carrot For grating, use a box grater or a food processor with a grating attachment, applying even pressure to grate the carrots into fine or coarse pieces as desired. Collect the grated carrots in a clebowl, ready for use in, baking, or cooking. (Abdallah, 2003).

Production of blend millet-ground and carrot recipe

The groudnut paste was substituted into the millet flour at 0, 5, 10, 15, 20, 25% to produce flour blend used to produce the blend dambu product in the preliminary work. The carrot flour was substituted (0, 5, 10, 15, 20, 25%) into the most prefered flour blend in the preliminary work

Production of Millet-Based Dambu

Following the reciepe millet flour was mixed with water to achieve a cohesive dough-like consistency, the mixture was steamed (ensuring thorough cooking of the millet and fostering the development of a desirable, firm texture), cooled and shaped into round form and analysed sensorilly and chemically.

Methods

Determination of functional properties

Water absorption capacity

The water absorption capacity was determined using the method described by Onwuka, (2005). Ten millilitres (10m) of distilled water added to 1g of cha-amaranth composite flour sample in weighed centrifuge tubu. The tube was agitated on a vertex mixer for 2min and then centrifuged at 4000rpm for 20min. The clear supernatant was decanted and discarded. The adhering drops of water was removed and then weighed. Water absorption capacity was expressed as the weighed of water bound by 100g of dried flour.

Oil Absorption Capacity

The oil absorption capacity was determined using the method described by Onwuka, (2005). One gram (1g) of acha-amaranth composition flour sample was mixed with 10ml of refined vegetable oil and allowed to stand at ambient temperature for 30min. It was then centrifuged for 30min at 2000rpm. The oil and adhering drops of oil was decanted and discarded. Oil absorption capacity was expressed as percent oil bound per gram flour.

Bulk density

The bulk density was determined using the method described by Onwuka, (2005). Fifty gram (50g) of ach-amaranth composite flour sample was poured into a 100ml measuring cylinder. The cylinder was tapped fifty (50) times on a laboratory bench to constant volume.

Bulk density (g/cm³) = weighed of sample/ Value of sample after tapping X 100

Foaming capacity

The foaming capacity and stability were determined using the method described by Onwuka, (2005). Two gram (2g) of acha-amaranth composite flour sample was added to 50ml of distilled water at 30 ± 2°c in a 100ml graduated cylinder. The suspension was mixed and shaken manually for 5min to foam. The volume of foam at second after whipping was expressed as foaming capacity using the formula;

Foam capacity= volume of foam after whipping/Volume of mixture

The volume of foam was recorded at different time interval (5, 10,15 and 20 second) after whipping to determine the foam stability as per cent of the foam volume.

Determination of the chemical composition of millet groundnut and carrots

Determination of Proximate composition of Dambu

froduced from millet and carrot blend

The proximate composition(moisture, crude fat, protein, ash, crude fiber, carbohydrate and energy content} of the blend dambu was analysed using AOAC(2010) method

Determination of mineral composition

The iron and potasium content of the dambu blend product was determined using AOAC(2010) while the calcium was determined as described by Adedeye *et. al.*, (1992). One gram of dried sample was digested with 2.5ml of 0.03N hydrochloric acid (HCI). The digest was boiled for minutes, allowed to cool to room temperature and transferred to 50ml volumetric flask and made up to the mark with distilled water. The resulting digest was filtered with ashless whatman No. 1 filter paper. Filtrate from each sample was analyzed for mineral (phosphorus, magnesium and Iron) contents using Atomic Absorption Spectrophotometer (Bulk Scientific Absorption Emission spectrophotometer model 205, manufactured by Nowalk, Connecticut, USA) using standard wavelength. The real value were extrapolated from the respective ions. A11 determinations were performed in duplicates.

Determination of vitamins(Vitamin B1 Thiamin)

Thiamine content was determined using the scalar analyzer method (AOAC, 2012).

Evaluation of sensory quality

The sensory evaluation of millet groundnut powder and grated carrots was carried out by twenty untrained panellists, randomly selected from Nutrition and Dietetics Department, Nasarawa state University, Lafia based on their familiarity with the Dambu nono. The Dambu nono, appropriately coded (ABP, BPF, AJD, and BAF) and of the same size and temperature (29± 3°C) were placed in white plastic plate separated by compartments and placed in sensory laboratory. The panel list were instructed to evaluate the coded sample for colour, crispiness, aroma test, texture, and general acceptability. The panel lists rinsed their mouths with bottled water after tasting each sample and were not allowed to make comment during evaluation to prevent influencing other panel list. A nine-point Hedonic scale with one (1) representing " extremely dislike " and nine 9 "extremely like" was used, presented as a questionnaire by Ayo (2015) and Iwe (2018).

