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Acceptability Assessment of *Ugali* Made from Blends of High Quality Cassava Flour and Cereal Flours in the Lake Zone, Tanzania

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Authors' contributions

Authors KEM and KML contributed to concept development, questionnaire design, statistical data analysis and interpretation, manuscript preparation and finalization. Author MNG contributed to concept development and data collection. Author TE contributed to concept development, manuscript preparation and manuscript finalization. Author CC contributed to data collection, data analysis and interpretation, managed the literature and manuscript finalization. All authors read and approved the final manuscript.

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ABSTRACT

Cassava is the most known hunger fighter crop in sub-Saharan African countries during drought and severe famine, its production has been limited to household's consumption and not to commercialization. The aim of this study was to assess consumer acceptability and willingness to pay for blends of high quality cassava flour (HQCF) and refined maize (*sembe*) or unrefined maize (*dona*) or sorghum in Lake Zone. The HQCF was mixed with either *sembe* flour (20:80) or *dona* flour (80:20) or sorghum flour (80:20) separately. *Ugali* made at these ratios of the blends were fed to 129 people (Mwanza n = 60 and Bunda n = 69) and descriptively evaluated sensory properties. It was found that 65.9% of the consumers preferred *ugali* made from blends of HQCF. About 51.2% consumer preferred *ugali* made from blends of HQCF and Sorghum flour and for blends of HQCF and *dona* at (80:20). Consumers willing to pay price between TZS 1000/kg and TZS1500/kg for

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blends of HQCF: *sembe* was 62%, HQCF: sorghum was 61% and HQCF: *dona* was 46%. Marketing expansion opportunities for blends of HQCF and cereal flours are high suggesting the needs for interventions at production, processing and supply to the market.

Keywords: Sensory; dona; sembe; sorghum; Udaga; Mwanza; Bunda.

1. INTRODUCTION

Cereals and cassava flour are affordable and popular ingredients for the preparation of ugali, an important traditional staple diet consumed in many areas of Tanzania [1,2,3]. Ugali is a stiff porridge made from cassava flour or cereal flour or their blends which mixed on boiling water and served with different stews containing various relish like fish, sardines, legumes, cooked green leafy vegetables, soured milk or meat [1,2,3,4]. Four types of cereal flours are most prevalent raw materials for the preparation of *ugali,* these include unrefined maize flour (*dona*), refined maize flour (*sembe*), pearl millet flour, finger millet flour and sorghum flour [2,3,5,6]. *Ugali* prepared from *sembe* is staple diet in urban areas among low, moderate and high incomes population [4,7]. While *ugali* made from *dona* is mostly consumed in village or rural areas although changes in food consumption and dietary patterns are also taking place in these areas [1,2,8,9].

Cassava crop has been undergoing a slow commercial change from a subsistence crop into money making crop for much of East African countries compared to West African countries such as Nigeria and Ghana [10,11,12]. However, since the inception of High quality cassava flour (HQCF) production, the transformation of cassava from a food insecurity reserve crop to commercial crop for small and medium scale farmers has become feasible [13,14,15]. HQCF is well defined as fine flour produced from wholesome freshly harvested and promptly processed cassava roots [13] usually contains low cyanide and is safe for consumption [11,12]. HQCF is ingredients for biscuits, cakes, baby foods, chin-chin, doughnut, breads, noodles, flakes, buns and croquettes [13,16,17,18]. An estimated 100 metric tons of HQCF produced in 2010 which increased to 319 metric tons in the year 2011 in Tanzania [16]. Through blends of HQCF and cereal flours for making ugali at household level will enhance intensification cassava production in all major production zones of Tanzania [16,19]. Evidences by households suggest that blends of HQCF and *sembe* or *dona* or sorghum to make *ugali* improves organoleptic parameters attracting more consumers that usually depend mostly on maize only [5,14,16,19,20]. Despite of these facts, the potential for commercialization of HQCF and cereal flour blends to make ugali has not been fully tapped due to lack of appropriate ratios. Our conviction is that the established ratio on blends of HQCF and cereal flours will maintain consistency of made *ugali* and continue attracting more consumers. In addressing of challenges, sensory evaluation study was carried out by our team members at Lake Zone Agricultural Research and Development Institute (LZARDI) to determine appropriate ratios of blends of HQCF and cereal flours for the preparation of *ugali*. It was observed that the blends of HQCF and *sembe* at the ratio of 20:80, blends HQCF and *dona* at the ratio of 80:20 and blends of HQCF and sorghum flour at the ratio of 80:20 were the most preferred by panelists of different cultural backgrounds (Tanzania Food and Nutrition Centre, Tanzania, Unpublished results). Besides, the blends of HQCF and cereal flours have added nutritional and sensory advantages by providing micronutrients that cannot be easily supplied by HQCF standalone. Therefore, based on the above findings, it was the objective of this study to carry out the assessment of consumer acceptance of *ugali* prepared from HQCF blended with cereal flours to evaluate their market potential and achieve optimal market penetration of HQCF in the lake zone.

