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Acceptability of Grain Amaranth Substituted Bakery Products and Weaning Food

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Abstract: Two varieties of grain amaranth IC-42258-1 (*Amaranthus hypochondriacus)* and R-104-1-1 (*Amaranthus cruentus*) were evaluated for acceptability test with the substitution of grain amaranth flour up to 50 per cent in bakery products viz., biscuit, cake and bread in comparison with the control (100 % wheat flour) and acceptability test of weaning mix and porridge prepared from 100 per cent popped grain amaranth flour and popped grain amaranth flour + roasted Bengal gram + skimmed milk powder (4:2:1) were also evaluated in comparison with *poshak*. Biscuit and cake prepared up to 50 per cent substitution of grain amaranth flour were acceptable except in case of appearance of cake showed significant difference ($p>0.01$) with that of the control. Bread with 10 per cent substitution of grain amaranth flour was acceptable and not significant ($p<0.05$) from the control. *Porridge* and weaning mix prepared with 100 per cent popped grain amaranth flour was acceptable.

Introduction

Protein - energy malnutrition is one of the major nutritional problem in developing countries. Several countries are advocating different nutritional policies to help in augmenting the protein production. However, one method that has often been neglected is the use of unconventional cereals and cereal like grains as sources of protein. One among them is the pseudo cereal, grain amaranth which is rich in protein particularly lysine and can be used to supplement cereals in breakfast foods, bakery products, weaning foods and extruded foods, thereby upgrading the over all protein quality of the diet. Improved nutritive value is not sufficient and it should also have good consumer acceptability. From this point of view, the present investigation was undertaken to study the acceptability test of the bakery products and weaning food substituted with grain amaranth flour.

Material and Methods

Two varieties of grain amaranth IC-42258-1 (*Amaranthus hypochondriacus*) and R-104-1-1 (*Amaranthus cruentus*) were procured from the Department of Agronomy, University of Agricultural Sciences, Dharwad and cleaned manually, washed ,dried, powdered in to flour and used for substitution in bakery products and weaning food.

Grain amaranth flour was substituted up to 50 per cent with wheat flour for the preparation of bakery products like bread, cake and biscuits. Weaning mix and porridge was made by using popped grain amaranth flour + roasted bengal gram + skimmed milk powder (4:2:1) and only popped grain amaranth flour (100%) in comparison with poshak and the acceptability of grain amaranth flour substituted bakery products and control (100% wheat flour) and weaning mix and porridge were evaluated by the panel of judges. Volume of the bread was measured by grain replacement method. All the samples were evaluated thrice for the acceptability test.

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Acceptability test by panel of judges was used as the main criterion for testing several characteristics such as appearance, texture, taste, doneness and flavor . The test was carried out by selecting the staff of Rural Home Science College, Dharwad as judges who had experience of serving on taste panels for several products. The members were provided with score cards for evaluation.

Analysis of variance was adopted to test the difference in organoleptic characteristics of grain amaranth products at different levels of substitution using randomized block design according to Steel and Torrie (1960)

Results and Discussion

The results on organoleptic studies of two varieties of grain amaranth flour substituted biscuits up to 50 per cent level and control (100 % wheat flour) are represented in table 1. It was observed that the biscuits made with 50 % substitution of grain amaranth flour scored least when compared to other levels of substitution. Marginal variations were found among the levels incorporated. However, statistical analysis did not reveal any significant difference between the incorporated biscuits of different levels of substitution and control. The marginal variation in the values observed in grain amaranth substituted biscuits as compared to control, may be due to slight brown colour and grainy texture of the substituted biscuits. The former may be due to colour of grain amaranth flour and latter may be due to larger particle size of the grain amaranth flour. The acceptability of biscuits in the present study was in agreement with the study conducted by Sanchez *et al.* (1985) on cookies made with 50:50 wheat and grain amaranth protein fraction.

The mean organoleptic characteristics scores of cakes made from 10 per cent, 25 per cent and 50 per cent substitution of two varieties of grain amaranth flour ranged between 2.1 to 3.8 (Table 2). Except in case of appearance of cake, the differences in all the characteristics were observed to be non significant. The appearance of cake substituted with the variety IC –42258-1 at 25 per cent and 50 per cent was significantly different from the control at five per cent and one per cent levels, respectively. Highly significant ($p > 0.01$) difference observed between 10 per cent and 50 per cent substitution and significant ($p > 0.05$) difference between 25 per cent and 50 per cent substitution. The appearance of cake substituted with the variety R-104-1-1 at 25 per cent and 50 per cent was significantly ($p > 0.05$) different from the control.

