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Nutritional Composition, Sensory Profile and Consumer Acceptability of Wheat-Jackfruit Seed Composite Buns

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Abstract

Jackfruit seeds flour is very rich in nutrients and may be incorporated into wheat flour to develop nutrient dense baked products. Consumption of these products may improve the nutrition status of the people, hence fulfill sustainable development goal number two. In this study, nutritional composition, sensory profile, and consumer acceptability of wheat-jackfruit seeds composite buns (*Mandazi)* were investigated. Jackfruit seeds flour (JSF) was developed and incorporated into wheat flour (WF) at 10, 20, and 30% to produce composite flour used for bun preparation. Flours and buns were subjected to proximate, mineral, and sensory analyses with WF serving as a control sample. JSF had significantly ($p < 0.05$) higher protein, fibre and mineral contents than wheat flour. Proximate and mineral contents increased significantly ($p < 0.05$) in bun samples with increasing levels of WF substitution in the formulations. As for sensory analysis, whole wheat control buns and 10% composite buns had significantly ($p < 0.05$) higher crumb colour, softness, sweetness and consumer acceptability but lower colour intensity than 20 and 30% composite buns. Therefore, incorporation of JSF up to 10% into WF produces composite buns with enhanced nutritional contents and similar sensory profile and consumer acceptability to whole wheat flour.

Keywords: Jackfruit seed, Nutritional composition, Sensory profile, Composite buns.

Introduction

Jackfruit (*Artocarpus heterophyllus* Lam) is the largest known edible fruit in the world. It belongs to the family Moraceae which originated in India and Malaysia and is currently found in many parts of Asia, South America, and Africa (Swami et al. 2015, Amadi et al. 2018). Worldwide, Bangladesh, India and Myanmar are among the major jackfruit producing countries (Sidhu 2012, Selva Rani et al. 2019). In Tanzania, the fruit is locally grown in limited areas of Zanzibar, Tanga, Coast, and Morogoro regions (Mushumbusi 2015). Jackfruit seed that represents 15–18% of the fruit weight is a good source of proteins, fibres, starch (Roy Chowdhury et al. 2012, Waghmare et al. 2019), and many minerals such as potassium, phosphorus, calcium, magnesium, zinc, and copper (Maurya and Mogra 2016, Zuwariah et al. 2018). Furthermore, the seeds have various health befits to human beings such as anti-inflammatory, antioxidant, antiulcer, and anti-diabetic activities which are linked to the phytochemicals and other bioactive compounds they contain (Ranasinghe et al. 2019, Adan et al. 2020, Sreeja Devi et al. 2021).

However, despite their high nutritional value and health benefits, jackfruit is still underutilized and highly perishable due to insufficient processing knowledge and resources in the regions where it is grown (Ranasinghe et al. 2019) including Tanzania. The seeds are discarded as waste because no studies have been conducted to explore their potential as a food ingredient in diet and industrial application. According to Adan et al. (2020) and Banarjee and Datta (2015), the seeds may be processed into flour and incorporated into wheat flour to produce composite bakery products and confectionery like cake, bread, and buns. Composite flour technology has been used to enhance the nutritional and functional properties of flour and its processed products in an economical way (Oke et al. 2019, Hasmadi et al. 2020). The technology has been used as a food based approach for curbing malnutrition especially in low-income countries where malnutrition is alarming (Bain et al. 2013).

Buns (*mandazi*) are among the most common baked food products mostly used for breakfast and in some cases for lunch in Tanzania. Due to rapid changes in the lifestyles of people that have led to an increase in the number of bakeries and fast-food restaurants, buns are now easily available in many places in town including shops, supermarkets, and bus stopovers and on the streets. The inclusion of jackfruit into wheat flour will result in buns with enhanced nutritional values and their consumption in the right amounts may improve nutrition outcomes of people in the society. This is in line with sustainable development goal number two which seeks to end hunger and improve the nutrition of people among other objectives (United Nations 2015). Despite adequate literature review, information on the nutrition composition, sensory profile, and consumer acceptability of jackfruit seed and wheat composite flour buns was missing. This study was therefore conducted to establish and avail the missing information.

