



Original Paper

## Evaluation of Proximate Composition and Sensory Attributes of Composite Porridge From Finger Millet, Common Beans and Carrot Flour

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**Abstract**— Porridge made solely from finger millet does not have better nutritional value. Nutritious and acceptable porridge can be developed by combining finger millet with protein-rich crops like common beans and those high in minerals and vitamins, such as carrots. This study is aimed to develop composite porridge using flour prepared from finger millet, common bean, and carrot. Formulation is computed using the D-optimal mixture design, in which 8% of malted finger millet and 15% of carrot were added to the formulation as fixed levels for enhancement of sensory attributes. The standardized official methods were utilized to evaluate the proximate composition and sensory attributes of developed porridge. The result showed that moisture, ash, protein, crude fat, crude fiber, and utilizable carbohydrate content of composite porridge in percentages were ranged from  $9.84\pm 0.07$  to  $10.6\pm 0.29$ ,  $2.82\pm 0.04$  to  $3.45\pm 0.03$ ,  $8.33\pm 0.05$  to  $13.17\pm 0.04$ ,  $1.39\pm 0.01$  to  $1.89\pm 0.01$ ,  $8.07\pm 0.05$  to  $8.86\pm 0.11$ ,  $64.24\pm 0.15$  to  $67.95\pm 0.31$ , respectively. The present study also found that the color and aroma attributes for finger millet based composite porridge were improved by inclusion of common beans, carrot and sprouted finger millet. Furthermore, texture, and taste did not show significant differences among the composite porridges. According to results of sensory attributes, composite porridge composed of 8% malted finger millet, 70% un-malted finger millet, 7% common bean, and 15% carrot was highly preferable over the other formulations. Incorporating common beans and carrot to finger millet is recommended in the production of composite porridge with improved nutrients and sensory qualities.

**Keywords**— Carrots, Common beans, Composite porridge, Finger-Millet, Protein, Taste

### I. INTRODUCTION

Porridge is a popular complementary food made by cooking flour prepared from cereals or legumes, in milk or water until desired thickness is achieved. It is a staple food and served at breakfast, especially in low income nations. Various types of porridge utilized in unindustrialized countries are supplied by staple cereals, which are relatively poor in nutritional qualities [1]. The functionalities, nutritional value, and sensory aspects of such complementary porridge can all be enhanced by blending of finger millet, with common beans, and carrot flours.

Finger millet is a drought tolerant cereal crop that may thrive in any season and grown across the wide agro ecology of Ethiopia. It is a great reserve for times and places where famine is likely to occur because they have a long storage life and are resistant to pests in storage [2]. Finger millet is also crop free of gluten and well-known for its high nutritional fiber, phytochemicals, essential amino acid, and carbohydrate content [3]. It is characterized by its high concentration of calcium, iron, magnesium, and methionine, an amino acid that is scarce in the diets of families with low nutritional status [4]. Calcium concentration in finger millets exceeds that of found in milk which makes it more important for mothers, babies and toddlers.

In several African and Asian countries, finger millets served as a major food component incorporated into various traditional foods and beverages [5]. Consumption of finger millet-based foods is associated with numerous health benefits, such as preventing cancer and cardiovascular diseases, reducing tumor incidence, lowering blood pressure, type II diabetes, risk of heart disease, cholesterol, and rate of fat absorption, and supplying gastrointestinal bulk [6,7]. Grains of finger millets are typically processed using widely utilized cultural food processing techniques such as dehulling, soaking, germination, cooking by dry heat, and milling to flour before being consumed or used in the food preparation.

These processes contributed to enhance the edible, bio-accessibility, nutritional, and sensory qualities of finger millet [8, 9, 10]. Germination of finger millet may cause certain biochemical changes and yield sprouted finger millet having better nutritional value that can be used as potential ingredients in various cultural and modern food preparation. The sprouted finger millet grains have been shown to have enhanced protein efficiency ratio and net protein ratio compared to non-sprouted [11]. Additionally, germination can significantly increase the in vitro digestibility of proteins and carbohydrates [12].

The improvement in protein digestibility after germination is attributed to the reduction of anti-nutrients such as phytic acid, tannins, and polyphenols, which are known to interact with proteins and other nutrients to form complexes [13]. Furthermore, finger millet can be added to a variety of health

foods as a source of calcium and dietary fiber, both in its native and sprouted forms [14]. Sprouted characteristics of cereal grains are impacted by numbers of variables like germination time, grain type/variety, drying method, and drying temperature.