Statistical Analysis

All the analyses were conducted in duplicates. The data were subjected to analysis of variance using Statistical Package for Social science (SPSS) software version 23, 2017. Means where significantly different and separated by the least significant difference (LSD) test. Significance was accepted at p<0.05.

Results and Discussion

Preliminary Work

Results of the preliminary work are shown in Table 1. The average mean scores for taste, aroma, colour, appearance, texture, and general acceptability ranged from 6.20 - 7.70, 6.10 - 6.35, 6.10 - 6.75, 6.00 - 6.75, 5.75 - 6.60, and 6.20 - 6.95 respectively, with increase in the level of added groundnut. The samples with millet:groundnut ratio which is 80:20 had the highest average mean score of 6.95.

The taste data reveals that the control (100:0) low groundnut blends respectively. Taste is an essential sensory attribute, as it directly impacts consumer acceptance and adherence to nutrient dense food. (Adeyeye *et. al.,* 2019). Who reported that reduced groundnut content improved taste satisfaction in enriched food, reinforcing the value of balancing flavors to consumer preferences in fortified products.

The average mean score for aroma ranged from 6.10 to 6.35, with no significant differences noted across the samples. The retention of a pleasant aroma in fortified foods is crucial for consumer acceptance, particularly for nutrient dense products targeting individuals with low appetite (Ajibola and Adeleke, 2018). Show that aroma is a key driver in consumer choice for blended cereal products.

Color evaluation revealed that the (90;10)M/G blend scored the highest (7.15) Color perception plays a vital role in food acceptance, as vibrant often indicate freshness and nutrient richness (Olawuyi *et. al.*, 2020) found that controlled levels of groundnut and carrot maintain appealing coloration, suggestion the importance if visual appeal in promoting consution of fortified foods.

All samples had similar scores for appearances (6.00 – 6.75) and texture (5.75 to 6.60) with no significant difference across varying carrot and groundnut contents. Appearance and texture influence both Palatability and the perception of satisfy, making them essential for foods

Table 1: Sensory Evaluation of Dambu (Preliminary Work)

M/G %	C %	Bulk Density (g/cm^3)	Oil Absorption (g/ml)	Water Absorption Capacity (g/ml)	Foam Capacity	Swelling Capacity (g/ml)
100	0	0.288^b±0.002	0.62^c±0.01	47.53^c±0.67	8.05^a±0.07	0.90^a±0.01
95	5	0.324^a±0.002	0.53±0.02	44.13^c±0.53	7.^{85ab}±0.07	0.11^c±0.01
90	10	0.324^a±0.002	0.70^b±0.01	50.50^b±0.71	7.^{65ab}±0.07	0.11^c±0.01
85	15	0.319^a±0.001	0.64^c±0.01	63.00^a±0.71	7.40^b±0.01	0.09^d±0.01
80	20	0.323^a±0.001	0.53±0.01	21.53^e±0.67	7.25^b±0.07	0.21^b±0.01
75	25	0.343^a±0.003	0.62^c±0.01	39.19^d±0.44	7.05^b±0.07	0.03^e±0.01
70	30	0.319^a±0.001	0.82^a±0.01	23.76^e±0.34	6.85^c±0.07	0.03^c±0.01

*Average mean score with the same alphabets on the same column are not significantly different p=0.5
*M=millet flour, G=groundnut flour

designed to support growth and nutrient intake (Ogundele *et. al.,* 2017).The highest score for overall acceptability was recorded in the (80:20)M/G blend (6.95) and was adopted for the production of millet and ground nut blend for the main research work.

Functional Properties

The result of the functional properties of danbu produced from millet, groundnut and carrot are shown in Table 2. The bulk density, oil absorption, water absorption, foam capacity and swellig capacity of the flour blends ranged 0.288 - 0.343, 0.53 - 0.82, 21.53 - 63.00, 6.85 - 8.05 and 0.03 - 0.90g/ml. The control

sample had the highest value in foam capacity (8.05) and swelling capacity (0.90). The effect of adding carrot is significant p=0.05 in all the parameters assessed.

Bulk density increased with the added carrot flour. This could be due to the addad carrot flour. Bulk density is important as it affects packaging, storage and consumer perception of food which can influence satiety (Eke and Akobundu 2017) increased density in fortified products with high-fiber.

The relative increase in the oil absorption capcity could be due to the increase fiber content in carrot. Highest oil absorption capacity can improve flavour retention as oil soluble flavors enhancing Palatability (Adegbola *et. al.,* 2018). Who highlighted that high fiber vegetable inclusions help retain flavors.

