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Effects of orange-fleshed sweet potato supplementation on the phytochemical composition, physicochemical, and sensory properties of sorghum-based *kunu-zaki*

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ABSTRACT: The phytochemical, physicochemical, and sensory properties of the blended *kunun-zaki* were determined. The fermented sorghum paste was substituted for orange-fleshed sweet potato puree at 0, 5, 10, 15, 20, 25 and 50% to produce orange-fleshed sweet potato-sorghum blended kunun-zaki. The phytochemical composition: carotenoids, flavonoids, and vitamin A content of the blended kunun-zaki increased from 0 to 28.14 mg/100g, 0 to 191.50 mg/100g and 0.44 to 7.74 mg/100g respectively, while the tannin content decreased from 4.97 to 1.51 mg/100g, with an increase in added orange-fleshed sweet potato puree. The effects were significant (p = 0.05). The physicochemical properties: pH, total soluble solids, total solid and specific gravity increased from 3.97 to 4.10, 4.95 to 8.25°Brix, 1.55 to 2.80 g/100g and 5.65 to 13.70 g/100g respectively, while the acidity decreased from 39.21 to 12.00 g/100g, with increase in the added orange-fleshed sweet potato puree (0-50%). The average mean scores for sensory quality; flavour, colour and taste increased from 6.70 to 7.06, 6.70 to 7.41 and 6.43 to7.40 respectively, whereas odour, mouth feel and appearance decreased with increasing inclusion level of oranged-fleshed sweet potato puree from 7.90 to 6.93, 7.40 to 6.40 and 7.26 to 6.72 respectively. Overall results show that the beverage formulated were generally acceptable of which the sample containing 20% orange-fleshed sweet puree was most preferred. The addition of oranged-fleshed sweet potato puree improved the phytochemical content and the sensory quality [taste, flavour and colour] of the sorghum-based *kunun-zaki*.

Keywords: *Kunun-zaki*, orange-fleshed sweet potato, sensory properties, sorghum.

INTRODUCTION

Cereal beverage products are one of the main thirst quenchers of an average individual in North-Eastern Nigeria and Africa as a whole (Agarry et al., 2000). Several methods in cereals preparation give rise to different beverage food products (Gaffa and Ayo, 2002). These techniques could be as a result of culture, tradition, and individual taste, with or without combining other ingredients to make up the beverage food product (Aderinola and Oluwamukomi, 2021). Locally made beverages of cereal origin include *Machacha, Burukutu, Pito, Busa, Kafir, and Kunu* among others.

Kunu is a Hausa name for unfermented beverages. *Kunun-zaki* is a local fermented beverage made from ungerminated cereal grains (Oluwajoba et al., 2013). It is among the widely consumed cereal-based non-alcoholic, non-carbonated beverages in Northern Nigeria (Aderinola and Oluwamukomi, 2021). *Kunu* occurs differently and their names are obtained based on the type of raw material used in its production, sensory attribute, locality, or any other ingredient that is introduced (Aderinola and Oluwamukomi, 2021). Some of these local beverages may include *kunun-gyada* having groundnut seed paste, *kunun-tsamiya* having tamarind fruit pulp, *kunun burukuru* having fermented cow milk, and *kunun-zaki* having sugar

as their individual main ingredients (Aderinola and Oluwamukomi, 2021).

The most preferrable types of *kunu* is the *kunun-zaki*; about 73% of the Nigerian population consume *kunun-zaki* daily and 26% drink *kunun-zaki* occasionally (Sengev et al., 2012). In general, it is mostly consumed during the hot season of the year when it is served chilled, and the consumption cuts across all age groups and social status (Gaffa and Ayo, 2002). Ayo and Okaka (1998) reported *kunun-zaki* to be rich in carbohydrates, B-vitamins, and minerals but slightly low in vitamin A.

The method of preparation involves steeping cereal grain in water for 24 hours, wet-milled and sieved. The obtained sediment is separated into two unequal portions; one portion is cooked and then combined with the uncooked portion as the source of inoculum and left to ferment for 8 to 10 hours (Aderinola and Oluwamukomi, 2021). The preparation and consumption of *kunu* drinks is a tradition for almost every household in Nigeria as a replacement for alcoholic beverages due to religious belief. *Kunun-zaki*, therefore, is rapidly gaining ground as a thirst-quenching beverage in the Northern part of Nigeria.