Materials and Methods

Materials

Mature and fresh jackfruits were purchased from local farmers in Kinole and Makuyuni villages in Morogoro Region. Morogoro Region was purposively selected as it is one of the famous regions for growing jackfruits in Tanzania. A high quality, commercial grade soft winter wheat patent flour, yeast (instant dry yeast), fat, baking powder, and sugar were purchased from local shops in Morogoro. Analytical food grade reagents and chemicals were obtained at the Departments of Food Technology, Nutrition and Consumer Sciences (DFTNCS) and Soil Sciences (DSS) laboratories at Sokoine University of Agriculture (SUA) in Morogoro Region where chemical and sensory analyses were conducted.

Research designs

A completely randomized design (CRD) was applied for the assessment of the chemical composition of the products. The formulation was the main factor and its effects on proximate and mineral contents of jackfruit flour and composite buns were assessed and compared. The mathematical model is shown in Equation 1.

$Y_{IJ} = \mu + \alpha_{IJ}$……………Equation 1

Where μ is the overall (grand) mean, α_i is the effect due to the ith treatment (formulation), and ε_{ij} is the error term.

Randomized complete block design (RCBD) was used to assess the sensory profile and acceptability. Panelists and formulations were the principal factors. The mathematical model is shown in Equation 2.

$Y_{IJ} = \mu + \beta_{IJ} + \alpha_{IJ}$…………Equation 2

Where μ is the overall (grand) mean, α_i is the effect due to the ith treatment (formulation), ßj is the effect due to the jth block (panelists) and ε_{ij} is the error term.

Preparation of jackfruit seed flour (JSF)

Flour and composite flours were prepared following a method described by Roy Chowdhury et al. (2012) with slight modifications. The fruits were washed with clean water to remove dirt and cut into two halves, the seeds were removed, cleaned with water and pre-dried using a clean piece of cloth. The seed coats were manually peeled off using a knife before the seeds sliced into thin chips using a knife, and then solar dried using a walk-in direct solar dryer at 40 °C for 2 days until they attained constant weight and predetermined moisture content of 10%. The dried seeds were milled to flour using a milling machine (Model N/50, 650 kg/ hour, Small Industries Development Organization (SIDO), Tanzania) and were packed into a polythene bag and stored in a refrigerator (< 10 °C) before composite flour preparation.

Preparation of wheat-JSF composite flours (WJCFs)

The wheat-jackfruit composite flours were processed by blending wheat and jackfruit seed flours at different levels of wheat flour substitutions. Ten (10), twenty (20) and thirty (30) parts by weight of jackfruit seed flour were mixed with ninety (90), eighty (80) and seventy (70) parts by weight of wheat flour to obtain 10, 20, and 30% of jackfruit-wheat composite flours, respectively. The processed flours were packed in a polythene bag and stored at 5 °C before buns preparations.

Preparation of buns

The whole-wheat (WWB) and wheat jackfruit seed flour composite buns (WJCBs) were made by mixing the flours with weighed ingredients to obtain a uniform mixture as indicated in Table 1. Water was added gradually into the mixture, and the mixture was kneaded into a soft dough. The dough was left to leaven at 27 °C for 45 minutes and then cut into small pieces of the desired shapes by using a knife and left to stay for 10 minutes. Pieces of dough were deep-fried in hot sunflower oil at 150 °C until the golden-brown colour was attained. Buns were removed from hot oil, kept in a metal sieve to drain the oil, and left to cool on a clean plate at room temperature. The cooled buns were preserved in a food-grade polyethylene bag and stored in a refrigerator (< 10 °C) before chemical and sensory analyses.

