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Production of Noodles from Composite Flour and it is Nutritional and Sensory Characteristics

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Abstract

Wheat flour is widely used in many food industries involving noodles. Therefore, noodles are an important part in the diet of many countries around the world. The objective of this study was to assess the nutritional and sensory characteristics of wheat-sorghum and Wheat-millet enhanced with guar flour for noodles production. The noodles were prepared as Daber-noodle and millet-noodle by mixing wheat flour to Daber or millet flours to obtain a mixture of 10%, 20% and 30% noodles) compared to control (Nobo). The falling number of wheat flour was 441, wet gluten was 32±0.01%, and dry gluten was 22±0.3%. As the concentration of millet and Daber flour increased in the prepared noodles, the moisture, ash, oil and protein contents consequently increased, while the case was reversed in carbohydrate contents. In the millet-noodle, and at the mixture of 10%, 20% and 30%, Na were 0.23, 0.31 and 0.31 mg/100g, respectively, while were 0.18, 0.24 and 0.25 mg/100g in Daber-noodle, whereas potassium content, at the same mixtures were 0.25, 0.22 and 0.32 mg/100g, respectively, in the millet-noodle, and 0.20, 0.29 and 0.29 mg/100g, respectively, in Daber-noodle. It seemed that control-noodle sample was more acceptable followed by Daber-noodle samples while the millet-noodle samples were the last choice for the panellists. ANOVA proved that the different noodle samples were statistically significant, i.e. some samples are highly preferred by panellists while others are fairly accepted. Further studies should concern adding some additives to improve acceptability for millet-noodle and Daber-noodle.

Keywords: Noodles, Millet, Sorghum, Sensory analysis, Minerals content, Nutritional value.

INTRODUCTION

Wheat flour noodles are an imperative part in the eating regimen of numerous Asians. It is trusted that noodles started in China as right on time as 5000 BC, at that point spread to other Asian nations. Today, the measure of flour utilized for noodle making in Asia represents about 40% of the aggregate flour devoured. As of late, Asian noodles have likewise turned out to be prevalent in numerous nations outside of Asia. This prevalence is probably going to increment [1]. This announcement is composed to give data on plan, preparing advances, and other related parts of Asian noodles. Millets are a gathering of very factor little seeded grasses, broadly developed far and wide as oat harvests or grains for feed and human nourishment. Millets are essential yields in the semiarid tropics of Asia and Africa (particularly in India, Sudan, Mali, Nigeria, and Niger), with 97% of millet creation in creating nations [2]. Noodles are a staple nourishment in numerous societies produced using unleavened batter which is extended, expelled, or folded level and cut into one of an assortment of shapes. While long, thin strips might be the most widely recognized, numerous assortments of noodles are cut into waves, helices, cylinders, strings, or shells, or collapsed over, or cut into different shapes. Noodles are typically cooked in bubbling water, now and then with cooking oil or salt included. They are regularly sautéed or broiled. Noodles are regularly presented with a going with sauce or in soup. Noodles can be refrigerated for transient stockpiling or dried and put away for some time later. The material creation or ecocultural starting point must be indicated while talking about noodles. The word gets from the German word Nudel [3]. Guar gum, likewise called guaran, is a substance produced using guar a bean which has thickening and balancing out properties helpful in different ventures, customarily the sustenance business and, progressively, the water powered cracking industry. The guar seeds are dehusked, processed and screened to acquire the guar gum. It is ordinarily created as a free-streaming, grayish powder. It is classed as a galactomannan [4]. Sorghum bicolor, generally called sorghum and furthermore known as extraordinary millet, durra, jowari, or milo, is a grass species developed for its grain, which is utilized for nourishment for people, creature feed, and ethanol generation. Sorghum began in northern Africa and is currently developed generally in tropical and subtropical districts. Sorghum is the world's fifth-most

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imperative grain edit after rice, wheat, maize, and grain. S. bicolor is regularly a yearly, however a few cultivars are lasting. It develops in clusters that may reach more than 4 m high. The grain is little, extending from 2 to 4 mm in width. Sweet sorghums are sorghum cultivars that are fundamentally developed for foliage, syrup creation, and ethanol; they are taller than those developed for grain [5]. Wheat flour noodles are an imperative part in the eating routine of numerous Asians. It is trusted that noodles origi¬nated in China as ahead of schedule as 5000 BC, at that point spread to other Asian nations. This fame is probably going to increment. This announcement is composed to give data on definition, preparing advances, and other related parts of Asian noodles. It is a without gluten oat which bears essentialness in the present-day situation where the event of Celiac Disease (CD), an immunological reaction to gluten narrow mindedness is on the ascent. Grain sorghum contains phenolic mixes like flavonoids which have been found to restrain tumor advancement. The starches and sugars in sorghum are discharged more gradually than in different grains, and thus it could be helpful to diabetics. The objective of the current study was to produce of noodles from composite flour, and it is nutritional and sensory characteristics.