The 85% M/G, 15% C showed the highest water absorption capacity (63.00), The increase could be due to the added carrot flour. High water absorption is desirable for products aimed at improving hydration and satiety particularly for nutrient dense foods found similar trends with high carrot blends, emphasizing the importance of balancing fiber and hydration properties in fortified foods. (Alobo and Offonry, 2019)

Both foam capacity (8.05) and swelling capacity (0.90) were highest in the control, with these values declining as carrot content increased, These properties are essential for foods requiring volume expansion for satiety and textural consistency, as seen in (Ogbeide *et al.,* 2019).

Table 2: Functional Properties of Dambu

M	G	TASTE	AROMA	COLOR	APPEARANCE	TEXTURE	GEN ACCEP
100	0	7.70^b±1.30	6.30^a±1.95	6.50^{ab}±1.24	6.00^a±1.84	6.60^a±1.27	6.55^a±2.19
95	5	7.00^{ab}±1.58	6.35^a±1.04	6.10^{ab}±1.71	6.50^a±1.47	6.60^a±1.64	6.75^a±1.52
90	10	7.05^{ab}±1.54	6.15^a±1.79	7.15^b±1.42	6.55^a±1.77	6.20^a±2.55	6.50^a±2.01
85	15	6.85^a±1.79	6.35^a±1.14	6.75^a±1.45	6.50^a±1.44	5.75^a±2.22	6.20^a±1.70
80	20	6.25^{ab}±1.80	6.25^a±1.77	5.80^{ab}±1.67	6.65^a±1.87	6.45^a±2.06	**6.95^a±1.76**
75	25	6.20^{ab}±1.96	6.10±2.19	6.45^{ab}±1.50	6.75^a±1.48	6.35^a±2.11	6.65^a±1.73

*Average mean score with the same alphabets on the same column are not significantly different p=0.5
*M=millet flour, G=groundnut flour, C=Carot

Proximate Analysis of Dambu

The proximate analysis results from Table 4.3 shows that the Moisture, crude lipid, crude protein and carbohydrate of the flour blended Dambu decreased 20.09 – 16.24, 3.07 – 2.07, 10.94 – 9.38 and 65.25 – 62.11%, respectively while the ash and the crude fiber increased from 0.63 – 1.75 and 5.09 –

5.94% respectively with increase (0-30) in the added carrrot flour.

The effect of adding carrot flour is significantly p < 05 in the all assessed parameters.

The moisture content showed decrease due to the addition of carrot content; moisture help in regulate breathing and lung function. Moiture content aid in foods breakdown and nutrient absorption. The control had the highest moisture content (20.0990), while the 30% carrot had the lowest (16.24%). Studies by Eke *et. al.,* (2007) and Ocheme *et. al.,* (2010) Suggest that reduced moisture content may enhance shelf stability. Ash content, representing total mineral content rose from 0.63% to 1.75% confirming that carrots contribute to mineral enrichment (Satter *et. al.,* 2016, Sarkar *et. al.,* 2017).

Crude fiber also increased, with the 30% carrot sample having the highest fiber content (5.94%) Supporting the finding of Ezeocha and Onwnka (2010) and Tiwari *et. al.,* (2012) on dietary fiber benefits. Fiber reduces heart disease risk, Regulates blood sugar

levels and manages diabetes, reduces inflammation & improve digestion. The decrease in lipid content with higher carrot levels reflects carrots lower fat levels compared to groundnuts (Onimawo and Egekun, 2020).

Protein content little increased with carrot, due to the lower level content of protein in carrot.protein is a vital nutrient with numerous uses,building and repairing tissue.Peaking at 14.81% in the 30% carrot sample, aligning with Onimawo and Egbekum (2017) and Haileselassie et al, (2021) both of whom observed similar protein enhancing effects of carrot enrichment in food products

Table 3: Proximate Analysis of Dambu

M/G	C	Vitamin B1	Vitamin B2	Vitamin E
100	0	437.24e±0.01	543.85^{e}±0.71	0.00^{e}±0.00
95	5	437.34^{e}±0.01	552.22^{d}±0.05	1.64^{d}±0.08
90	10	437.34^{e}±0.13	561.18^{d}±0.014	1.76^{d}±0.09
85	15	506.72^{cd}±0.10	601.72^{cd}±0.07	1.68^{d}±0.24
80	20	575.93^{c}±0.07	643.36^{c}±1.41	1.97^{c}±0.02
75	25	636.48^{b}±14.14	726.23^{b}±7.10	2.47^{b}±0.73
70	30	747.72^{a}±43.35	800.25^{a}±0.28	2.65^{a}±0.71