Porridge made from cereals or tubers for children in many African countries are known for their high bulkiness and concentrations of fiber and inhibitory anti-nutrients, which reduce their nutritional benefits [15,16]. Germination and other techniques like extrusion could be used to address the issue of excessive dietary bulk [17]. Formulating and development of nutritious porridge from locally and readily available raw materials have received a lot of attention in many developing countries. Low-cost, protein-rich, and high-energy food formulations based on cereal, legume, tuber, and fruit mixtures have been suggested [18,19,20].

Legume crops are known by high levels of protein, dietary fibers, oil, fatty acids, vital amino acids, and minerals [21]. Common beans are a popular legume crop that could be used as dried seeds, and as processed products for human consumption. It is a good source of numerous nutrients like proteins, vitamins, minerals, essential fatty acids, and bioactive substances [22]. The high protein and dietary fiber content of common bean seeds is double to that of cereal seeds [23].

Carrots are a significant root crop that are rich in many health-promoting chemicals, dietary fiber, and carotenoids [24]. It is also an excellent source of antioxidants that protect the human body from oxidative stress. The consumption of carrots and their products is more popular because of their health benefits, pleasant sensory attributes and nutritional properties. Carrot can be processed to powder and has been used to develop various types of bakery products and extruded products [25]. Production of nutritious porridge is an important food-based approach to lower nutrition insecurity and malnutrition in older infants, lactating mothers, young children, and elders. Therefore, this study is aimed to develop nutrient dense and acceptable porridge from finger millet, common beans and carrot based composite flour.

## II. RESEARCH METHODS

### A. Sample Collection and Preparation

Finger millet (Tadesse variety) was obtained from Melkassa Agricultural Research Center, Ethiopia. Weed seeds, chaff, plant leaves, sand or broken stones, dust and damaged grain from the finger millet samples were removed using air flow, sieving, and hand winnowing. After being submerged in cold tap water, the kernels were manually agitated and the water was drained out of the kernels. The cleaned kernels were placed on paper towels and dried under sun drying conditions. The dried kernels were milled and stored in polyethylene bags at ambient temperature (27±2 oC) until utilized for ingredient formulation and analysis.

The common beans (Roba variety) was obtained from the Melkassa Agricultural Research Center. It was cleaned and soaked using tap water in the plastic container at a ratio of 1:4 w/v weight of common seeds to volume of water and kept overnight at room temperature. Then soaking water was drained, and common bean seeds were dried using oven drying at 65oc for 18 hours. Then it was roasted for 15 minutes at medium heat,

the husk separated and milled, and kept in a clean, airtight polyethylene bag for blending and analysis.

Samples of carrots free from infestation, deterioration, and mechanical damage were procured from the local market in Awash Melkassa, Oromia state, Ethiopia. After washing it in tap water to get rid of dirt and soil particles, the carrots were sliced to a uniform thickness and blanched at 90oc for 5 minutes. After that it was transferred to a hot air oven and allowed for drying at 65°C for 20 hours. The dried carrot was milled by using a cyclotec miller, and the powder was sieved and kept in a clean polyethylene bag for blending and analysis.

### B. Germination of Finger Millet Grains

The Germination of finger millet was carried out using the procedure described by Nefale and Mashau [26] with modification. About 600 grams of sorted and cleaned finger millet grain was soaked at a ratio of 1:3 (weight/ volume) grains to water in a cleaned plastic container for 12 hours at ambient temperature. Then, soaking water was decanted before moist finger millet had been allowed to sprout at ambient temperature for 40 hours. The germination time of 40 hours was selected based on preliminary trials. At the end of germination time, the sprouted grain was washed under running water and dried using an oven drying at 60 oC to constant weight. After dried, it was milled to flour using laboratory scale grinding equipment and kept in a poly ethylene bag until used for desired purpose.

### C. Formulations

Formulation of composite flour from finger millet, carrot, and common bean is computed using Minitab 14 Software's generate mixture design program. Ingredient formulation was based on protein levels recommended for older infants and children after six months to 3 years of age in accordance with the Codex Alimentarius Commission's [27] and the world health organization recommendations [28]. The guideline of Traoré et al. [29] was utilized for estimating the rate of incorporation of sprouted finger millet flour in the formulated composite flours. After being formulated, the composite flours were placed in airtight polyethylene bags and kept at room temperature. D-optimal mixture design is employed to formulate the mixture, and ranges were extracted as described in table 1.