Kunun-zaki, being a cereal-based beverage, is associated with little nutritional value and high-water content (Fapohunda and Adeware, 2012). This necessitates the improvement of the dietary status of the beverage for the benefit of consumers. Deficiency in Vitamin A which leads to blindness (Maziya Dixon et al., 2006), is a grave public health issue in almost all developing countries. It contributes to over 0.6 million mortality rates per annum (Odongo et al., 2015). The most affected are young children and pregnant women (Akhtar et al., 2013). Over 1.90 million infants, toddlers and pregnant women stand a high risk of vitamin A deficiency globally (WHO, 2009). In Nigeria, the nutritional agencies employed a mandatory dietary approach which includes compulsory fortification of some domestic foods like vegetable oil, flour, salt, and sugar with Vitamin A. The absorption of this vitamin via other methods is quite low due to socioeconomic reasons. Supplementation with orange-fleshed sweet potato (OFSP) generally has been anecdotally proven widely as one way of improving the vitamin A quality of *kunun-zaki*. This strategy might strengthen its wider acceptability and consumption as well as the needed socioeconomic demand.

The orange colour of the orange-fleshed sweet potato could improve the sensory quality, most especially the colour and the taste of any food product even *kunun-zaki.* Bovell-Benjamin (2007) and Irakiza et al. (2014) reported that OFSP consists of very high trans-β-carotene concentrations and shows high pro-vitamin A activities. OFSP could serve as an essential vitamin A supplement for cereal-based beverages like *kunun-zaki,* which has great potentials that can be used for food-based intervention programs in addressing vitamin A deficiency (Kurabachew, 2015). On the averge, OFSP comprises 3000 to 16000 µg/100g of β-carotene that can contribute 250 to 1300 Retinol Activity Equivalent (RAE) (Gurmu et al., 2017). It is also a very good source of energy (Nduka et al., 2018).

The thrust of this study is to assess the effects of supplementing sorghum-based *kunun-zaki* with OFSP on the phytochemical composition, physiochemical and sensory quality of the product.

MATERIAL AND METHODS

The raw materials used in this work include sorghum, ginger, orange-fleshed sweet potato, cloves, and sugar. These materials were procured from Wukari's new market, Wukari, Taraba State.

Preparation of orange fleshed sweet potato (OFSP) puree

The OFSP puree was produced from its fresh roots using the modified method described by Tedesco and Stathers (2015). 200 g of sweet potatoes were peeled, washed, and sliced into ± 5 mm thickness. The sliced OFSP was steamed (30 minutes), strained with the aid of filter coth to produce orange-fleshed sweet potato puree and stored at refrigeration temperature (10°C).

Preparation of sorghum paste

The method used by Sengev et al. (2012) was slightly modified for the production of fermented sorghum sediment. 500 g of dehulled sorghum grains were cleaned, sorted, weighed, and steeped in 1000 ml of potable water for 16 hours. It was enclosed with moistened cleaned jute bag after the grains were drained and splashed on a tray, then it was allowed to sprout for 24 hours. To remove the vegetative parts of the grains, the sprouted grains were washed with potable water. The grains were allowed to stay for 36 hours at room temperature after it was milled, sieved using a clean muslin cloth in a covered plastic container. The slurry sediment and the floatable liquid were decanted and the sediment was used in *kunun-zaki* production.

Preparation of OFSP-sorghum blended *kunun-zaki*

The OFSP-sorghum *kunun-zaki* was prepared through a method described by Adebayo et al. (2010) with slight modifications (Figure 1). The sweet potato paste (200 g) was blended with fermented sorghum sediment (300 g) using Saisho blender, model S-748. Thereafter, it was mixed with 100 ml of potable water (2:1 w/v). The slurry portion weight ratio of 3:2 was divided into two parts; 500

