African Journal of Food Science Vol. 6(15), pp. 412-415, 15 August, 2012
Available online at http://www.academicjournals.org/AJFS
DOI: 10.5897/AJFS12.091
ISSN 1996-0794 ©2012 Academic Journals

Full Length Research Paper

Chemical and sensory properties of roselle drink fortified with grain amaranth

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Accepted 18 June, 2012

Efforts were made at improving the nutritional status of children in this study. Grain amaranth was washed and dried in the oven at 40°C to constant weight, and then ground to powdery form. Roselle calyces were washed and boiled, during boiling; the ground amaranth powder was included at different ratios (1:10 w/v); (2:10 w/v); (3:10 w/v) and (4:10 w/v) to make Roselle drinks; traditional plain Roselle drink served as control. Each sample was subjected to chemical and sensory evaluations. The following nutrients increased significantly (p<0.05) as the level of inclusion of grain amaranth increased, protein (from 0.35% to between 0.55 and 6.89%); carbohydrate (from 6.34% to between 7.00 and 13.10%), fat (from 0.25% to between 0.42 and 1.53%), ash; (from 2.29% to between 2.35 and 3.10%), fibre (from 0.24% to between 0.28 and 0.62%). Sensory evaluation showed that Roselle drink, fortified with grain amaranth at ratios (1:10 w/v); (2:10 w/v); 3:10 (w/v) and (4:10 w/v) compared favourably with the traditional plain Roselle drink.

Key words: Roselle seeds, ground amaranth, sensory evaluation, chemical properties.

INTRODUCTION

Roselle fruit drink (Zobo) is a popular drink among children, it is easy to prepare, and when served chilled, it is refreshing. Roselle drink is prepared from dried Roselle calyces of *Hibiscus sabdariffa.* Roselle is a member of the family Malvaceae to which belongs okro, cotton and kenaf (Fasoyiro et al., 2005). It is much like the kenaf but it can be distinguished by the size of the flower and shape of the seed. Roselle is a tropical shrub. The calyxes' varieties are red, dark red and green types (Schippers, 2000). The crop is native to India but it has been introduced to other parts of the world such as Central America, West Indies and even Africa (Fasoyiro et al., 2005). It is an annual crop and it is easily adapted to varieties of climatic and soil conditions. It is well-grown in the tropics and sub-tropical regions. The calyces have been found to be rich in vitamin C and other antioxidants such as flavonoids (Wong et al., 2002) and also minerals (Babalola et al., 2001).

Amaranthus cruentus is a vegetable widely consumed in Nigeria; the utilization of its seeds has a great prospect because of its high protein content as compared with other grains (Taylor, 1995). The grain amaranth is a pseudo-cereal with unique nutritional and agronomic attributes. The cooked grain is 90% digestible and because of its ease of digestion it has traditionally been given to those recovering from illness or fasting period (Mnkeni et al., 2007). Amaranth seed is high in protein (8.8 to 19.5%) which is in turn high in lysine and sulphur-containing amino acids that are not frequently found in appreciable amounts in plant proteins (Centeotl, 2002). The fibre content of *Amaranth* seeds is three times that of wheat and its iron content is five times more than wheat. It contains two times more calcium than milk. Using amaranth in combination with wheat, maize or brown rice resulted in a complete protein as high in food value as fish, red meat and poultry. The oil from the seeds (5 to 10%) is predominantly unsaturated and is high in linoleic acid and rich in squalene (Dhellot et al., 2006).

Protein energy malnutrition (PEM) remains a major public health problem in the developing world, Nigeria inclusive; and it affects young children more than other members of the society. Evidence has shown that 4% of