MATERIALS AND METHODS

Wheat flour, millets, *Sorghum bicolor* (Daber), guar, edible oil and custard, were purchased from a local market in Wad Medani City, Gezira State, Sudan, and then transferred to the laboratory of food analysis, Department of Food Engineering and Technology, Faculty of Engineering and Technology, University of Gezira, Sudan. All other chemicals and reagents were of the highest grade commercially available.

Preparation of noodles

The noodles were prepared (Figure 1) as Daber-noodle and millet-noodle compared to "Nobo" noodle as a control. The basic processing steps for noodles involve mixing 450 g, 400 g and 350 g of wheat flour to 50, 100 and 150, respectively, of Daber or millet flours (to obtain mixture of 10%, 20% and 30% noodles, respectively) in addition to guar gum (0.5 g), custard (small spoon), 20 mL groundnut oil, and 250 mL water.

Wheat -Sorghum +Peanut+ Guar flour +Water

⇩

Mixing /Blending

⇩

Kneading / Sheeting

⇩

Resting

⇩

Cutting

⇩

Drying

⇩

Noodles

⇩

Noodles

Figure 1: Noodle processing procedure

Mixtures were then sheeted to dough into a specified thickness and slitting into noodle strands. Noodle drying was achieved by air drying that takes 5-8 hours.

Gluten content

Wet gluten content was determined by washing the flour sample by a salt solution to remove the starch and other soluble from the sample . The residue remaining after washing was the wet gluten. This determination was adapted according to the AACC [6]. A 10 g sample was weighed and placed into the glutamic washing chamber on top of the polyester screen. The sample was mixed and washed with 2% salt solution (NaCl) for 5 minutes. At the end of the wash cycle, the wet gluten was removed from the washing chamber, placed in the centrifuge holder, and centrifuged. The residue retained on top of the screen and through the screen was weighed to get total gluten. Wet gluten content results were expressed as a percentage on 14% moisture basis. It was then dried in a heater to give the dry gluten. Calculation of wet, dry, and gluten index was as follows: wet gluten % = (total gluten (g)/ sample weight (g)) × 100, Dry gluten % = (weight of dry gluten (g)/ sample weight (g) ×100.

Falling number

Falling number method determines α – amylase activity using the starch in the sample as a substrate. The method of falling number weight 7.0 g of the flour and added 25 ml distilled water and fit a rubber stopper onto the tube and mix to obtain a homogenous suspension, remove the stopper and the place the viscometer stirrer. Scarping into the suspension any flour adhering to the walls of the tube. The tube with stirrer into the boiling water bath within 20 seconds after mixing swing the motor unit immediately into its working position above the viscometer tube and viscometer. The apparatus has built-in functions to carry out the test automatically from now on. The red light and bumper indicate the conclusion of the test. Swing back the motor unit by releasing the lever at the back. The beeper stops and the cuter show the falling number value remote the viscometer tube wash the tube and stirrer. Read the falling number from the cuter display.

Chemical analysis

Moisture content

Moisture determination was conducted using the AOAC [7]. Disposable aluminium weighing dishes, (<50 mm diameter and <40 mm deep) which had been numbered, dried in the oven for 30 minutes, cooled in a desiccator and weighed again were used. A two-g sample was weighed out and repeated in triplicate. Using tongs, aluminium weighing dishes containing the samples were placed in an air-drying oven at 130° C for about one hour. The samples were removed and placed in a desiccator to cool for 30 minutes and reweighed. The moisture content was calculated according to the following equation:

$$\text{Moisture Content} = \frac{W_1 - W_2}{\text{Moist samples weight}}$$

Where:

W_1= weight of dish and dry sample.
W_2=weight of the dish.