TABLE I. FORMULATED RATIOS FOR COMPOSITE PORRIDGE

Formulations	Finger millet (%)	Malted finger millet (%)	Common bean (%)	Carrot
F0	100	0	0	0
F1	55	8	22	15
F2	44	8	33	15
F3	66	8	11	15
F4	70	8	7	15
F5	62	8	15	15
F6	59	8	18	15
F7	47	8	30	15
F8	40	8	37	15

#### D. Proximate composition

The proximate compositions of the composite porridge were determined using AOAC official methods. Moisture, ash value and crude fat composition of finger millet based composite porridge were evaluated using procedure described by AOAC [30]. Additionally, crude protein and fiber contents of finger millet based composite porridge were determined using [31] official standard method. Utilizable carbohydrate content of composite porridge was computed by subtracting percentage of moisture, crude protein, crude fat, crude fiber and ash value from 100 [32].

$\% \text{Utilizable carbohydrate} = 100 - (\% \text{ moisture} + \% \text{ crude protein} + \% \text{ crude fat} + \% \text{ crude fiber})$ . Energy value of the formulated composite porridge was calculated using the Atwater and Benedict coefficients according to the following formula [33]. It was calculated from crude fat, crude protein and carbohydrate contents using At water's conversation factors; 16.7 kJ/g (4 kcal/g) for protein, 37.4 kJ/g (9 kcal/g) for Fat and 16.7 kJ/g (4 kcal/g) for carbohydrates [34].  $1 \text{ kJ}/100 \text{ g} = 4.18 \text{ kcal}/100 \text{ g}$ .

Energy value (Kcal/100 g) =  $\% \text{ Utilizable carbohydrates} \times 4 \text{ (Kcal)} + \% \text{ proteins} \times 4 \text{ (Kcal)} + \% \text{ fat} \times 9 \text{ (Kcal)}$ .

#### E. Porridge preparation procedure

Porridge was prepared from all the composite flour and the control sample. Porridge preparation proceeded, firstly, by boiling water in the kettle. Next, 1.2 liters of warm water was added into a cooking metal pan. Then, 8 grams of salt was added into warm water for taste. After that, about 400 grams of composite flour prepared from finger millet (sprouted and non-sprouted), common beans, and carrot powder, was added to a cooking metal pan and stir constantly during cooking. It was kept stirring over medium heat for 20 minutes, or until the desired consistency was reached. Finally, the prepared porridge was cooled to a mild temperature and served for panelists with plastic plates.

#### F. Sensory evaluation

A semi-trained panelists consisting of twenty-five individuals, selected from among mothers and employees of the Melkassa Agricultural Research Center in Ethiopia, evaluated the sensory acceptability of developed porridge samples. Panelists used a five-point hedonic scale to evaluate the acceptability of porridge's sensory qualities, including color, aroma, taste, texture, and overall acceptability [35]. Five point hedonic scales were as follows: 5 = Like very much, 4 = Like, 3 = Neither like nor dislike, 2 = Dislike, and 1 = Dislike very much. The porridge products cooled to a mild temperature were served for panelists with plastic plates.

#### G. Statistical Analysis

The collected data for composite porridge samples are analyzed using SAS software. One way analysis of variance (ANOVA) is being computed during statistical data analysis. The critical difference at  $p < 0.05$  was estimated and utilized to find significant differences among the sample mean.

#### A. Proximate composition

Results indicated in Table 2 showed the proximate composition of finger millet based composite porridge. Moisture content is an indication of how much the product is shelf-stable, desirable in appearance, keeping quality and yield [36]. All values of Moisture content for composite flour, obtained in the present study was below 11% which indicates its suitability for long time storage. Products with the low moisture content are shelf stable as growth and development of moisture dependent mould and biochemical reactions are lowered [37].