2. MATERIALS AND METHODS

2.1 Materials

High-quality cassava flour (HQCF) prepared from Mkombozi cassava variety was purchased from cassava processing centers in Sengerema district. The maize flour (*dona* and *sembe*), traditionally processed cassava flour (*udaga*) and sorghum flour were purchased from the local markets in the study areas.

2.2 Formulation of Composite Flour

The ratios of HQCF blended with cereal flours used for the preparation of *ugali* preferred by panelists in the previous sensory evaluation study were used in this study (Tanzania Food and Nutrition Centre, Tanzania, Unpublished

results). The HQCF was mixed with either *sembe* flour (20:80) or *dona* flour (80:20) or sorghum flour (80:20) separately. The control sample was prepared in the same manner as explained above except that the traditionally processed cassava flour (*udaga*) was used instead of HQCF.

2.3 Preparation of *Ugali*

The preparation of *ugali* was carried out in the same manner as street food vendors do. The flour was gradually added to 1 liter of boiling water and continuously stirring to form uniform moderately hard dough or until the desired consistency of *ugali* was achieved as presented in Fig. 1.

2.4 The Study Areas

The study was conducted in different restaurants available in Mwanza city (n = 60) and Bunda district (n = 69) in the lake zone. Mwanza is a city with population of different backgrounds that consume ugali every day (no ugali no meal). Bunda grows and consume mostly cassava based ugali.

2.5 Sensory Data Collection

The sensory panel consisted of 129 consumers (111 males and 18 females, ages between 17 and 60 years). Panelists selected on basis of their experience with eating *ugali* and willingness to participate in the study to evaluate the taste, texture, color and aroma of blended *ugali*. Prior to the actual sample evaluation, panelists were told to rinse their mouths with distilled water between samples to create the neutral environment. The samples of *ugali* were coded and saved to individual consumer at random. Using paired comparison test, the panelists were asked to select the sample of *ugali* most preferable between the two samples. They were also asked to state the reasons for preferring that sample of *ugali*, willingness to buy blended flours used to prepare sample of *ugali* preferred and the maximum price they are willing to pay (WTP) for the blended flour used to prepare *ugali* preferred. Also the consumers were asked to state the frequency on consumption of *ugali* and type of *ugali* usually consumed in their area.

2.6 Statistical Analysis

Data on socio-economic characteristics of consumers, consumer evaluation of *ugali* and prices willing to pay (WTP) for blended flours and other parameters were summarized and descriptive statistics (percentages) were generated using Excel pivot table.

Fig. 1. Picture of *ugali* prepared from HQCF blended with cereal flours

3. RESULTS AND DISCUSSION

3.1 Socio-economic and Demographic Characteristics of the Study Population

The information on Socio-economic and Demographic Characteristics of the study population are presented in Table 1. According to [19,21,22], the characteristics of consumers such as age, gender, education level and income have a significantly impact on food product acceptability in the market because they influence consumption patterns and willingness to pay (WTP). The results showed that of the total 129 consumers (Mwanza = 60 and Bunda = 69), 14% were females and 86% were males. Based on the employment status about 51.1% of the consumers were employed in a public sector (public servants), 20.2% were entrepreneurs, 26.4% were farmers and the remaining 2.3% were students. The study also showed that the consumers (11%) had attained a university education, 45% of the consumers attained ordinary secondary school education and the remaining (44%) attained primary school education. These results suggest that majority of the consumers in the study area were males, this may be due to the fact that most females prepare lunch meal and consume together with their children at home in contrary to males who take their meals at restaurants. The results also showed that consumers participated in this study are either literate or attained at least primary school education.