Protein Content

Protein content was determined according to the Kjeldahl method described by (AOAC [8]). Two grams of each sample were placed in digestion flask (500 ml), KSO_4 was added to it. Then 25 ml of concentrated sulfuric acid was added, and the content was heated at 35˚C in a fume cupboard until a clear solution was obtained (2-3 hours) and left to cool before those antidumping granules were added. The digested samples were poured in a volumetric flask (100 ml) and diluted to 100 ml with distilled water. Five ml were distilled using 10 ml of 40% NaOH, 25 ml of boric acid with drops of methyl red were placed in a conical flask. Distillation of the reaction mixture liberated ammonia and reacted with boric acid, changing the colour from red to light greenish blue. Excess alkali was then titrated using 0.1 N hydrochloric acid until colour changed to light purple. The titration reading was reported. The protein content was determined by multiplying the percentage nitrogen by empirical factor 6.36; as follow:

$$N\% = \text{Volume of HCl} \times N \times 14 \times \frac{\text{dilution factors}}{1000 \times \text{weight of sample}} \times 100$$

Protein % = N% × 6.63
Where: 14 = the molecular weight of nitrogen
N = Normality of acid of HCl.

Ash content

The ash content was determined according to the AOAC (2000) using muffle furnace. Four grams of the sample was weighed and repeated in triplicate into porcelain crucibles, which have been ignited, cooled in a desiccator and weighed and placed in a cool electric muffle furnace. The temperature was 540°C overnight for complete ashing. The ash crucibles were transferred directly into a desiccator, then cooled for 30 minutes and weighed immediately. The ash was determined by calculation and expressed as a percentage using the equation:

$$\text{Total ash (\%)} = = \frac{\text{Ash weight}}{\text{Sample weight}} \times 100$$

Fat content

The fat content was determined according to the AOAC (2000) with some modification. Oil was extracted by petroleum ether (PE) on a Goldfish extractor. Samples of 2 g in triplicate were wrapped in filter paper and placed in a cellulose thimble condenser. 40 ml of the solvent PE were added to the weighed Goldfish beakers. The extraction was carried out for 4 hours until all the soluble components of the sample were removed. Burners were allowed to cool for 30 minutes then the beakers were moved to a tray, covered with an evaporation-type watch glass, and set in a hood to allow all ether to evaporate overnight. The air oven removed the traces of solvent at 130° C for 15 minutes; cooled in a desiccator for 30 minutes and re-weigh. The fat content was calculated according to the following equation:

$$\text{Crude fat \%} = \frac{\text{Weight of oil extracted}}{\text{Weight of sample}} \times 100$$

Total carbohydrates

The number of carbohydrates was calculated by difference. The values refer to “total carbohydrate by difference” that is, the sum of the figures for moisture (MC%), protein (PC %), fat (FC %), and ash (Ash %) are subtracted from 100.

Total Carbohydrate % = 100 – [MC% + PC% + FC% + Ash C%].

Minerals

According to AOAC [7], samples were dried and ashed at 525°C for 4 hours. The ash was dissolved in (1 ml hydrochloric acid + 3 ml distilled water) and a few drops of nitric acid, brought to a final volume of 250 ml with distilled water and filtered. Sodium and calcium were determined by flame atomic absorption spectroscopy.

Sensory evaluation

Sensory evaluation was performed using the Triangle test through a questionnaire (Appendix, 1) and then a 10-member (panellists) to measure colour, appearance, flavour, taste and overall acceptability. A hedonic scale of 1 to 9 was used; 1: extremely bad, 2: very bad, 3: bad, 4: fairly bad, 5: satisfactory, 6: fairly good, 7: good, 8: very good, 9: excellent.

Statistical analysis

The analysis of variance (ANOVA) was performed to examine the significant level in all parameters measured. (SPSS) The test was used to separate between the means. All analyses were performed in triplicate (n = 3). The level of significance was 0.005.

RESULTS AND DISCUSSION

Falling number

As shown in Table 1, the falling number of wheat flour was 441. The falling number of wheat flour in this study was lower than the falling number of wheat flour obtained by Mariam *et al*., [9] which was 536.4. Also, the falling number of wheat flour was lower than that obtained in the study of Salim *et al*., [10] which was 521.

Table 1: Falling number, wet and dry gluten of wheat flour

Parameters	Value
Falling number	441±0.03
Wet gluten (%)	32±0.01%
Dry gluten (%)	22±0.30%

Values are means ± standard deviations of 3 determinations.