Ash content is an indication of total minerals present in any food sample. There were significant differences ( $P < 0.05$ ) among some ash values recorded for porridge formulated from finger millet based composite flour. Ash content of the composite porridge in the present study was increased as the incorporation level of common beans increased. As observed from the table 2 the highest content of ash ( $3.45 \pm 0.03$ ) was recorded in composite flour contained 40% finger millet, 37% common bean, 8% malted finger millet and 15% of carrot powder while the lowest content of ash content ( $2.82 \pm 0.04$ ) was recorded in 100% finger millet flour.

This indicates that composite flour consisting of a high amount of common beans contained the highest total mineral value. Total ash content ( $2.82 \pm 0.04$  to  $3.45 \pm 0.03$ ) of the composited flour obtained the present study was slightly higher than that of reported by Martha and Wenaty, [38] for complementary porridge formulated from yellow maize, pumpkin seeds, soybeans and carrots composite flour. This difference might be attributed to the variation in ingredients ratio and their mineral composition. Protein is an important macronutrient for repairing the damaged cell and tissues, as well as helps growth and development of the infant and young children.

The result indicated in Table 2 showed that the highest protein content ( $13.17 \pm 0.04$ ) was recorded for a composite flour consisting 40% of finger millet and 37% of common bean flour. Protein content of composite ingredients increased as the common bean incorporation levels increased [39]. Current study was in agreement with the protein content reported by Anila Kumari et al., [39] for malted sorghum and maize flour. Increases in protein content of flour milled from sprouted wheat and legumes were also reported in previous studies [40,41].

There were significant differences ( $P < 0.05$ ) among crude fat content of composite flours. Complementation of finger millet with common beans and carrot flour didn't improve the fat content of the formulated composite flour. As can be observed from table 2, the highest crude fat content ( $1.65 \pm 0.05$ ) next to the fat content of 100% finger millet flour was recorded in composite flour contained 70% finger millet, 7% common bean, 8% malted finger millet and 15% of carrot powder while the lowest content of crude fat ( $1.39 \pm 0.02$ ) was recorded in composite flour contained 40% finger millet, 37% common bean, 8% malted finger millet and 15% of carrot powder.

The results of the present study demonstrated that the crude fiber contents of finger millet based composite porridge was significantly ( $P < 0.05$ ) reduced as inclusion levels of common

beans increased (Table 2). The composite porridge prepared from the lowest level of common beans had the highest crude fiber content (8.82±0.09). The average crude fiber content of composite porridge in the present finding was higher than that of composite flour prepared from wheat, chick pea, finger millet and barley [42]. This might be attributed to the variation of the incorporated levels of ingredients utilized in the preparation of composite porridge in the current study.

The present study revealed that the utilizable carbohydrate content of composite porridge significantly ( $P < 0.05$ ) decreased due to the increment of common beans ingredient ratios. Accordingly, the highest utilizable carbohydrate content (67.79±0.19) recorded for porridge prepared from 70% of finger millet, 8% malted finger millet, 7% common beans and 15% of

carrot flour where as the lowest utilizable carbohydrate content (64.24±0.15) was noted for composite porridge consisting of 40% finger millet, 37% common beans, 8% malted finger millet and 15% of carrot flour.

The utilizable carbohydrate contents of developed finger millet based composite porridge were in the range (60% -75%) recommended by Codex Alimentarius Commission's [27]. Statistically, non-significant ( $P > 0.05$ ) difference was observed among the energy value of finger millet based composite porridge. This revealed that energy values of the finger millet based composite porridge in the present study might not be enhanced with the inclusion levels of common beans, and carrot flour.

