SENSORY EVALUATION OF NEWLY DEVELOPED MILLET CEREAL MIX

TECHNICAL REPORT SUBMITTED TO CSIR-FOOD RESEARCH INSTITUTE

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1.0 Introduction

Millets are small-seeded with different varieties such as pearl millet (*Pennisetum glaucum*), finger millet (*Eleusine coracana*), kodo millet (*Paspalum setaceum*), proso millet (*Penicum miliaceum*), foxtail millet (*Setaria italic*), little millet (*Panicum sumatrense*), and barnyard millet(*Echinochloautilis*). They are known as coarse cereals beside maize (*Zea mays*), sorghum (*Sorghum bicolor*), oats (*Avena sativa*), and barley (*Hodeum vulgare*) (Bouis 2000; Kaur and others 2012). The world total production of millet grains at last count was 762712 metric tons and the top producer was India with an annual production of 334500 tons (43.85%) (FAO 2012).

In addition to their cultivating advantages, millets were found to have high nutritive value and comparable to that of major cereals such as wheat and rice (Parameswaran and Sadasivam 1994). It contains about 92.5% dry matter, 2.1% ash, 2.8% crude fiber, 7.8% crude fat, 13.6% crude protein, and 63.2% starch (Ali and others 2003). It has also been reported that millet proteins are good sources of essential amino acids except lysine and threonine but are relatively high in methionine. Millets are also rich sources of phytochemicals and micronutrients (Mal and others 2010; Singh and others 2012). For example, pearl millet was found significantly rich in resistant starch, soluble and insoluble dietary fibers, minerals, and antioxidants (Ragaee and others 2006). Health benefits such as cancer and cardiovascular diseases prevention, tumor reduction incidence, lowering blood pressure and risk of heart diseases, reducing cholesterol and rate of fat absorption, delaying gastric emptying, and supplying gastrointestinal bulk have been reported for millet (Truswell 2002; Gupta and others 2012).

Millet grains, before consumption and for preparing of food, are usually processed by commonly used traditional processing techniques include decorticating, malting, fermentation, roasting,

flaking, and grinding to improve their edible, nutritional, and sensory properties. The negative changes in these properties during processing are not avoidable because industrial methods for processing of millets are not as well developed as the methods used for processing of wheat and rice (FAO 2012). Therefore, with value-added strategies and appropriate processing technologies, the millet grains can find a place in the preparation of several value-added and health food-products, which may then result in high demand from large urban populations and non-traditional millet users (Mal and others, 2010).

In Ghana, because of their potential contribution to national food security, millet grains as a food resource have been relatively neglected but are now receiving increasing attention from agriculture and food security policymakers. There is a need for studying the processing, food manufacturing, nutritive value improvement, and potential health benefits of millet grains to promote their utilization as food for in Ghana. The presence of all the required nutrients in millets makes them suitable for large-scale utilization in the manufacture of food products such as baby foods, snack foods, and dietary food and, increasingly, more millet products have entered into the daily lives of people, including millet porridge, millet wine, and millet nutrition powder from both grain and flour form (Subramanian and Viswanathan 2007; Liu and others 2012).

Although potential health benefits and nutritive value of millet grains are comparable to major cereals. Several processing technologies were found to improve nutritional characteristics of millets. Utilization of millet grains as food is still limited to populations in rural areas. This is due to lack of innovative millet processing technologies. This proposal will promote the utilization of millet grains in urban areas to open new markets for farmers to improve their income, developing

highly improved products from millets is needed. Millet can be used in different food formulations for making value added products due to its well-balanced protein profile and gluten free properties. Although the consumption pattern of this millet is specific and continue to remain as such therefore its popularization in the broader range is essential and specific design of foods acceptable to the population can help in promoting the consumption of this millet. Currently almost all cereal mix products in Ghana are produced using maize, soyabean, rice, cowpea and peanut, neglecting millet. Millet is used extensively in a porridge known as Hausa *koko*. The objective of this work was to determine the consumer acceptability of cereal mix prepared using millet and other cereals.

2.0 Methodology

2.1 Materials

The millet, peanuts, soybean and maize were obtained from a local grains market.

2.2 Formulation of three samples of millet cereal mix.

The samples were formulated using different proportions of millet flour, peanuts, soyabean flour and maize flour as shown in Table 1.

Table 1: formulation for millet-cereal mix

Sample	Millet (%)	Peanuts (%)	Soybean (%)	Maize (%)
Formula 1 (100%)	100	5	20	-
Formula 2 (70%)	70	5	20	30
Formula 3 (50%)	50	5	20	50

The unit operations followed in production of individual cereal flour is shown in Figure 1