3.2 Assessment of Consumer Acceptability of *Ugali*

The results of the assessment of the consumer acceptability of *ugali* are presented in Fig. 2. The results showed that *ugali* prepared from HQCF blended with *sembe* at the ratio of 20:80 was the most acceptable by 65.9% of the consumers as compared to 34.1% of the consumers preferred *ugali* prepared from *udaga* blended with *sembe* (control) at the same ratio. Meanwhile, *ugali* prepared from the HQCF blended with *dona* at the ratio of 80:20 scored high acceptability from 51.2% of the consumers as compared to 48.1% of the consumers preferred *ugali* prepared from *udaga* blended with *dona* (control) at the same ratio. Furthermore, the analysis revealed that 51.2% of the consumers preferred *ugali* prepared from HQCF blended with sorghum at the ratio of 80:20 compared 48.2% of the consumers preferred *ugali* prepared from *udaga* blended with sorghum (control) at the same ratio. These findings are consistent with previous research carried out by [5] on formulations of *Ugali* consumed in Kenya. Suggestively, blending flours improves sensory characteristics of food products [23,24].

Table 1. Socio economic and demographic characteristics of the study population

Variable	Frequency (n=129)	Percentage (%)
Age of consumers		
Between 17 and 60 years	129	100
Gender		
Female	18	14
Male	111	86
Level of education		
University	14	11
Secondary	58	45
Primary	57	44
Occupation (Employment status)		
Public servants	66	51.1
Entrepreneurs	26	20.2
Farmers	34	26.4
Students	3	2.3
Ownership		
House	47	36
Car	9	7
Motorcycle	34	26
Bicycle	23	18
None	43	33

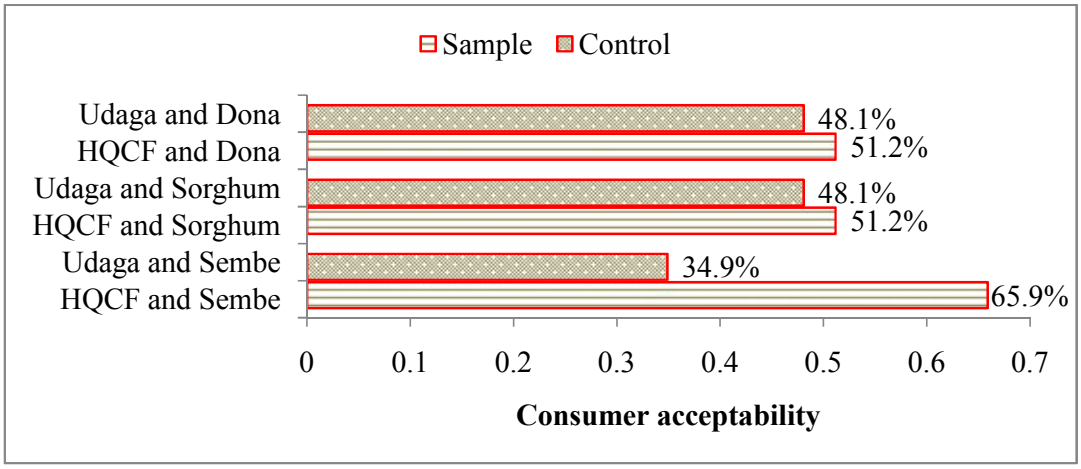

Fig. 2. Consumer acceptability of *ugali* made from HQCF blended with cereal flours

3.3 Food Attributes Influencing Preference of *Ugali*

The test consumer result on *ugali* made from the blends of HQCF and cereal flours is presented in Table 2. The taste was the sensory attribute which showed significant influence on consumer preference of *ugali* made from blends of HQCF and *sembe* (88%), blends of HQCF and *dona* (76%) and blends of HQCF and sorghum (58%). The study further showed the texture to influence consumer preference only by 22% blends of HQCF and *sembe*, 36% blends of HQCF and *dona* and 36% blends of HQCF and sorghum. Color and aroma were the sensory descriptors which showed least consumer preference and the influence of color was 8% blends of HQCF and *sembe*, 8% blends of HQCF and *dona* and 6% blends HQCF and sorghum. While the aroma was 6% blends of HQCF and *sembe*, 8% blends of HQCF and *dona* and 4% blends of HQCF and sorghum. The reason for a high score of the taste of *ugali* made from the blends of HQCF and cereal flour probably could be associated with the presence of compounds which influence taste in HQCF. The HQCF is usually produced without undergoing fermentation [13,18] as it is for *udaga* which have been produced by extensive fermentation. Sensory quality improvement linked to blended flour was reported for Pogăcele a traditional Transylvanian product when added with soy and rice [23]. Man et al. [24] observed that incorporation of sunflower seed flour (SSF) increased the overall acceptability of crackers biscuits as significantly improved texture and aroma [24]. The result supports documented finding that taste is the most sensory attribute contributing to the preference of foods at the restaurant [25]. Besides, taste rated ones of the important quality descriptor that influence customers' decisions to purchase fast food products in Malaysia [26].