TABLE II. PROXIMATE COMPOSITION IN DRY WEIGHT BASIS (% dwb) OF COMPOSITE PORRIDGE

FM (%)	Malted FM (%)	CB (%)	Carrot (%)	Moisture	Ash	Protein	Crude fat	Crude fiber	Utilizable CHO	Energy (Kcal/100g)
100	0	0	0	10.6±0.29 <sup>a</sup>	2.82±0.04 <sup>d</sup>	8.33±0.05 <sup>i</sup>	1.89±0.01 <sup>a</sup>	8.86±0.11 <sup>a</sup>	67.95±0.31 <sup>a</sup>	322.20±1.49 <sup>a</sup>
55	8	22	15	10.16±0.19 <sup>b</sup>	3.26±0.08 <sup>bc</sup>	11.06±0.05 <sup>d</sup>	1.48±0.02 <sup>de</sup>	8.42±0.04 <sup>d</sup>	65.99±0.17 <sup>e</sup>	321.50±0.70 <sup>a</sup>
44	8	33	15	9.98±0.16 <sup>bc</sup>	3.38±0.10 <sup>ab</sup>	12.58±0.02 <sup>b</sup>	1.39±0.01 <sup>f</sup>	8.1667±0.03 <sup>ef</sup>	64.793±0.22 <sup>f</sup>	322.06±0.89 <sup>a</sup>
66	8	11	15	10.23±0.14 <sup>b</sup>	3.17±0.03 <sup>c</sup>	9.43±0.04 <sup>g</sup>	1.57±0.01 <sup>c</sup>	8.69±0.06 <sup>b</sup>	67.36±0.20 <sup>b</sup>	321.32±0.78 <sup>a</sup>
70	8	7	15	10.19±0.16 <sup>b</sup>	3.16±0.04 <sup>c</sup>	8.87±0.02 <sup>h</sup>	1.65±0.05 <sup>b</sup>	8.82±0.09 <sup>a</sup>	67.79±0.19 <sup>a</sup>	321.50±0.87 <sup>a</sup>
62	8	15	15	9.98±0.22 <sup>bc</sup>	3.24±0.02 <sup>bc</sup>	10.06±0.03 <sup>f</sup>	1.58±0.04 <sup>c</sup>	8.59±0.05 <sup>bc</sup>	66.85±0.18 <sup>c</sup>	321.82±0.86 <sup>a</sup>
59	8	18	15	10.057±0.11 <sup>bc</sup>	3.29±0.04 <sup>bc</sup>	10.47±0.05 <sup>e</sup>	1.51±0.03 <sup>d</sup>	8.55±0.07 <sup>c</sup>	66.49±0.17 <sup>d</sup>	321.46±0.81 <sup>a</sup>
47	8	30	15	9.84±0.07 <sup>c</sup>	3.23±0.21 <sup>bc</sup>	12.13±0.04 <sup>e</sup>	1.45±0.03 <sup>e</sup>	8.23±0.04 <sup>e</sup>	65.15±0.22 <sup>f</sup>	322.17±1.07 <sup>a</sup>
40	8	37	15	10.09±0.18 <sup>b</sup> <sub>c</sub>	3.45±0.03 <sup>a</sup>	13.17±0.04 <sup>a</sup>	1.39±0.02 <sup>f</sup>	8.07±0.05 <sup>f</sup>	64.24±0.15 <sup>g</sup>	322.22±0.91 <sup>a</sup>

Note: FM=finger millet flour, CB= Common bean flour, CHO, Carbohydrate, Means ± standard deviation, Means within same column followed by the different letters are showed statistically significant ( $P < 0.05$ ) difference.

### B. Sensory attributes of porridge

The results of sensory attributes for prepared finger millet based composite porridge were presented in Table 3. Color is an important sensory attribute for determining the marketability and consumers preference for developed food products. The present study found that the highest color attributes for composite porridge prepared from 70% finger millet, 7% common bean, 8% malted finger millet and 15% carrot flour. The scores of color attributes for all developed composite porridge in the present study revealed that the products were

preferred by panelists. Carrot flour is attributed to the color quality of porridge. Polyphenolic compounds and fatty acids are responsible for formation of food aroma.

Statistically, incorporation levels of used ingredients in this study had a significant effect ( $p < 0.05$ ) on aroma attributes for composite porridge. Accordingly, the highest average aroma value (3.50 ±0.43) was recorded for composite porridge consisting of 47% finger millet, 30% common bean, 8% malted finger millet and 15% carrot flour where as the lowest aroma scores (2.78 ±0.27) was noted for porridge developed from

100% finger millet flour. The result of the aroma score obtained in the present study is in line with that of porridge formulated from malted pregelatinized maize, soyabean and carrot flour [43]. The statistical analysis showed that there were non-significant differences ( $P > 0.05$ ) between texture, and taste of the developed composite porridge.