Table 1: Composition of wheat-jackfruit seed buns

Ingredients	Formulation (%)			
	WFB	WJCF 1	WJCF 2	WJCF 3
Wheat flour % (g)	100 (500)	90 (450)	80 (400)	70 (350)
Jackfruit flour % (g)	0 (0)	10 (50)	20 (100)	30 (150)
Baking powder (g)	3.5	3.5	3.5	3.5
Fat (g)	10	10	10	10
Sugar (g)	65	65	65	65
Salt (g)	1.5	1.5	1.5	1.5

Chemical analyses

Proximate analysis

Proximate composition of the flours and buns were determined using the Association of Official Analytical Chemists (AOAC 2005) standard procedure. Moisture content was determined by oven drying (Method 925.10), fat by Soxhlet extraction (Method 2003.05), ash by combustion (Method 923.03), crude fibres by dilute acid, and alkali hydrolysis (Method 978.0) and proteins by micro Kjeldahl method (Method 960.52). A conversion factor of N = 6.02 was used for the calculation of protein content. The carbohydrate content was determined by calculation using the different method (AOAC 2005). Each proximate parameter was analyzed in triplicate and computations were based on a dry weight basis.

Determination of mineral contents

The ash content was used for the analysis of the minerals according to the AOAC (2005) procedures. The ash was dissolved in 20 ml of 1 N HCl and heated for 5 minutes at 80-90 °C. The solute was then transferred quantitatively to a 100 ml volumetric flask and made to level with distilled water. Calcium and magnesium were determined by Atomic Absorption Spectrometer (AAS) (Unicam 919, Pye Unicam, England). Potassium was determined using a flame photometer (flame analyzer) and phosphorus was determined using a UV-Vis spectrophotometer at 722 nm (AOAC 2005). Each sample was analyzed in triplicate and quantification was accomplished by comparison with a standard curve drawn using a standard solution of known concentrations at 0.5, 1.00, 1.5, and 2.5 ppm. The mineral content was expressed using the formula shown in Equation 3.

$$\text{Mineral content (Mg/100g)} = \frac{R \times 100 \times DF \times 100}{S \times 1000} \quad \text{Equation 3}$$

where R is reading value (in ppm), DF is a dilution factor and S is a sample weight (g).

Sensory analysis

Quantitative descriptive analysis (QDA)

Quantitative descriptive analysis was conducted at the Department of Food, Nutrition and Consumer Science laboratory involving a trained panel of 8 assessors (3 male and 5 female) with ages ranging from 23 to 30 years according to the method described by Lawless and Heymann (2010). Assessors were selected and trained according to ISO method 8586 (2012). During training, panelists developed and agreed on the seven attributes aroma, crumb colour, crust colour, mouthfeel, oiliness, softness, and sweetness as shown in (Table 2). Assessors also developed and agreed on an unstructured 10-line scale which was used for rating the intensity of the agreed attributes with the left side corresponding to the lowest intensity of each attribute (value 1) and the right side corresponding to the highest intensity (value 10). All samples were coded with 3-digit random numbers and served to each panelist in a randomized order. The average responses obtained from the panelist were used in the univariate and multivariate analyses. Panel performance to ascertain panelists' agreement, discrimination ability, and reproducibility were done during a pre-trial session of the training.

Table 2: Definitions of sensory attributes used in descriptive sensory analysis

Parameter	Attribute	Definition
Aroma	Wheat bun aroma	Aromatic associated with bun
Crust colour	Brown hue	Brown colour associated with bun crust
Crumb colour	White hue	Cream white colour associated with bun crumb
	Colour intensity	Clear, strong colour
Oily	Oiliness	Amount oiliness exuded in the bun
Taste	Sweetness	The taste associated with sucrose solution
Texture	Softness	The force to compress a sample via first compression (The force required to bite through the sample)
	Mouthfeel	Stickiness feeling when chewing bun

Source: Study panelists

Consumer test

***Acceptability test*:** Acceptability test was conducted by 70 untrained consumers using a 9-point hedonic scale (where 1 = dislike extremely and 9 = like extremely) as described by Lawless and Heymann (2010). Buns samples were cut into small pieces of 2 mm, placed on disposable plates coded with three-digit random numbers and the plates were served to the panelists in a randomized manner.