Table 2. Food attributes influencing the preference of *ugali*

Food attributes	HQCF: *sembe* (20:80)	HQCF: *dona* (80:20)	HQCF: sorghum (80:20)
	Score (%)	Score (%)	Score (%)
Taste	88	76	58
Aroma	6	8	4
Color	8	8	6
Texture	22	36	36

Table 3. The influence of gender and education level on the overall acceptability of *ugali*

Samples of *ugali* preferred	Gender		Education level		
	Female (%)	Male (%)	University (%)	Secondary school (%)	Primary school (%)
HQCF and *sembe* (20:80)	50	68.5	64.3	67.2	64.9
HQCF and *dona* (80:20)	38.9	64.9	50	69.0	51.1
HQCF and sorghum (80:20)	61.1	48.6	50	44.8	56.1

3.4 The Influence of Gender and Education Level on the Overall Acceptability of *Ugali*

Gender: Women and Men have been reported to influence liking or preference of food because they have different consumption habits [22]. The influence of gender on the overall acceptability of *ugali* is presented in Table 2. The results showed that *ugali* prepared from HQCF blended with *sembe* at the ratio of 20:80 was preferred by 50% of female consumers and 68.5% of male consumers participated in the study. The sample of *ugali* prepared from HQCF blended with *dona* at the ratio of 80:20 was preferred by 38.9% of female consumers and 64.9% of male consumers. On the other hand, the sample of *ugali* prepared from HQCF blended with sorghum flour at the ratio of 80:20 the overall acceptability was 61.1% of female consumers and 48.6% of male consumers. A related study by [4] women were reported to prefer unrefined maize and sorghum *ugali* because of the attractive taste. This concur to the previous study conducted in South Florida comparing resident's preference with visitor's which observed female residents preferred taste more than male residents [27].

Education level: The influence of education level of the consumers on the overall acceptability of sample of *ugali* (as indicated in Table 3) prepared from the blends of HQCF and *sembe* at the ratio of 20:80 was 64.3% of consumers with University education, 64.9% of consumers with primary school education and 67.2% of secondary school education. The study also revealed that sample of *ugali* prepared from HQCF blended with *dona* at the ratio of 80:20 was preferred by 50% of consumers with University education, 51.1% of consumers with primary school education and 69.0% of consumers with secondary school education. The analysis also showed that sample of *ugali* prepared from HQCF blended with sorghum at the ratio of 80:20 was preferred by 50% of the consumers with a university education, 44.8% of the consumers with secondary school education and 56.1% of consumers with primary school education. These results suggest that education levels had no influence in the preference of *ugali* made from blends of HQCF and cereal flours. The preference for *ugali* could have influenced by inherited food eating habits in the region against acquired education that has a positive influence on skills development and ultimately food consumption choices on base of quality [28]. In addition, study conducted in Canadian market in British Colombia observed consumers of free-range eggs against consumers of white regular eggs came from smaller households and had a higher education level [29]. An educated consumer is an informed consumer and their choice is influenced by factors of health and nutritional value [29].

3.5 Willingness to Buy Blended Flours Used to Prepare Sample of *Ugali* Preferred

Willingness to buy one kilogram of the blended flours used to prepare *ugali* preferred by consumers in the study areas are presented in Fig. 3. The results showed that 64% of the consumers participated in the acceptability study of *ugali* are ready to buy the HQCF blended with *sembe* at the ratio of 20:80 if will be available in the market. The analysis also revealed that 50% of the consumers are ready to buy the HQCF blended with sorghum at the ratio of 80:20. The assessment also indicated that 61% of the consumers are ready to buy the HQCF blended with *dona* at the ratio of 80:20 if will be available in the market. The results suggest that above 50% of consumers were willing to buy the flour made from blends of HQCF and cereals if were available at the market. This could be attributed to good source of income from the various sources including employments. A study in Malaysia, revealed consumers' purchase decisions were motivated by income level [30]. An analysis of an Indiana Survey on consumers' willingness to purchase locally produced agricultural products, the perception of quality was found to have the strongest positive effect on the likelihood to purchase [31].