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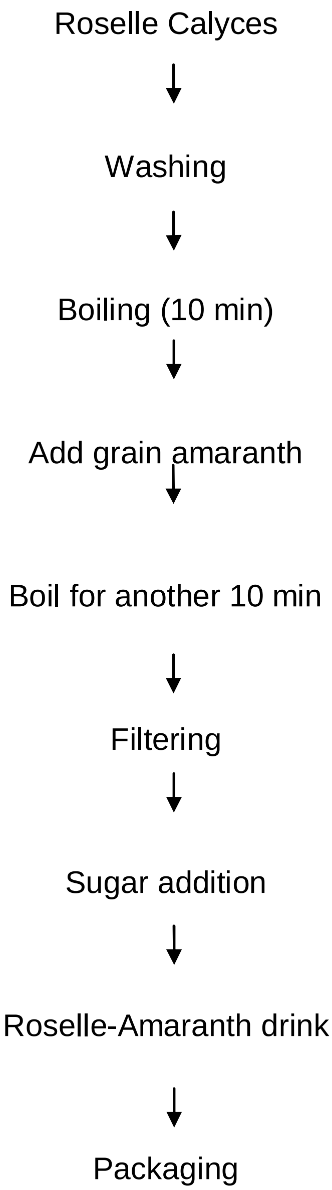

Figure 1. Preparation of Roselle-Amaranth (R-A) drink.

the total children born in developing countries die of malnutrition before they are five years old (Ijarotimi and Ijadunola, 2007). It has been projected that under the most likely circumstances, about 135 million children under the age of five in developing countries will be malnourished by 2020 (Pinstrup-Andersen et al., 1999). In Nigeria the number of malnourished children is forecast to increase by more than 30% to reach 40 to 45 million by 2020 (WHO, 1997; Pinstrup-Andersen et al., 1999). Moreover, more than 50% of all childhood deaths have under nutrition as an underlying factor in Nigeria (NPC/UNICEF, 1998). The first few years are the most crucial to the intellectual capacity and physical development of children and can promote their future productivity growth, for children who survive malnutrition; the consequences can follow into adulthood.

Studies by Olayemi et al. (2011); Fasoyiro et al. (2005); Bablola et al. (2001) have indicated that “Zobo” is a nutritious drink which can be used to meet the vitamin and mineral needs of its consumers. However, the low protein content of this drink limits its use as a nutritious drink. Though leaves of Amaranthus sp. are widely consumed in Nigeria, the use of its seeds for food is not well known. The objective of this work is to study the effect of fortifying Roselle drink with grain amaranth on its chemical and sensory properties.

MATERIALS AND METHODS

Preparation of Roselle drink

The dark red variety of dried Roselle calyces was obtained from IAR&T research farm; the grain amaranth (*Amaranthus cruentus)* was obtained from the seed store of IAR&T. Both materials were harvested in 2010 and used in 2011. Grain amaranth was washed and dried in the oven at 40℃ to constant weight, g round to powdery form in a hammer mill model 303 SAP, and kept in covered plastic containers. Roselle-Amaranth drinks were prepared as shown in Figure 1. Roselle calyces were washed and boiled in clean water (1:10 w/v). The ground amaranth was included at different ratios (1:10 w/v); (2:10 w/v); (3:10 w/v) and (4:10 w/v), sugar was added at (1:20 w/v), to make Roselle-Amaranth drinks. Traditional plain Roselle drink served as control. After cooling, the drinks were packaged into previously labelled polyethylene terephthalene (PET) bottles. Each sample was subjected to chemical and sensory evaluations.

Chemical analysis

The chemical analysis for percentage carbohydrate, crude protein, fat, crude fibre, and ash of the drinks were done using AOAC (1984) methods. Protein was obtained by multiplying Kjedahl Nitrogen by the factor 6.25 according to AOAC (1984) methods. All chemical analyses were done in triplicates.

Sensory analysis

The Roselle drinks fortified with ground amaranth seeds at different concentrations were presented as coded samples to a 10 member taste panel that are familiar with Zobo drink. The traditional plain Zobo drink which had no amaranth added to it served as control. The panellists were provided with a mouth-rinse after each tasting. They were requested to assess the drinks for the following attributes: colour, taste, flavour, appearance and overall acceptability. Scores were based on the nine- point hedonic scale where one equals extremely dislike and nine equals extremely like.

Statistical analysis

Data obtained from the analyses were subjected to analysis of variance (ANOVA) and means were separated by Duncan’s multiple range test.

Table 1. Mean percentage chemical composition of Roselle drinks fortified with grain amaranth at different ratios ± SD.