All good sensory practices such as consideration of the testing environment, sample, and panelist as well as testing protocol such as sample labeling, serving as well as rinsing mouth between tests were carefully observed to avoid biases.

Statistical data analysis

Data were analyzed by R statistical package (R Development Core Team, Version 3.0.0 Vienna, Austria) for Analysis of Variance (ANOVA) to determine the significant differences in proximate composition, mineral contents, sensory attributes intensities, and consumer acceptability of flours and their composite buns. Means were separated using Tukey's Honest Significant Difference ($p < 0.05$). Principal Component Analysis (PCA) was used to determine the systematic variations in sensory data using Latentix Software (LatentiX Aps Team, version 2.12, Frederiksberg Denmark). Results were presented as arithmetic mean values and standard deviations in Tables and graphs as well as in PCA biplots.

Results and Discussion

Proximate composition of flours and buns

Results for the proximate composition of wheat and jackfruit seed flours and buns are shown in Table 3. Jackfruit seed flour had significantly ($p < 0.05$) higher protein, ash, and fibre contents than lower values in wheat flour. This results in a significant ($p < 0.05$) and progressive increase in the same proximate parameters in bun samples as the wheat flour substitution increased in the formulations. However, jackfruit flour had lower fat contents than wheat flour resulting in significant ($p < 0.05$) lower values in composite buns as the jackfruit seed flour levels increased in the formulation (Table 3).

Table 3: Proximate composition of flours and composite buns (g/100 g DM)

Sample	Moisture	Ash	Fat	Protein	Fibre	CHO
Flour						
Wheat	11.6 ± 0.28^{a}	0.4 ± 0.02^{b}	1.0 ± 0.2^{a}	8.5 ± 0.24^{b}	1.4 ± 0.31^{b}	82.3 ± 0.64^{a}
Jackfruit	9.5 ± 0.24^{b}	3.4 ± 0.33^{a}	0.9 ± 0.4^{a}	13.3 ± 0.07^{a}	5.1 ± 1.16^{a}	67.8 ± 1.63^{b}
Buns						
WFB (100)	20.5 ± 1.31^{a}	0.3 ± 0.01^{d}	31.4 ± 0.03^{a}	5.9 ± 0.07^{c}	1.5 ± 0.00^{c}	40.4 ± 0.05^{b}
WJCB 1 (90:10)	18.4 ± 0.64^{ab}	0.9 ± 0.02^{c}	28.8 ± 0.11^{b}	6.2 ± 0.00^{b}	1.6 ± 0.00^{c}	44.1 ± 0.78^{ab}
WJCB 2 (80:20)	17.9 ± 0.00a^{b}	1.3 ± 0.03^{b}	27.5 ± 0.48^{c}	6.5 ± 0.07^{b}	2.3 ± 0.07^{b}	44.6 ± 0.59^{ab}
WJCB 3 (70:30)	15.6 ± 0.28^{b}	1.5 ± 0.00^{a}	26.7 ± 0.08^{c}	7.1 ± 0.07^{a}	2.9 ± 0.02^{a}	46.3 ± 0.27^{a}

Values are expressed as mean ± SD (n = 3). Mean values with different letters along the columns are significantly different at $p < 0.05$. Key: WFB is a wheat flour bun and WJCB is a wheat jackfruit seed composite bun.

Jackfruit seed flour contains high amounts of ash, proteins, and fibres as previously reported by Zubair et al. (2017) and Ranasinghe et al. (2019). Their increased levels in composite flours therefore could be associated with high levels of these nutrients in buns samples. A similar increase in ash, protein and fibre contents was previously reported in composite chapatti (Sultana et al. 2014), composite cake (Khan et al. 2016), and composite chocolate cake (Arpit and John 2015). Contrarily, the observed decrease in fat content in composite buns may be attributed to low fat contents in jackfruit seed flour coupled with reduced fat absorption up to a certain limit making good components of the fat free diet (Butool and Butool 2015, Zubair et al. 2017). However, Sultana et al. (2014) and Islam (2015) observed an increase in fat contents from 1.03 to 1.67 g in wheat jackfruit composite chapatti and biscuits, respectively.