3.6 Maximum Price the Consumers Willing to Pay for Flour Used to Prepare this Type of *Ugali*

Consumers were asked to mention the maximum price they are willing to pay (Fig. 4) for one kilogram of the blended flour used to prepare the sample of *ugali* preferred. The results indicated that those who are willing to pay the price between TZS 1000/kg and TZS 1500/kg were 61% for HQCF: *sembe*, 60% for HQCF: sorghum and 46% for HQCF: *dona*. A few consumers were willing to pay for the same blended flours at the prime price above TZS 1500/kg were 5% for HQCF: *sembe*, 3% for HQCF: sorghum and 9% for HQCF: *dona*. At price below TZS 1000/kg was 24% for HQCF: *sembe*, 35% for HQCF:

sorghum and 45% for HQCF: *dona*. When these results were compared with *ugali* prepared according to the traditional method that is using *udaga* in the place of HQCF for the price between TZS 1000/kg and 1500/kg it was less 9% for HQCF: *sembe* and HQCF: sorghum but it was only 1% less for HQCF: *dona*. The findings suggest that majority of the consumers are willing to pay the price between TZS 1000/kg and TZS 1500/kg for flours made from blends of HQCF and cereals, however any change of income status may affect the willingness to pay. Other studies have reported a similar observation on women, high income groups and educated people willingness to pay premium price for a product with good quality attributes [32,33]. In contrary, young consumers compared to other age groups rated low on willingness to pay for processed food products [34].

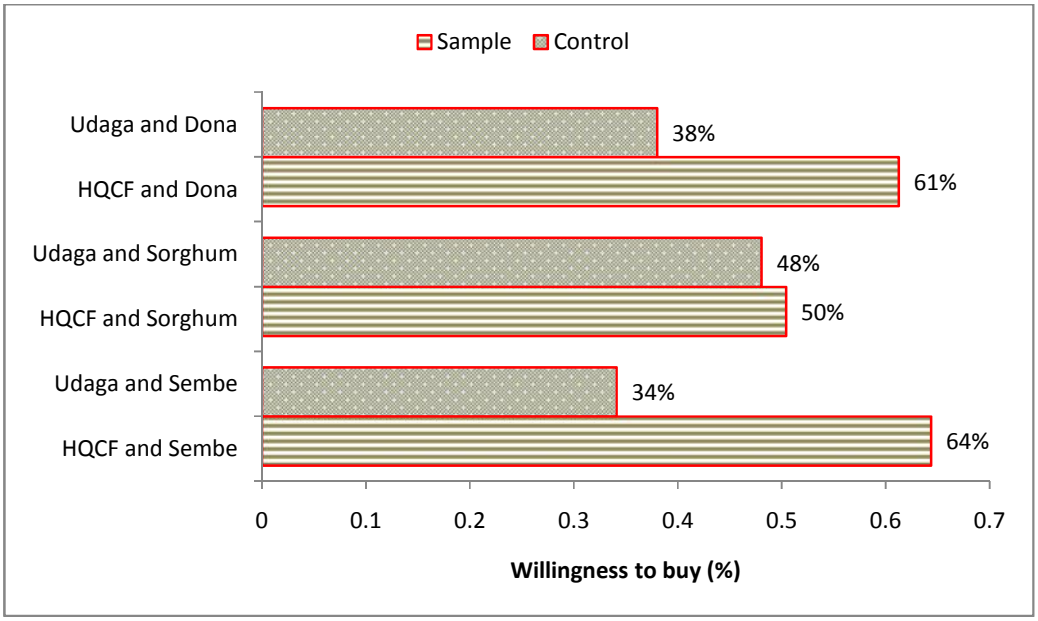

Fig. 3. Willingness to buy one kilogram of blended flour used to prepare sample of *ugali* preferred