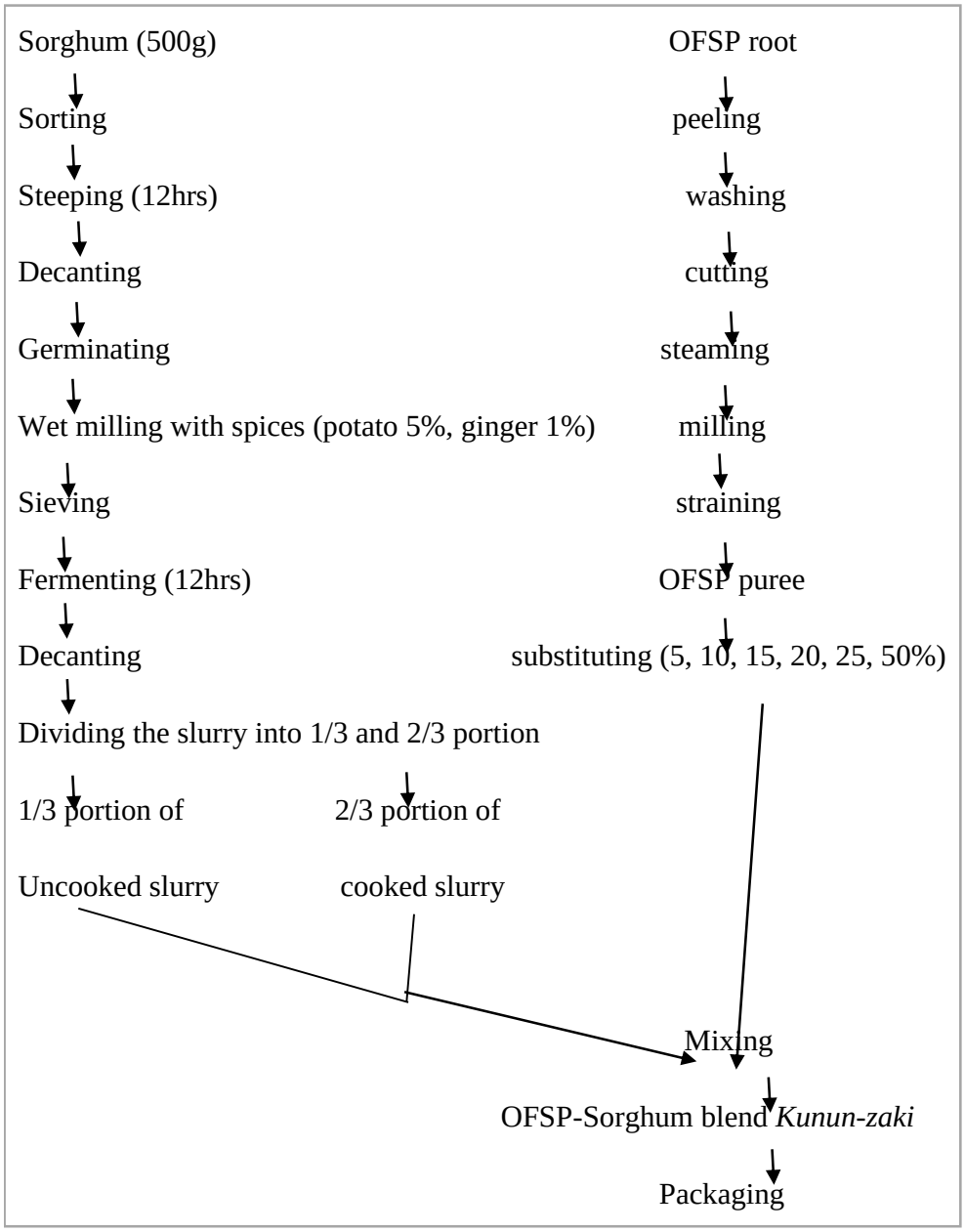

Figure 1. Flow chart for the production of *kunun-zaki*.
Legend: OFSP – Orange-fleshed sweet potato.
Source: Modified method (Adebayo et al., 2010; Sengev et al., 2012; Tedesco and Stathers, 2015).

ml of boiling water was added to the larger portion for cooking. It was then allowed to stand for about 5 minutes after which, cold water (500 ml) was added to the second part of the slurry and fermented. The fermented sorghum paste was substituted for orange-fleshed sweet potato puree at 0, 5, 10, 15, 20, 25 and 50% to produce orange-fleshed sweet potato-sorghum blended kunun-zaki. The slurries were thoroughly mixed and sweetened with 10 g of sucrose (granulated sugar). One hundred millilitre (100 ml) was added to the resulting slurry which becomes a ready to drink *kunun-zaki.*

Analytical methods

Determination of physicochemical composition

The parameters such as pH, total soluble solids, total

solids, ginger acidity, and specific gravity were analyzed as per standard guidelines and procedures as described by Eneke (2015).