Mineral composition of flours and buns

Table 4 shows that jackfruit seed flour had significantly ($p < 0.05$) higher values for all minerals than wheat flour, with potassium ranking as the highest. This resulted in a progressive increase in mineral contents in the composite buns as their proportions increased in the formulations. However, no significant ($p > 0.05$) differences in calcium and magnesium contents between wheat and 10% buns were observed.

Table 4: Mineral contents of flours and composite buns at different levels of wheat flour substitution (mg/100 g DM)

Samples	Calcium	Magnesium	Potassium	Phosphorus
Flours				
Wheat	13.4 ± 0.07^{e}	14.5 ± 0.07^{b}	137.5 ± 0.71^{e}	79.8 ± 0.74^{e}
Jackfruit	68.4 ± 0.70^{a}	161.6 ± 0.25^{a}	1454.4 ± 1.39^{a}	301.7 ± 2.26^{a}
Formulations				
WFB (100)	38.3 ± 1.31^{c}	21.3 ± 0.01^{c}	136.7 ± 0.03^{a}	138.6 ± 0.07^{c}
WJCB 1 (90:10)	41.4 ± 0.64^{b}	21.0 ± 0.02^{c}	176.3 ± 0.11^{b}	147.2 ± 0.00^{b}
WJCB 2 (80:20)	$46.1 \pm 0.00a^{a}$	30.3 ± 0.03^{b}	240.1 ± 0.48^{c}	159.3 ± 0.07^{b}
WJCB 3 (70:30)	49.8 ± 0.28^{a}	38.7 ± 0.00^{a}	312.0 ± 0.08^{c}	165.6 ± 0.07^{a}

Values are expressed as mean ± SD (n = 3). Mean values with different superscript letters along the columns are significantly different at $p < 0.05$. Key WFB is wheat flour and WJCB is wheat jackfruit seed composite bun.

Jackfruit flour is rich in potassium phosphorus, calcium, magnesium, zinc, and copper than wheat flour (Abedin et al. 2012). The higher values in flour resulted in a progressive increase in mineral contents in the composite buns similar to the findings reported by Airani (2007) in jackfruit flour composite biscuits. The high amounts of minerals in composite buns are very important in the human diet and normal body health. Potassium is an essential nutrient needed for the maintenance of total body fluid volume, acid and electrolyte regulation, nerve function, muscle control, and blood pressure (Bellows and Moore 2013, Weaver 2013). World Health Organization (WHO 2012) recommends an increase in potassium intake (3510 mg/day) from food to reduce blood pressure and risk of cardiovascular disease, stroke, and coronary heart disease in adults (WHO 2012). This means one needs to consume up to 2 kg/day of 10% composite buns to meet the requirement suggesting consumption of other potassium rich foods. The seeds contain an abundance of magnesium which plays a vital role in lowering blood pressure and maintaining bone health since it aids in calcium absorption and hence helps to strengthen the bones (Maurya and Mogra 2016).

Sensory analysis

Quantitative descriptive analysis

Table 5 presents the mean intensity scores of different sensory attributes of bun samples. Control whole wheat and 10% composite bun samples had significantly ($p < 0.05$) lower crust hue but higher mean crumb hue, sweetness, and intensities than 20 and 30% composite bun samples. On the other hand, higher mean crust hue intensity of 7.9 was observed in the 30% composite sample than the lowest value of 7.1–7.2 in control and 10% composite bun samples.