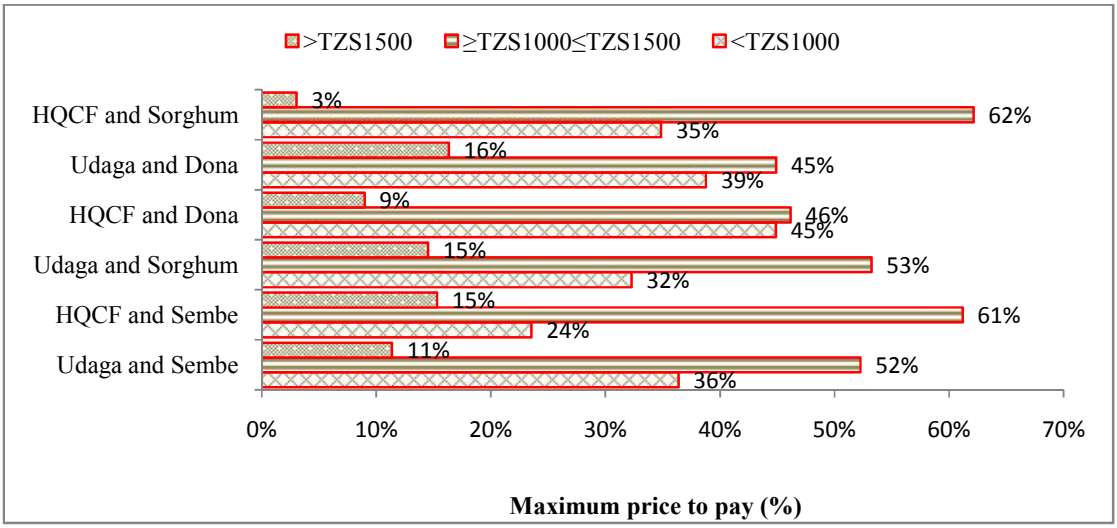

Fig. 4. Maximum price would you be willing to pay for one kilogram of flour used to prepare this type of *ugali*

3.7 Frequency on Consumption of *Ugali*

Based on the frequency of consumption of *ugali* (Fig. 5), the majority of the consumers (56%) reported that they consume *ugali* twice a day while 29% reported that they consume *ugali* once a day. About 2% of the consumers reported consuming *ugali* at least once a week, whereas only 5% of the consumers reported consuming *ugali* for three times a week. These results indicate that majority of the consumers (more than 90%) in the study areas consume *ugali* at least once a day. These findings are consistent with previous research carried out by [2,4,35,36]. *Ugali* is conceived by households as real food and is ones of hot meals eaten a day and is widely spread among communities of different cultures in the region [4]. From these findings it is convincible that majority of the consumers had experience with eating *ugali*.