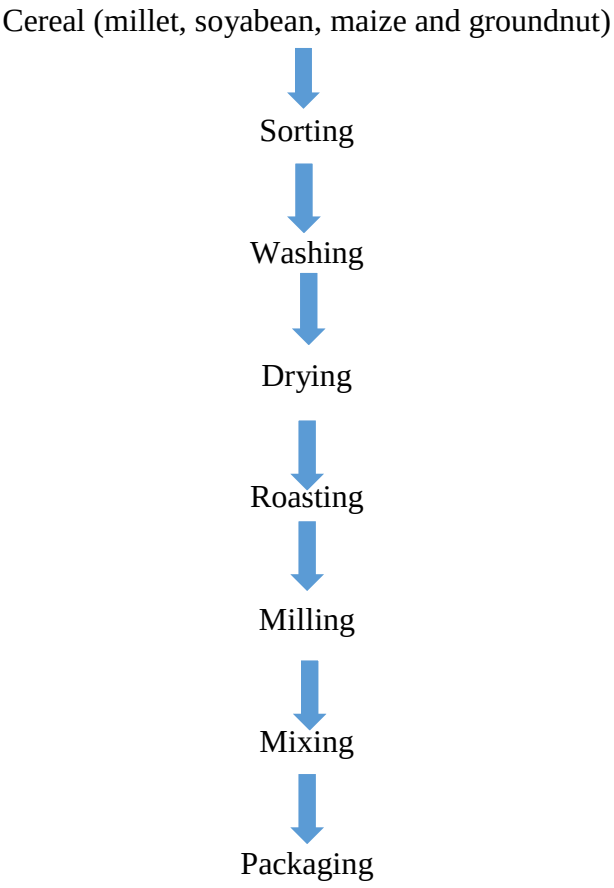

Figure 1: Flow diagram showing the unit operations for the production of cereals

2.3 Preparation of Millet-mix cereal porridge

The ingredients used for the millet mix preparation are millet (500g), salt (2 teaspoons), sugar (120g) and 16 cups of water (4000ml). Ten cups (2500 ml) of water was put into a cooking pot and brought to boil. 6 cups (1500ml) of water was mixed with the millet mix. The slurry was

poured into boiling water and stirred for about 10-15 minutes. Two (2 teaspoons) of salt was added to taste. Sugar was added to the porridge and allowed to cook for 10minutes

2.4 Consumer acceptability of millet-mix cereal porridge

Consumer acceptance test was carried out using 50 consumers recruited from CSIR-Food Research Institute. All selected participants regularly consumed *cereal porridges* at least twice in a week. Each participant evaluated three (3) samples in a randomized order under white fluorescent light at the Sensory Laboratory of the CSIR-Food Research Institute. 50 mls of samples were served. The samples were coded with 3-digit random numbers. A glass of water and sliced cucumber were provided to cleanse the palate between samples. Consumers were asked to provide their liking responses on a 9-point hedonic scale (1 = dislike extremely and 9 = like extremely) for taste, texture, odour and overall acceptability.

3.0 Statistical analyses

Ratings of overall acceptance, appearance, color, aroma, mouth-feel, and taste of each sample were analyzed by analysis of variance (ANOVA) and then Fisher's least significant difference (LSD) procedure with Statistical Analysis Software (SAS, version 9.2, SAS Inst. Inc., Cary, N.C., U.S.A.).

4.0 Results and Discussion

The results for the consumer acceptability scores for millet mix cereal is shown in Table 2. A general trend of a decrease in preference for the cereal mix was observed when the proportion of millet was increased. There were significant differences ($p<0.05$) in the appearance, colour, taste and mouth-feel, especially in formulations that had more than 70% of millet.

Table 2: Mean scores for consumer acceptability of millet cereal mix

	MILLET MIX CEREAL		
Attributes	**50% millet**	**70% millet**	**100% millet**
Appearance	8.0±0.83[a]	7.76±0.96[a]	6.9±1.59[b]
Color	7.92±0.84[a]	7.46±1.14[a]	6.66±1.60[b]
Aroma	7.18±1.31[a]	7.16±1.50[a]	6.9±1.69[a]
Taste	7.38±1.21[a]	6.58±1.57[b]	6.58±1.71[b]
Mouth feel	7.76±0.90[a]	7.26±1.42[ab]	7.06±1.55[b]
Overall acceptability	7.96±1.06[a]	7.22±1.38[b]	6.90±1.83[b]

Mean of scores ± standard deviation. The same letter in a rows means that there are no significant difference at $p<0.05$.

The results show that the appearance was scored 8 (like very much) for both 50% millet and 70% millet mix cereal, but the 100% millet mix was scored 7 (very moderately) (Table 1). Consumers appreciated the color of the 50% millet compared to the others, the same applied to the score for the aroma of the 50% millet mix. In the case of aroma, however, no significant differences ($p>0.05$) existed between the scores for the 3 formulations. The scores for the taste for 70% and 100% millet mix was the same (6.6) but that for 50% was significantly higher (7.4). The mouth-feel for the 50% millet cereal was liked very much, and this was followed by that of the 70% and 50% millet which were moderately liked (Table 1). Generally, the 50% millet mix cereal was highly acceptable, with a score of 7.96 whereas the 70% and 100% millet mix were moderately liked and both obtained a score of 7.

5.0 Conclusion

The 50% millet cereal mix was the most preferred among the three product assessed by the consumers.

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PICTURES

Figure 1: Pictures showing consumers assessing the millet-mix cereal product.