Determination of total solids (TS) content: The total solid content of *kunun-zaki* was determined as described by Agu et al. (2012). 25ml of *kunun-zaki* was evaporated on a boiling water bath, dried in an oven at 100°C for 2 to 3hours.

$$\%\text{Total Solids} - \text{Dry weight} \times 100 \text{ weight of the sample}$$

Determination of total soluble solid (TSS) content: Agu et al. (2012) described the determination of the total soluble solid content of the *kunun-zaki*. The analysis of TSSC readings was performed by refractometry using the Abbe refractometer (PZO-RLI, Warszawa, Poland). The refractive index of a sugar-containing solution depends on temperature. The refractometer was typically calibrated at 20°C. Deionized water was used to calibrate the equipment (refractive index=1.3330 and 0°C Brix at 20°C) and the readings of the samples were recorded (Ekanem et al., 2018).

Measurement of pH: The pH was determined as described by Ekanem et al. (2018). The pH of each sample was determined using a pH meter (TEC-2 PH meter; Tcecnal, Sion Paulo sp Brazil) directly placed into each solution at room temperature (20°C). 0.1 of the meter accuracy was calibrated according to the manufacturer's instruction using buffer standards of pH meter immersed into the solution and the value was recorded.

Acidity of ginger *kunun-zaki*: The acidity of ginger *kunun-zaki* was determined by the method described by Ndulaka et al. (2014). The samples were thoroughly homogenised in a container at 20°C. A volume of 17.6 ml *kunun-zaki* sample was pipetted into a conical flask. Six drops of phenolphthalein indicator solution was added to the sample and titrated with sodium hydroxide (NaOH) solution, while stirring with glass rod till the appearance of faint pink colour which indicates the endpoint.

Determination of phytochemical composition

The following phytochemicals were determined according to standard methods: flavonoids, carotenoids, vitamin A and tannin.

Determination of carotenoids content: The method described by Krishnaiah et al. (2009) was used to determine the carotenoids content. The weighted sample of *kunun-zaki* was measured and homogenized in methanol using a laboratory blender (Saisho blender, model S-748). A mixture of 1:10 (1%) was used. The initial crude extract was obtained by filtering the homogenate, the mixture of the filtrate and distilled water of 20 ml were mixed in a separating funnel. The recovered ether layer was evaporated and dried at low temperature (35 to 50^{o}C) in a vacuum desiccator. The saponification of the dry extract was carried out with 20 ml of ethanoic potassium hydroxide and kept in a dark cupboard, and the carotenoids was taken up the following day (7 hours) in the solutions containing 20 ml of ether. Distilled water (20 ml) was then used to wash the remaining two portions. The carotenoids extract (ether layer) was dried in a desiccator and later treated with light petroleum (petroleum spirit) and allowed to stand overnight (5 hours) in a freezer (-10^{o}C). The steroid was precipitated and removed by centrifugation after 12 hours and the carotenoids extract was evaporated to dryness in a weighed evaporation dish, cooled in a desiccator, and weighed. The carotenoids weight was determined and expressed as a percentage of the sample weight.

$$\%\ \text{carotenoids content} = \frac{\text{Weightofsample}}{\text{Weightofsampletaken}} \times 100$$

Determination of flavonoids content: The flavonoids content was determined as described by Singleton et al. (1999). 10 g of *kunun-zaki* sample was extracted with 100 ml of 80% aqueous methanol at room temperature (30±2°C). The mixture was then filtered through a Whatman No. 42 grade filter paper into a weighed 250 ml beaker. The filtrate was transferred into a water bath, evaporated to dryness, and weighed. The percentage of flavonoids was calculated as:

$$\%\ \text{flavonoidscontent} = \frac{\text{Weightofresidue}}{\text{Weightofsampletaken}} \times 100$$

Determination of tannin content: One gram of the ground sample (*kunun-zaki*) was macerated with 20 ml of methanol for 2 minutes and filtered as described by Wang et al. (2021). 5 ml of the filtrate was poured into three test tubes and 0.3 ml of 0.l M ferric chloride and 0.3 ml of 0.0008 M potassium ferricyanide were added. Finally, the absorbances were taken at 720 nm.

Determination of vitamin A (retinol) contents: The method describes by Romeu-Nadal et al. (2006) was adopted. The procedure involved using liquid chromatography with spectrophotometric and gas chromatographic techniques.