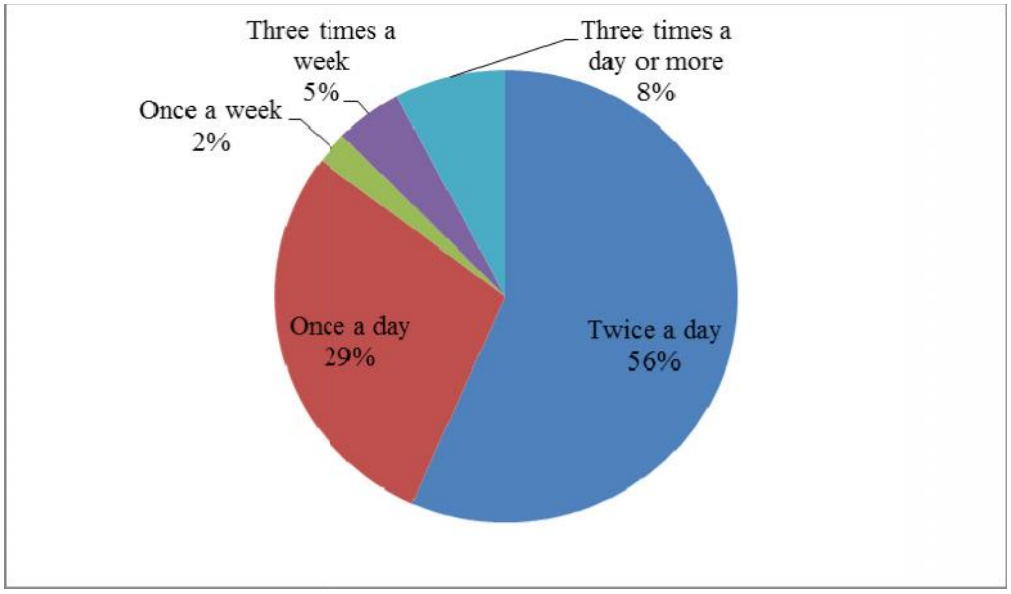

Fig. 5. Frequency on consumption of *ugali*

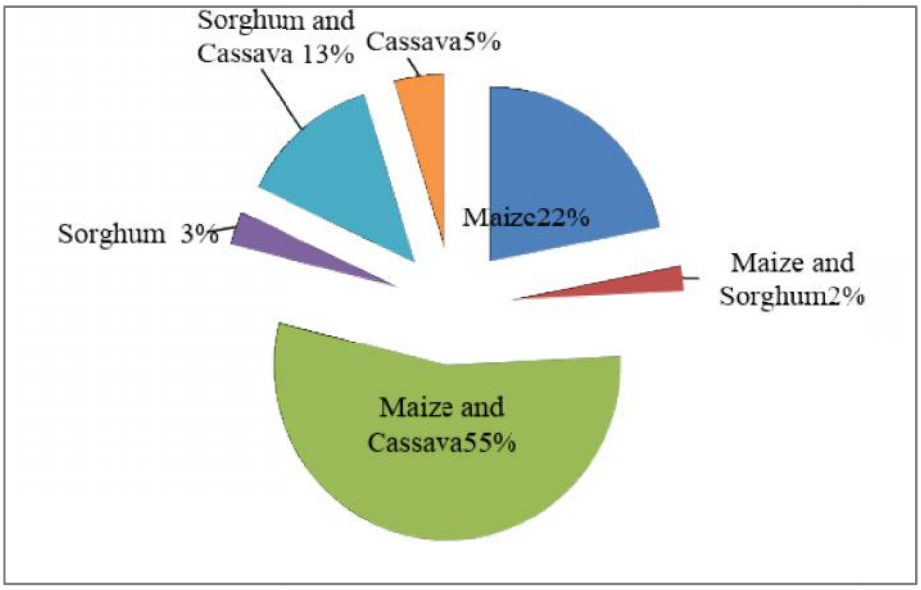

Fig. 6. Type of *ugali* commonly consumed in the study area

3.8 Type of *Ugali* Commonly Consumed in the Study Areas

Type of *ugali* prepared from maize flour blended with cassava flour (Fig. 6) was reported by 55% of the consumers and is the most commonly consumed in the study areas. About 22% of the consumers reported that they consuming *ugali* prepared from maize flour alone. Meanwhile, 13% of the consumers said that they usually consuming *ugali* prepared from cassava flour blended with sorghum flour. The findings also showed that *ugali* prepared from maize flour blended with sorghum was consumed by 2%, and 3% consumed *ugali* prepared from sorghum alone while those consumed *ugali* made from cassava alone was 5%. Bangu et al. [37] observed decrease in consumer acceptability when less 10% of sorghum incorporated to maize. Literature shows food style defines the behaviour of the consumer on food choices [28]. On this regards, variation on type of flour to make *ugali* do exist across ethnic groups in the region which could have influenced the consumption preferences. Consumers from agricultural families would prefer maize based *ugali* over sorghum based *ugali* mostly consumed by pastoralist families [2]. From these results it is clear that majority of the consumers above 65 % in the study areas would prefer *Ugali* prepared from blends of cassava and cereal flours.

4. CONCLUSION

In conclusion, the observation made from this study showed that over 80% of consumers eat *ugali* at least once per day confirming that *ugali* is staple diet in the study areas. It was also found that more than 65% of the consumers preferred *ugali* made from blends of cassava and cereal flour over *ugali* from unblended flours. This can promote cassava productions, utilization and commercialization of HQCF in Tanzania. Due to the high acceptability of *ugali* prepared from HQCF blended with cereal flours and the willingness of the consumers to pay (WTP) maximum price for the blended flours, therefore we recommend that efforts to ensure availability in the market need to be done. The fact that blends of HQCF and cereal flours promoted taste of *ugali*, the flavor analysis can be conducted to reveal the components.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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