Nutrient	R-A0	R-A1	R-A2	R-A3	R-A4
CHO	6.34±0.72^{e}	7.00±0.53^{d}	8.24±0.76^{c}	11.13±1.32^{b}	13.10±0.64^{a}
Protein	0.35±0.06^{de}	0.55±0.02^{d}	3.42±0.05^{c}	4.95±0.08^{b}	6.89±1.64^{a}
Fat	0.25±0.05^{e}	0.42±0.03^{d}	0.76±0.02^{bc}	0.98±0.04^{b}	1.53±0.02^{a}
Fibre	0.24±0.01^{c}	0.28±0.03^{c}	0.41±0.02^{b}	0.53±0.04^{ab}	0.62±0.01^{a}
Ash	2.29±0.07^{d}	2.35±0.04^{c}	2.62±0.03^{bc}	2.84±0.03^{b}	3.10±0.01^{a}

Means in the same row followed by the same superscript are not significantly different from each other at p>0.05. R-A= Roselle- Amaranth, R-A 0= Roselle drink with no Amaranth, R-A 1= Roselle-Amaranth drink (1:10 w/v), R-A 2 = Roselle-Amaranth drink (2:10 w/v), R-A 3 = Roselle-Amaranth drink (3:10 w/v), R-A 4 = Roselle-Amaranth drink (4:10 w/v).

Table 2. Sensory evaluation of Roselle drinks fortified with grain amaranth at different levels.

Variable	Color	Appearance	Flavor	Taste	Overall acceptability
R-A0	8.1^{a}	8.3^{a}	8.2^{a}	8.0^{a}	8.1^{a}
R-A1	8.1^{a}	8.0^{a}	8.1^{a}	8.0^{a}	8.1^{a}
R-A2	8.3^{a}	8.1^{a}	8.1^{a}	7.9^{a}	8.0^{a}
R-A3	8.2^{a}	7.5^{b}	8.0^{a}	7.9^{a}	8.0^{a}
R-A4	8.0^{a}	6.8^{c}	7.4^{b}	7.2^{b}	7.4^{b}

Means in the same column followed by the same letter are not significantly different from each other at p<0.05. R-A 0= Roselle drink with no Amaranth, R-A1= Roselle-Amaranth drink (1:10 w/v), R-A2 = Roselle-Amaranth drink (2:10 w/v), R-A3 = Roselle-Amaranth drink (3:10 w/v), R-A4 = Roselle-Amaranth drink (4:10 w/v).

RESULTS AND DISCUSSION

Table 1 shows the proximate composition of Roselle drink fortified with grain amaranth at different ratios. The percentage carbohydrate of the drinks increased steadily (6.34-13.10%) as the amount of amaranth increased; Sady et al. (2005) also reported an increase from 5.92 to 7.77% in the carbohydrate content of bioyoghurt made from cow milk and ground amaranth seeds. The percentage protein of the drinks increased from 0.35% at no inclusion of amaranth to 6.89% when amaranth was included at ratio 4:10 (w/v); this result is similar to increased protein content reported when maize gruel (*Ogi*) was fortified with grain amaranth (Akingbala et al., 1994). Sady et al. (2005) also reported a slight increase from 4.55 to 4.92% in the protein content of yoghurt into which ground amaranth seeds was added. Taylor (1995) had earlier reported that utilization of amaranth seeds has a great prospect because of its high protein content as compared with other grains. The percentage fat, fibre, and ash of the drinks also increased as the inclusion of ground amaranth seeds increased. This confirms that the amaranth seeds have considerable amount of fat, fibre and minerals as had been reported in the past (Taylor, 1995; Dhellot et al., 2006; Olayemi, 2011). These nutrients could therefore be used to enhance the nutritional content of foods which are relatively low in them.

Sensory evaluation results (Table 2) showed no significant difference (p<0.05) in consumer acceptability of Roselle drinks when fortified at ratios (1:10 w/v); (2:10 w/v); (3:10 w/v) and (4:10 w/v); (Amaranth powder: Roselle drink) in all parameters evaluated; (colour, appearance, flavour and taste). Babalola et al. (2007) had reported that ground amaranthus flour could be used to improve nutrient composition of food without impairing the organoleptic characteristics. Akingbala et al. (1994) also reported good organoleptic characteristics of maize gruel (*Ogi*) produced from maize and grain amaranth at a mixed ratio of 1:3.

Conclusion

Fortifying Roselle drink with grain amaranth can be used to improve the nutrient composition of the drink, hence the nutritional status of its consumers without affecting consumer acceptability.

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