Evaluation of sensory properties

The *kunun-zaki* samples were evaluated for colour, taste, odour, flavour and general acceptability by twenty (20) trained panelists who were randomly selected among staff

and students of the Department of Food Science and Technology, Faculty of Agriculture and Life Sciences, Federal University Wukari, Taraba State, Nigeria based on their familiarity with *kunun-zaki* as described by Aderinola and Oluwamukomi (2021). The *kunun-zaki* samples were presented on a 3-digit coded white plastic plates at 29±3°C. The samples were evaluated on a 9-point Hedonic scale where 1 = disliked extremely and 9 = like extremely. The order of presentation of the samples to the panelist was randomized. The panelists were provided with bottled water to rinse their mouths in between evaluations. The sensory evaluation was carried out at mid-morning (10 am) in the sensory evaluation laboratory under adequate lighting and ventilation.

Statistical analysis

Data were analyzed in 3 replicates by one-way analysis of variance (ANOVA) in a completely randomized design using statistical package for social sciences (SPSS: 23.00 version). The statistically significant difference ($p<0.05$) were separated using Duncan's Multiple Range Test (DMRT) (Awadallah, 2019).

RESULTS AND DISCUSSION

The phytochemical composition of sorghum - OFSP blended *kunun-zaki*

The phytochemical composition of the sorghum-orange-fleshed sweet potato blended *kunun-zaki* is shown in Table.1 The carotenoids and flavonoids contents of the sorghum-orange-fleshed sweet potato blended *kunun-zaki* increased from 0 to 28.14 mg/100g and 0 to 191 mg/100g respectively, while tannin content decreased from 4.97 to 1.51 mg/100g with an increase in the added orange-fleshed sweet potato. The vitamin A content of the sorghum-orange-fleshed sweet potato blended with *kunun-zaki* increased from 0.44 to 10.18 mg/100g with an increase in the added orange-fleshed sweet potato. The effects were significant ($p = 0.05$). The increase in carotenoids, flavonoids, and vitamin A could be due to the inherent high content of these constituents in the OFSP roots (Obanewo and Zidon, 2003). This finding also agrees with an earlier study carried out by Abong' et al. (2021), that the total carotenoids, flavonoids, and Vitamin A activity significantly ($p < 0.05$) varied with the type of processing. The corresponding significant ($p<0.05$) decrease in tannin content with increasing levels of OFSP is attributed to orange-fleshed sweet potatoes not containing tannin (Adejuyitan et al., 2008); thereby making the beverage safe for consumption. It has been proven that carotenoids and vitamin A are important in the maintenance of good eye sight (Barros et al., 2011).

The physicochemical properties of sorghum - OFSP blended *kunun-zaki*

The physicochemical properties of the sorghum-orange-fleshed sweet potato blended *kunun-zaki* is shown in Table 2. The total soluble solids (TSS), total solids (TS), pH, and specific gravity of the sorghum-orange-fleshed sweet potato blended *kunun-zaki* increased from 4.95 to 8.25%, 1.55 to 2.80 g/100 cm^3, 3.97 to 4.10, and 5.65 to 13.70, respectively, while the acidity decreased ($p<0.05$) from 39.21 to 12.44 g/100g, with an increase in the added orange-fleshed sweet potato puree [0-50%]. The relative increase in the TSS with added orange-fleshed sweet potato puree could be due to relative high sucrose level in orange-fleshed sweet potato root (Sengev et al., 2012), while the decrease in acidity could be due to low acid content of the orange-fleshed sweet potato root. The freshly prepared *kunun-zaki* pH value was lower than the results obtained by Lola et al. (2018), but similar to the report of Obanewo and Zidon (2003). The acidity of the fresh *kunun-zaki* sample (39.21) was higher than the reconstituted sample (12.44). This could be due to the loss of volatile acids during the processing. This result is in agreement with the report of Ndulaka et al. (2014) which indicate a higher hydrogen ion concentration in the freshly prepared *kunun-zaki*. The relative decrease in the acidity of *Kunun-zaki* could be attributed to the low acid content in orange-fleshed sweet potato. The relative increase in the sugar content could be of an advantage economically as the beverage could be taken without sweetener. It could also increase the energy content of the drink. The decrease in the acidity of the blended drink could make it safe for the consumer, particularly ulcer patients. The increase in total solids could help in increasing the bulk and consequently improve emptying of the bowel or intestine (Lola et al., 2018).