The highest average score in texture, and taste was noted for composite porridge developed from 70 % finger millet, 7% common bean, 8% malted finger millet and 15% of carrot flour. Statistically, overall acceptability score in the current study showed the significant variation ( $p < 0.05$ ) among some

proportions utilized in the porridge production. Composite porridge contained the lowest percentage of common beans had the highest ( $4.00 \pm 0.43$ ) score in overall acceptability while that had 55% finger millet, 22% common beans, 8% malted finger millet and 15% of carrot flour showed the lowest ( $3.16 \pm 0.19$ ) score in overall acceptability. Similar finding was reported for overall acceptability of complementary food prepared from maize, plantain and soybeans based composite flour [44]. The present finding revealed that composite porridge having an enhanced taste, texture and overall acceptability were developed by incorporation of common beans, malted finger millet and carrots to finger millet.

TABLE III. SENSORY CHARACTERISTICS OF FINGER MILLET BASED COMPOSITE PORRIDGE

FM (%)	Malted FM(%)	CB (%)	Carrot (%)	Color	Aroma	Texture	Taste	Over all acceptability
100	0	0	0	$3.16 \pm 0.43^{abc}$	$2.78 \pm 0.27^d$	$3.08 \pm 0.50^a$	$3.25 \pm 0.31^a$	$3.25 \pm 0.56^b$
55	8	22	15	$3.16 \pm 0.43^{abc}$	$2.91 \pm 0.16^c$	$3.08 \pm 0.31^a$	$3.25 \pm 0.31^a$	$3.16 \pm 0.19^b$
44	8	33	15	$3.16 \pm 0.33^{abc}$	$3.25 \pm 0.31^{ab}$	$4.00 \pm 0.19^a$	$3.25 \pm 0.41^a$	$4.00 \pm 0.31^a$
66	8	11	15	$3.16 \pm 0.19^{abc}$	$3.16 \pm 0.19^{ab}$	$3.16 \pm 0.19^a$	$3.00 \pm 0.27^a$	$3.16 \pm 0.33^b$
70	8	7	15	$4.00 \pm 0.56^a$	$3.08 \pm 0.41^{ab}$	$4.00 \pm 0.43^a$	$4.00 \pm 0.41^a$	$4.00 \pm 0.43^a$
62	8	15	15	$4.00 \pm 0.31^{ab}$	$3.16 \pm 0.19^{ab}$	$4.00 \pm 0.19^a$	$3.16 \pm 0.43^a$	$4.00 \pm 0.27^a$
59	8	18	15	$3.00 \pm 0.31^c$	$2.94 \pm 0.19^c$	$4.00 \pm 0.50^a$	$3.16 \pm 0.57^a$	$4.00 \pm 0.33^a$
47	8	30	15	$3.08 \pm 0.31^{abc}$	$3.50 \pm 0.43^a$	$3.16 \pm 0.19^a$	$3.33 \pm 0.47^a$	$3.33 \pm 0.38^b$
40	8	37	15	$3.25 \pm 0.56^{abc}$	$3.00 \pm 0.47^b$	$3.25 \pm 0.41^a$	$3.16 \pm 0.43^a$	$3.41 \pm 0.56^b$

Note: FM=finger millet flour, CB= Common bean flour, Means  $\pm$  standard deviation, Means within same column followed by the different letters are statistically significant ( $P < 0.05$ ) difference .

#### IV. CONCLUSION

The study evaluated proximate composition and sensory acceptability of finger millet-based composite porridge. Incorporating common bean and carrot to the finger millet were resulted in an enhancement of proximate composition, and sensory acceptability of composite porridge. Ash and protein content of the composite porridge were increased as common bean incorporation levels increased. The highest value of ash and crude protein content were noted with more common beans inclusion, at 37% common beans incorporated levels. The present finding also revealed that crude fat, fiber and carbohydrates were decreased with increased added common beans.

In addition, the sensory attributes of finger millet based composite porridge were improved by blending ratio. Consequently, incorporation of carrot and malted finger millet in the composite porridge contributed to the enhancement of its

taste, color and aroma. The study showed that porridge made from 70% finger millet, 7% common bean, 8% malted finger millet, and 15% carrot flour, was highly preferred by panelists in terms of color attributes. Furthermore, the highest score of aroma was recorded for composite porridge prepared from a mix of 47% finger millet, 30% common bean, 8% malted finger millet, and 15% carrot flour. There were no significant differences in texture, and taste attributes. It is recommended to add common beans, malted finger millet, and carrot in the production of finger millet based composite porridge with improved nutrients and sensory qualities. Further study is required to evaluate these ingredients in the production of gruels and other alternative value added food products.

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