Table 5: Mean intensity scores of wheat and jackfruit seed flour composite buns

Sample	Crust hue	Crumb hue	Sweetness	Aroma	Mouthfeel	Oiliness	Softness
WFB (100)	7.2 ± 1.72^{b}	7.5 ± 1.82^{a}	6.9 ± 1.77^{a}	6.7 ± 2.09^{a}	7.4 ± 1.78^{a}	7.6 ± 1.09^{a}	7.3 ± 1.53^{a}
WJCB 1 (90:10)	7.1 ± 1.71^{b}	6.3 ± 2.18^{ab}	6.8 ± 1.60^{a}	6.1 ± 2.31^{b}	6.3 ± 2.12^{b}	6.9 ± 1.61^{b}	6.4 ± 1.75^{ab}
WJCB 1 (90:20)	7.6 ± 1.54^{ab}	5.8 ± 2.32^{bc}	6.0 ± 2.13^{b}	6.1 ± 2.16^{b}	6.2 ± 2.46^{b}	6.8 ± 1.95^{b}	5.0 ± 1.15^{c}
WJCB 1 (90:30)	7.9 ± 1.5^{a}	4.6 ± 3.00^{c}	5.6 ± 2.25^{c}	5.6 ± 2.31^{c}	5.6 ± 2.55^{c}	6.2 ± 1.72^{c}	4.0 ± 1.31^{d}

Values are expressed as mean ± SD (n = 10). Mean values with different superscript letters along the columns are significantly different at $p < 0.05$. Key: WFB is wheat flour bun and WJCB is wheat jackfruit seed composite bun.

Furthermore, the biplot of principal component analysis (Figure 1) shows that PC 1 accounts for 97.6% of the total variability and it is a contrast between control and 10% composite samples related to all attributes except crust colour on one side and 20–30% composite samples associated with crust colour on the other side. PC 2 accounts for only 2% of total variability and it is a contrast between 10% composite sample associated with sweetness and softness on one side and the other samples on the other side.

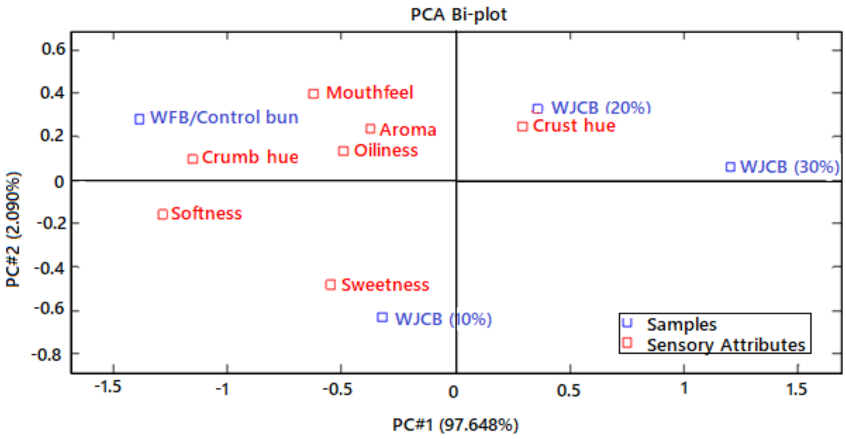

Figure 1: Principal component analysis biplot for sensory data. Key: WFB is a wheat flour bun and WJCB is a wheat jackfruit seed composite bun.

Substitution of wheat flour with jackfruit seed flour at 20% and above affects the sensory profile of the bun samples. The reported lower intensities in all sensory attributes except crust colour as the level of jackfruit seed flour increased in the formulations may be associated with the addition of non-wheat flour as previously reported in wheat-orange fleshed sweet potato composite buns (Mongi et al. 2015) and wheat jackfruit composite biscuits (Islam et al. 2015). High brown crust colour and low white crumb intensities in 20 and 30% composite samples could be associated with increased light brown jackfruit seeds flour in the formulations and composite products. Jackfruit seed is surrounded by a brown outer covering (spermoderm) that affected the colour of its flour (Prakash et al. 2009). In addition, the deep crust colour may be associated with the Maillard reaction between reducing sugars and amino acids in the flours (Phisut and Jiraporn 2013). This finding is in agreement with previous findings by Hossain (2014) that the addition of more than 25% jackfruit seed flour in bread led to a change in colour from light brown to dark brown. Colour is one of the quality criteria for the initial acceptability, purchasing, and consumption of the baked product by the consumers.