The sensory quality of the sorghum - OFSP blended *kunun-zaki*

Quality and appearance can be described by colour, flavour, and taste. The sensory quality of the sorghum-orange-fleshed sweet potato blended *kunun-zaki* is shown in Table 3. The average mean score for the taste, flavour, mouthfeel, and appearance decreased from 7.43 to 6.10, 7.36 to 7.06, 7.40 to 6.93, and 7.26 to 6.72, respectively while that of colour increased from 6.70 to 7.41 with an increase in the added orange-fleshed sweet potato puree. The blend *kunun-zaki* (50%) orange-fleshed sweet potato has the highest average mean score (7.41). The effects are significant ($p = 0.05$). This result was higher than the findings of Ndulaka et al. (2014). The increase must have been as a result of an increase in the quantity of orange-fleshed sweet potato added for the production of the *kunun-zaki*. Colour is an important attribute that influences

Table 1. Phytochemical composition (mg/100g) of sorghum orange-fleshed sweet potato blend.

Sorghum	OFSP	Phytochemical composition			
		Carotenoids (mg/100g)	Tannin (mg/100g)	Flavonoids (mg/100g)	Vitamin A (mg/100g)
100	0	0.00 ^{f}± 0.00	4.97^{a} ± 0.07	0.00^{d}± 0.00	0.44^{f} ± 0.02
95	5	5.27^{e} ± 0.21	2.61^{b}± 0.21	22.00^{d} ± 0.00	3.08^{e} ± 0.14
90	10	6.01^{e} ± 0.14	2.41^{b} ± 0.14	71.00^{c} ± 1.41	5.27^{d} ± 0.21
85	15	9.63^{d} ± 0.21	2.27^{c} ± 0.28	72.50^{c} ± 2.12	5.66^{d} ± 0.14
80	20	15.61^{c} ± 0.21	2.20^{d} ± 0.21	113.00^{b} ± 1.41	6.45^{c} ± 0.49
75	25	22.02^{b} ± 0.14	2.03^{e} ± 0.28	161.00^{a} ± 1.41	7.74^{b} ± 0.14
50	50	28.14^{a} ± 0.21	1.51^{f} ± 0.21	191.50^{a} ± 9.19	10.18^{a} ± 0.07

Values are mean ± standard deviation of two (2) replicates. Means within a column with the same superscripts are not significantly different (p>0.05). Legend: OFSP: Orange-fleshed sweet potato.

Table 2. Physicochemical properties of sorghum-OFSP blend.

Sorghum	OFSP	Physicochemical properties				
		pH	TSS (°Brix)	TS (mg/L)	Acidity	Specific gravity
100	0	3.97^{d} ± 0.28	4.95^{cd}± 0.70	1.55^{d} ± 0.70	39.21^{a} ± 6.38	5.65^{g} ± 2.12
95	5	4.00^{cd} ± 0.07	4.65^{d} ± 0.94	1.95^{c} ± 0.70	26.20^{b} ± 0.28	6.00^{f} ± 0.00
90	10	4.00^{c} ± 0.07	5.45^{c} ± 0.36	2.05^{c} ± 0.70	24.72^{b} ± 0.35	6.45^{e} ± 0.36
85	15	4.01^{cd} ± 0.07	5.95^{bc} ± 0.70	2.40^{b} ± 1.10	23.71^{bc} ± 0.14	6.50^{d} ± 0.84
80	20	4.02^{bc} ± 0.07	6.05^{bc} ± 0.70	2.50^{ab} ± 1.10	18.94^{c} ± 0.56	7.40^{c} ± 0.14
75	25	4.06^{bc} ± 0.14	7.05^{ab} ± 0.70	2.60^{ab} ± 1.10	16.32^{c} ± 0.35	9.45^{b} ± 0.64
50	50	4.10^{ab} ± 0.07	8.25^{a} ± 0.35	2.80^{a} ± 1.10	12.44^{d} ± 0.14	13.70^{a} ± 0.07

Values are mean ± standard deviation of two (2) replicates. Means within a column with the same superscripts are not significantly different (p>0.05). **Legend:** OFSP: Orange-fleshed sweet potato.

Table 3. Sensory quality of sorghum-orange-fleshed sweet potato blend.