Gluten content

The results of gluten content of wheat flour were shown in Table 1, for wet gluten and dry gluten of wheat flour was 32±0.01% and 22±0.3%, respectively. These results were higher than that reported by Huebner and Rothfus, [11] who concluded that dry gluten from different cultivars of hard wheat ranged between 9 to 11%. Gluten can be defined as a composite of storage proteins termed prolamins and glutelin’s and stored together with starch in the endosperm (which nourishes the embryonic plant during germination) of various grass-related grains. Gluten is found in wheat, barley, rye, oat [12], related species and hybrids like spelt, Khorasan, emmer, einkorn, triticale, kamut, etc.) and products of these such as malt. Gluten is appreciated for its viscoelastic properties. It gives elasticity to dough, helping it rise and keeps its shape and often gives the final product a chewy texture [13].

Proximate composition of the prepared noodles

The moisture content of the noodles millet and which have been added millets 10%, 20% and 30% were 3.7 %, 4.5% and 8.3%, respectively, while those of Daber-noodles were 5%, 5.6% and 8.6%, respectively (Table 2). These results showed that, as the concentration of millet and Daber flour increased in the prepared noodles, the moisture content consequently increased. The ash content in millet-noodle were 4.9%, 4.96% and 4.96%, while those of Daber-noodle were 0.3%, 0.3% and 0.5%, respective for the concentration of 10%, 20% and 30%. The increase in the ash content did not exceed 0.06% in millet-noodle and 0.2% in the Daber-noodle. The protein content corresponding to concentrations of 10%, 20% and 30% were 6.5%, 12.0% and 17.5% in millet-noodle, while they were 8.5%, 16.6% and 17.5%, in Daber-noodle. This result proved that, as the concentration of millet and Daber flour increased in the prepared noodles, the protein content also increased. The fat content in millet-noodles at concentration of 10%, 20%, and 30% were 1.5%, 1.6% and 1.9%, respectively. The corresponding fat contents in Daber-noodle were 0.9%, 1.3% and 1.7%, respectively. There was an obvious increase in the oil contents in the prepared noodles as the concentration of millet and Daber flour increased. The fiber content in millet-noodles at concentration of 10%, 20%, and 30% were 0.2%, 0.5% and 0.9%, respectively. The corresponding fiber contents in Daber-noodle were 0.1%, 0.3% and 0.7%, respectively. The obvious increase in the fibre contents was correlated to the increase of the millet and Daber flour in the noodles. Carbohydrates content at the mixture of 10%, 20% and 30% were 83.7%, 76.0% and 65.8%, in millet-noodle and were 85.0%, 75.5% and 70.4%, in Daber-noodle, respectively. The obvious decrease in the carbohydrate contents was correlated to the increase of millet and Daber flour in the prepared noodles. In millet, protein content was 10.6%, the fiber was 1.3%, and ash content was 2.3 (USDA National Nutrient Database, 2015) while sorghum contains 6.3% fibre, 3.3% fat, 11.3% protein and 74.6% carbohydrates (National Research Council, 1996).

Table 2: Proximate analysis for millets and Daber Noodles

%	Moisture		Ash		Protein		Fibre		Oil	
	M	D	M	D	M	D	M	D	M	D
10	3.7±0.10	5±0.01	4.9±0.17	0.3±0.41	6.5±0.15	8.5±0.15	0.2±0.10	0.1±0.15	1.5±0.11	0.9±0.12
20	4.5±0.11	5.6±0.18	4.96±0.18	0.3±0.42	12±0.71	16.6±0.12	0.5±0.11	0.3±0.18	1.6±0.10	1.3±0.10
30	8.3±0.13	8.6±0.13	4.96±0.12	0.5±0.31	17.5±0.31	17.5±0.11	0.9±0.13	0.7±0.21	1.9±0.11	1.7±0.11

M = Millet-noodle, D = Daber-noodle, values are means ± standard deviations of 3 determinations

Table 3: Minerals (sodium and potassium) in Millets and Daber Noodles

%	Sodium		Potassium	
	M	D	M	D
10	0.23±0.71	0.18±0.10	0.25±0.41	0.20±0.11
20	0.31±0.41	0.24±0.18	0.22±0.14	0.29±0.10
30	0.31±0.81	0.25±0.31	0.32±0.15	0.29±0.19

M = Millet-noodle, D = Daber-noodle, values are means ± standard deviations of 3 determinations.