*Average mean score with the same alphabets on the same column are not significantly different p=0.5

**M=millet flour, G=groundnut flour, C=Carot

Vitamin Content of Danbu

The vitamin content of the blend dambu is showed in Table 4. The Vitamins B1, B2 and E increased from 437.24 to 747.72, 543.85 to 800.25 and 1.64 to 2.65mg/100g, respectively with increas in the added carrot flour. The relative increase in these vitamins could be due to the high content of the same in the added carrot flour. Vit B1 is crucial for energy metabolism and neurological health(Agbaje *et. al.,* 2019) and Vit E as antioxidant plays a critical role in immune health, skin integrity, improving immune resilence and protection against oxidative stres(Jimoh and Kolapo 2018).

Table 4: Vitamin content of Danbu (mg/100g)

Sample M/G:C	MD %	Ash %	Crude fibre %	Crude Lipid %	C P %	CHO%	Egcal/g%
100:0	20.09a±0.00	0.63f±0.00	5.09d±0.00	3.07a±0.00	10.94g±0.00	65.25	334.37
95:5	19.28b±0.00	0.99e±0.00	5.42c±0.00	2.61b±0.00	10.72f±0.00	645.31	331.73
90:10	18.48cd±0.00	1.34d±0.00	5.75b±0.00	2.14d±0.00	10.50e±0.00	65.35	331.26
85:15	18.55c±0.00	1.48c±0.00	5.80b±0.00	2.37c±0.00	10.38d±0.00	61.04	318.01
80:20	18.63c±0.00	1.61b±0.00	5.86b±0.00	2.59b±0.00	9.80c±0.00	60.34	318.91
75:25	17.43e±0.00	1.68b±0.00	5.94a±0.00	2.33c±0.00	9.63b±0.00	60.26	320.77
70:30	16.24f±0.00	1.75a±0.00	5.09d±0.00	2.07d±0.00	9.38a±0.00	62.11	326.31

*Average mean score with the same alphabets on the same column are not significantly different p=0.5

**M=millet flour, G=groundnut flour, C=Carot

Mineral Content of Danbu

Mineral content shows that iron (Fe) ,calcium (CA) and potassium of flour blend dambu increased from 1.62-1.80, 2.48-3.95 and 9.40-9.94ppm, respectively, with the increased in the added carrot flour . The effect of adding carrot flour is singnificantly $p<0.5$ on all assessed parameters. Iron is essential for hemoglobin production and oxygen transport, making fortified products beneficial for populations at risk of anemia (Adekunle *et al*, 2021). Calcium supports bone health, while potassium help regulate blood pressure, indication the nutritional advantage of adding carrot (Ayinde and Ajani 2020).

Table 5: Mineral content of Dambu

M/G	C	Taste	Aroma	Colour	Appearance	Texture	Mouth Feel	Overall Acceptability
100	0	$7.60^{a}\pm1.10$	$6.55^{ab}\pm1.61$	$6.80^{a}\pm1.57$	$6.70^{a}\pm1.38$	$6.00^{ab}\pm1.45$	$5.65^{b}\pm1.73$	$5.85^{b}\pm2.41$
95.	5	$6.75^{b}\pm1.72$	$6.50^{ab}\pm1.73$	$6.30^{b}\pm1.61$	$6.15^{ab}\pm1.66$	$5.20^{bc}\pm2.09$	$5.65^{b}\pm1.35$	$5.65^{b}\pm1.90$
90.	10	$7.10^{ab}\pm1.71$	$6.20^{b}\pm1.64$	$6.05^{c}\pm1.43$	$6.10^{ab}\pm2.10$	$5.80^{b}\pm1.96$	$6.05^{ab}\pm2.04$	**$6.30^{a}\pm1.72$**
85.	15	$6.50^{bc}\pm1.73$	$5.80^{c}\pm2.07$	$6.15^{bc}\pm1.79$	$6.30^{ab}\pm1.69$	$4.95^{c}\pm2.48$	$5.70^{b}\pm1.92$	$5.25^{bc}\pm1.80$
80.	20	$6.45^{c}\pm2.19$	$6.20^{b}\pm2.09$	$6.35^{b}\pm2.01$	$5.90^{c}\pm2.00$	$5.15^{bc}\pm1.50$	$5.65^{b}\pm2.01$	$5.65^{b}\pm1.79$
75.	25	$6.30^{c}\pm1.69$	$6.30^{b}\pm1.81$	$6.80^{a}\pm1.99$	$6.30^{ab}\pm1.66$	$6.45^{a}\pm1.36$	$6.20^{a}\pm1.64$	$6.20^{ab}\pm1.85$
70.	30	$7.45^{ab}\pm1.32$	$6.80^{a}\pm1.54$	$6.50^{ab}\pm1.82$	$6.25^{ab}\pm1.74$	$6.45^{a}\pm1.47$	$6.40^{a}\pm2.04$	$5.95^{b}\pm2.19$