Sorghum	OFSP	Sensory quality						
		Taste	Flavour	Colour	Odour	Mouth feels	Appearance	General acceptability
100	0	6.43^{a} ± 1.38	6.70^{a} ± 1.40	6.70^{b} ± 0.95	7.90^{a} ± 1.21	7.40^{a} ± 1.63	7.26^{a} ± 1.74	6.16^{c} ± 0.64
95	5	6.59^{a} ± 0.75	6.74^{b} ± 1.50	6.54^{c} ± 0.07	6.61^{d} ± 1.60	7.20^{a} ± 0.05	6.38^{d} ± 1.83	6.36^{c} ± 0.90
90	10	6.70^{b} ± 0.54	6.93^{b} ± 1.89	6.46^{c} ± 1.38	7.40^{b} ± 0.45	7.10^{a} ± 1.47	7.30^{a} ± 1.36	6.50^{b} ± 0.74
85	15	6.83^{c} ± 0.77	6.50^{c} ± 1.61	6.13^{c} ± 1.50	6.70^{d} ± 0.78	6.80^{b} ± 1.75	6.96^{b} ± 1.40	6.80^{b} ± 0.32
80	20	6.96^{c} ± 0.64	6.66^{c} ± 1.56	7.13^{b} ± 1.50	7.03^{c} ± 0.51	6.60^{b} ± 0.03	6.53^{d} ± 1.61	7.00^{a} ± 0.73
75	25	7.15^{c} ± 0.19	7.10^{a} ± 1.44	7.10^{b} ± 1.68	6.46^{c} ± 1.97	6.00^{b} ± 0.75	6.83^{c} ±1.68	6.63^{b} ± 0.09
50	50	7.40^{d} ± 0.75	7.06^{a} ± 0.99	7.41^{a} ± 1.68	6.93^{c} ± 1.77	6.40^{c} ± 0.31	6.72^{a} ± 1.83	6.22^{c} ± 0.22

Values are mean ± standard deviation of two (2) replicates. Means within a column with the same superscripts are not significantly different (p>0.05). **Legend:** OFSP: Orange-fleshed sweet potato.

the acceptability of products by consumers. Taste is also an important attribute that plays a major role in acceptability of food products. The taste of the samples became less appealing to the panellists as the proportion of orange-fleshed sweet potato in the *Kunu-zaki* increased. Though the decrease in taste is not significant p = 0.05. This result agrees with the work of Lola et al., (2018), which has the best sensory attributes. The decrease in the average mean scores of the taste and flavour could be due to the inherent component of the orange-fleshed sweet potato root which is not acceptable in *kunun-zaki.* The increase in the average mean scores of

the colour and taste of the blended *kunun-zaki* could be due to the inherent attractive golden colour imparted by the carotenoids pigment. The increase in the average mean scores of the colour could be attributed to the attractive and acceptable golden colour impacted by the carotenoids in the orange-fleshed sweet potato puree. The result of the sensory evaluation revealed that *kunun-zaki* made from 100% sorghum and those produced from blended puree with 10 and 20% orange-fleshed sweet potato puree were rated closely in almost all the quality attributes evaluated. This showed the acceptability of orange-fleshed sweet potato in *kunun-zaki*. This result suggests the potential application of orange-fleshed sweet potato either as a full puree or substituted puree in the food industry.

Conclusion and Recommendation

The result of the study showed that the sorghum-orange-fleshed sweet potato blended *kunun-zaki* is acceptable up to 50% added orange-fleshed sweet potato puree, with an improvement in the phytochemical up to 28.14 ml/100g of carotenoids and 10.18 ml/100g of vitamin A. The addition of orange-fleshed sweet potato reduced the tannin to the minimum level of 1.5 ml/100g which is safe for consumption. There was no significant p = 0.05 difference in taste, flavour, colour, odour mouth feels appearance and general acceptability in the addition of orange-fleshed sweet potato puree. The addition of orange-fleshed sweet potato puree did improve the phytochemical content of the sorghum-based *kunun-zaki*. Also, the colour and taste of the beverage were greatly improved. The relatively low acidity of orange-fleshed sweet potato-sorghum makes it safe for an ulcer patient. The addition of orange-fleshed sweet potato could also improve the quality of other food products if carefully used. The blend was most preferred and acceptable at 20% added orange fleshed potato purree and could therefore be level of recommendation for food enrichment. The incorporation of orange-fleshed sweet potato puree could be said to have improved the phytochemical composition and physicochemical properties of *kunun-zaki*

CONFLICT OF INTERESTS

Authors declare that they have no conflict of interests.

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