Consumer test

Consumer panel characteristics

Consumer panel comprised of 40 panelists whereby 26 (75%) were males and 14 (25%) were females. All (100%) panelists were University undergraduate students in the age group of 20-27 years pursuing different programs with 24 (60%) of them were frequent users of buns on daily basis, 8 (20%) consumed once a week, 5 (12.5%) consumed once per month and 3 (7.5%) were seldom users of buns as indicated in Table 6.

Table 6: Characteristics of the consumer acceptability panel (n = 40)

Attribute	Category	Frequency (n)	Percentage (%)
Gender	Male	26	75
	Female	14	35
	Total	**40**	**100**
Age group	19-30	40	100
	31-40	0	0
	Total	**40**	**100**
Education group	Undergraduate	40	100
	Postgraduate	0	0
	Total	**40**	**100**
Consumption	Daily	24	60
	Once/week	8	20
	Once/month	5	12.5
	Seldom	3	7.5
	Total	**40**	**100**

Consumer acceptability

Whole wheat and 10% bun samples had statistically ($p > 0.05$) higher mean hedonic values which differed significantly ($p < 0.05$) from 20 and 30% composite bun samples as depicted in Figure 2. No significant ($p > 0.05$) variation was observed between the control and 10% composite buns.

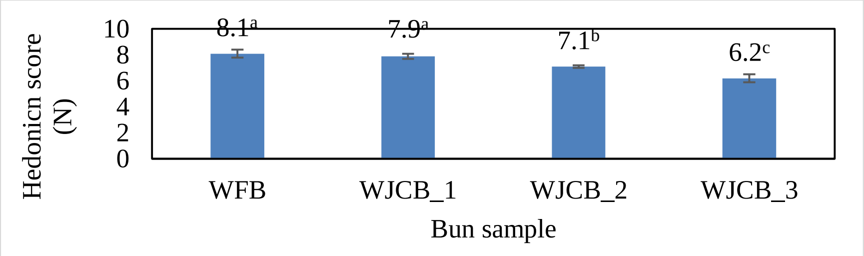

Figure 2: Mean hedonic scores of control and composite buns samples. Values are expressed as mean ± SD (n = 60). Bars with mean values with different letters are significantly different at $p < 0.05$. Key: WFB is a wheat flour bun and WJCB is a wheat jackfruit composite bun.

The fact that consumers could not establish the significant variation between control and 10% composite samples suggests that jackfruit seed flour up to 10% may be incorporated into wheat flour to produce buns with comparable consumer acceptability as whole wheat buns. Beyond this level, sensory characteristics, and consumer acceptability may be affected. Low acceptability of composite samples as substitution of wheat flour increases in the formulations could be ascribed to high addition of non-wheat flour which affects sensory profiles and consequently consumer acceptability as observed in the current and previous studies (Mongi et al. 2015, Islam et al. 2015, and Butool and Butool 2015). The present study revealed that jackfruit seed flour has a great potential for the development of new bakery food products along with wheat flour as reported in other studies. Sultana et al. (2017) developed nutrient-dense wheat jackfruit seed flour composite cakes, while David (2016) and Amin (2009) developed nutritious jackfruit seed flour chocolate cake. Furthermore, Hossain et al. (2014) developed wheat jackfruit seed floor composite bread, and Hasan et al. (2010) prepared biscuits from jackfruit seed flour blended with wheat flour.

Conclusion

In a view of the findings, jackfruit seed flour has more proteins, fibres, ash, carbohydrates, calcium, magnesium, potassium, and phosphorus than wheat flour. Substitution of wheat flour with jackfruit flour at different levels enhances protein, ash, fibre calcium, magnesium, potassium, and phosphorus contents of the processed composite flour and the resulting buns. The control whole wheat buns (100% wheat) had high sensory attribute intensities except for crust colour. Moreover, there was no significant difference in overall consumer acceptability between control whole wheat bread and 10% composite bun samples. Therefore, the present study revealed that jackfruit seed flour is nutritious and its incorporation of up to 10% into wheat flour produces composite buns with enhanced nutritional contents and similar sensory profile and consumer acceptability to whole wheat flour.

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Conflict of interest: None.

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