*Average mean score with the same alphabets on the same column are not significantly different p=0.5
**M=millet flour, G=groundnut flour, C=Carot

Table 6 Sensory Properties of Danbu Samples

Millet/ ground nut,	Carrot	Taste	Aroma	Colour	Appearance	Texture	Mouth Feel	Overall Acceptability
100	0	$7.60^{a}\pm1.10$	$6.55^{ab}\pm1.61$	$6.80^{a}\pm1.57$	$6.70^{a}\pm1.38$	$6.00^{ab}\pm1.45$	$5.65^{b}\pm1.73$	$5.85^{b}\pm2.41$
95.	5	$6.75^{b}\pm1.72$	$6.50^{ab}\pm1.73$	$6.30^{b}\pm1.61$	$6.15^{ab}\pm1.66$	$5.20^{bc}\pm2.09$	$5.65^{b}\pm1.35$	$5.65^{b}\pm1.90$
90.	10	$7.10^{ab}\pm1.71$	$6.20^{b}\pm1.64$	$6.05^{c}\pm1.43$	$6.10^{ab}\pm2.10$	$5.80^{b}\pm1.96$	$6.05^{ab}\pm2.04$	**$6.30^{a}\pm1.72$**
85.	15	$6.50^{bc}\pm1.73$	$5.80^{c}\pm2.07$	$6.15^{bc}\pm1.79$	$6.30^{ab}\pm1.69$	$4.95^{c}\pm2.48$	$5.70^{b}\pm1.92$	$5.25^{bc}\pm1.80$
80.	20	$6.45^{c}\pm2.19$	$6.20^{b}\pm2.09$	$6.35^{b}\pm2.01$	$5.90^{c}\pm2.00$	$5.15^{bc}\pm1.50$	$5.65^{b}\pm2.01$	$5.65^{b}\pm1.79$
75.	25	$6.30^{c}\pm1.69$	$6.30^{b}\pm1.81$	$6.80^{a}\pm1.99$	$6.30^{ab}\pm1.66$	$6.45^{a}\pm1.36$	$6.20^{a}\pm1.64$	$6.20^{ab}\pm1.85$
70.	30	$7.45^{ab}\pm1.32$	$6.80^{a}\pm1.54$	$6.50^{ab}\pm1.82$	$6.25^{ab}\pm1.74$	$6.45^{a}\pm1.47$	$6.40^{a}\pm2.04$	$5.95^{b}\pm2.19$

*Average mean score with the same alphabets on the same column are not significantly different p=0.5
*M=millet flour, G=groundnut flour

Sensory Properties of Danbu Samples

The result of the sensory evaluation is showed in Table 6. The average mean scores for the taste, aroma, colour, appearance, texture, mouth feel and over all acceptability increased from 6.30-7.60, 5.80-6.80, 6.05-6.80, 5.90-6.70, 5.15-6.00, 5.65-6.40, 5.25-6.30, respectively with increase in the carrot flou . Generally all the blend damnu products are acceptable with average means scores above 4.5 in all assesed sensory parameters, as proof that the millet, groudnutand carrot flour can form a good substutute. The samples with millet/groundnut and carrot ratio (90:10) had the highest overall acceptability average mean score of 6.30. The observations inthis research work agreed with other researchers in the applications of carrot flour to food products. This trend suggests carrot flour could enhance taste, due to the contribution of natural sugars and complementary flavors (Adeyeye *et al;* 2019), improve, consumer preferences, balanced proportions of complementary ingredients(Ajibola and Adeleke 2018), enhance visual appeal and product's desired appearance(Alobo and Offonry 2019). This finding is consistent with

Ogbeide *et al;* (2019), who reported that mouth feel, alongside texture, plays a critical role in food acceptability, particularly in high-fiber foods.

Conclusion

This research characterized the supplementation of millet and groundnut based dambu with carrot flour. This study showed that carrot, groundnut and millet can be blended to produce acceptable dambu. However, the most acceptable and preferred is that which contains 10% carrot flour which correspond to increase in protein (60%), Calcium (2.0%), magnesium (30%), zinc (20%) and iron (50%) content. This study could open up new possibilities of application for carrot and groundnut for the production of dambu and other food products.

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