Table 4: Sensory evaluation of the prepared noodle samples

Sample	N	Colour	Texture	Flavour	Appearance	Taste	Overall
Control	10	8.60	8.50	8.70	8.60	8.80	8.40
Millet 10%	10	5.50	6.20	700	6.30	7.10	6.10
Millet 20%	10	5.80	6.30	7.20	6.20	7.20	6.40
Millet 30%	10	6.20	6.00	7.00	6.00	7.00	6.30
Daber 10%	10	6.30	6.50	6.10	6.50	6.80	6.70
Daber 20%	10	6.70	6.40	7.00	6.90	6.40	7.00
Daber 30%	10	5.80	6.60	6.50	6.80	6.80	6.30

Table 5: Analysis of variance of sensory evaluation of the prepared noodle samples

Character		SS	df	MS	F	Sig.
Color	Between Groups	65.09	6	10.85	4.27	0.001
Texture		42.57	6	7.10	4.78	0.000
Flavour		39.54	6	6.59	4.46	0.001
Appearance		45.77	6	7.63	4.41	0.001
Taste		35.57	6	5.93	5.07	0.00
Overall		37.37	6	6.23	3.92	0.002

Minerals (Na and K) composition of the prepared noodles

Sodium (Na) and potassium (K) content (in mg/100g) in the prepared millet-noodle and Daber-noodle were presented in Table 3. At the mixture of 10%, 20% and 30%, Na was 0.23, 0.31 and 0.31, respectively, in the millet-noodle, while were 0.18, 0.24 and 0.25, respectively, in Daber-noodle. Concerning potassium content, at the mixture of 10%, 20% and 30%, it was 0.25, 0.22 and 0.32, respectively, in the millet-noodle, while it was 0.20, 0.29 and 0.29, respectively, in Daber-noodle. The mineral contents are usually associated with the ash content Micheal *et al* [14]. The same trend was observed by Taneya *et al* [15] on the preparation of instant noodles from wheat flour supplementing with sweet potato flour.

Sensory evaluation of the prepared noodles

Sensory mean scores of controls, millet-noodle (10%, 20% and 30%), and Daber-noodle (10%, 20% and 30%) were presented in Table 4. All evaluated characters (colour, texture, flavour, appearance, taste and overall acceptability) ranged between 8.40 – 8.80 (judged between very good and excellent). The sensory evaluation of millet-noodle revealed that, the mixture of 10% scored between 5.50 (color) to 7.10 (taste) and the mean overall acceptability of 6.10 (about fairly good), while the mixture of 20% scored between 5.80 (color) to 7.20 (taste and flavor) and the mean overall acceptability of 6.40 (about fairly good), whereas the mixture of 30% scored between 6.00 (texture and appearance) to 7.00 (flavour and taste) and the mean overall acceptability of 6.30 (about fairly good).

The sensory evaluation of Daber-noodle revealed that, the mixture of 10% scored between 6.10 (flavor) to 6.80 (taste) and the mean overall acceptability of 6.70 (nearly good), while the mixture of 20% scored between 6.40 (texture and taste) to 7.00 (flavor) and the mean overall acceptability of 7.00 (good), whereas the mixture of 30% scored between 6.80 (colour) to 6.80 (appearance and taste) and the mean overall acceptability of 6.30 (about fairly good). It seemed that control-noodle sample was more acceptable than the other samples followed by the Daber-noodle samples while the millet-noodle samples were the last choice for the panellists of analysis of variance (ANOVA) showed that, the judge of the panellists for the different noodle samples were statistically significant ($P<0.005$), indicating that some samples are highly preferred by panellists while others are fairly accepted (Table 5).

CONCLUSION

The falling number of wheat flour was 441, wet gluten was 32±0.01%, and dry gluten was 22±0.3% As the concentration of millet and Daber flour increased in the prepared noodles, the moisture, ash, oil and protein contents consequently increased, while the case was reversed in carbohydrate contents. In the millet-noodle, and at the mixture of 10%, 20% and 30%, Na were 0.23, 0.31 and 0.31, respectively, while were 0.18, 0.24 and 0.25 in Daber-noodle, while potassium content, at the same mixtures were 0.25, 0.22 and 0.32, respectively, in the millet-noodle, and 0.20, 0.29 and 0.29, respectively, in Daber-noodle. It seemed that control-noodle sample was more acceptable than the other samples followed by the Daber-noodle samples while the millet-noodle samples were the last choice for the panellists. ANOVA proved that the different noodle samples were statistically significant, i.e. some samples are highly preferred by panellists while others are fairly accepted.

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