The significant difference in appearance of cake of grain amaranth substituted flour and control may be due to brown colour of the grain amaranth substituted cake which in turn depends on the higher amount of bran and also larger size of the flour particles.The mean organoleptic characteristics of grain amaranth flour substituted and control (100 % wheat flour) bread are presented in table 3. The mean organoleptic characteristics ranged between 1.10 and 4.00. Highest mean score was in control, followed by 10 per cent , 25 per cent and 50 per cent substitution. Analysis of variance indicated that, there was a significant difference in the organoleptic characteristics of the control, 10 percent , 25 per cent and 50 per cent substitution of grain amaranth flour. As the percentage of substitution of grain amaranth flour increased in bread, the scores decreased. This difference was found to be highly significant ($p > 0.01$). The organoleptic characteristics like appearance, texture, taste and flavor of bread substituted by the two varieties of grain amaranth, IC-42258-1 and R-104-1-1 showed highly significant difference ($p > 0.01$). In case of doneness there was significant difference ($p > 0.05$) in control, 25 per cent and 50 per cent substitution.

Table 1. Mean scores of organoleptic characteristics of *biscuits* substituted with grain amaranth flour

Treatments	Variety IC- 42258-1					Variety R-104-1-1				
	Appearance	Texture	Taste	Doneness	Flavor	Appearance	Texture	Taste	Doneness	Flavor
Control (100% W)	3.133	3.300	3.467	3.700	3.333	3.167	3.00	3.467	3.700	3.100
W +A (90:10)	2.867	3.267	3.567	3.800	3.200	3.267	3.333	3.167	3.200	3.100
W + A (75:25)	3.367	3.167	3.467	3.733	2.933	3.067	3.267	3.453	3.367	2.900
W + A (50: 50)	2.633	3.100	3.167	3.500	3.067	2.767	3.100	3.167	3.500	2.800
SE	0.157	0.184	0.177	0.101	0.155	0.119	0.091	0.136	0.069	0.128
CD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS- Non significant A –Grain amaranth flour W- Wheat flour

Table 2. Mean scores of organoleptic characteristics of *cakes* substituted with grain amaranth flour

Treatments	Variety IC- 42258-1					Variety R-104-1-1				
	Appearance	Texture	Taste	Doneness	Flavor	Appearance	Texture	Taste	Doneness	Flavor
Control (100% W)	3.467	3.333	3.500	3.800	3.200	3.467	3.333	3.500	3.800	3.200
W +A (90:10)	2.967	3.233	3.500	3.567	3.000	3.100	3.167	3.500	3.467	2.500
W + A (75:25)	2.767	3.233	3.267	3.533	3.167	2.767	3.067	3.533	3.600	2.733
W + A (50: 50)	2.100	2.833	3.133	3.200	3.000	2.933	2.700	2.900	3.467	2.267
SE	0.153	0.152	0.110	0.184	0.076	0.122	0.132	0.211	0.132	0.233
CD (0.05)	0.530	NS	NS	NS	NS	0.423	NS	NS	NS	NS
CD (0.01)	0.802	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS- Non significant A –Grain amaranth flour W- Wheat flour

Table 3. Mean scores of organoleptic characteristics of *bread* substituted with grain amaranth flour

Treatments	Variety IC- 422258-1					Variety R-104-1-1				
	Appearance	Texture	Taste	Doneness	Flavor	Appearance	Texture	Taste	Doneness	Flavor
Control (100% W)	3.767	3.733	3.633	3.967	3.733	3.767	3.733	3.633	3.967	3.733
W +A (90:10)	3.667	3.700	3.467	3.633	3.600	3.567	3.533	3.300	3.767	3.500
W + A (75:25)	2.333	2.800	1.967	3.567	2.567	2.500	3.000	2.267	3.600	2.900
W + A (50: 50)	1.700	2.633	1.700	3.400	2.100	1.533	2.467	1.866	3.467	2.100
SE	0.088	0.100	0.228	0.097	0.088	0.081	0.066	0.133	0.088	0.074
CD (0.05)	0.303	0.348	0.790	0.335	0.303	0.281	0.228	0.460	0.305	0.256
CD (0.01)	0.460	0.527	1.197	NS	0.460	0.425	0.346	0.697	NS	0.387

NS- Non significant   A –Grain amaranth flour   W- Wheat flour

As the percentage incorporation of grain amaranth flour increased the appearance of bread colour was increasingly dull. This may be due to the colour of the grain amaranth flour due to higher content of bran and also due to larger sized particles of flour (Myasnikova *et al.,* 1969) . The texture of the bread substituted with 25 per cent and 50 per cent was hard and less porous. As the substitution of grain amaranth flour increased the porosity of the bread decreased. This is attributed to lower amount and poor quality gluten, higher amount of bran and larger size flour particles characterized by a reduced rate of swelling (Myasnikova *et al,* 1969).The taste and flavor of the bread substituted with grain amaranth flour at 25 per cent and 50 per cent were significantly different due to slightly bitter after taste and typical odour of grain amaranth. Significant difference in doneness in the bread with 25 per cent and 50 per cent substitution of grain amaranth flour may be due to half baking. This may be attributed to excessively high alpha amylase activity in grain amaranth flour and hence may not bake satisfactorily because after enzymatic activity the starch fails to hold adequate water during baking, giving poor baking quality (Myasnikova *et al,* 1969).

Effect of incorporation of grain amaranth flour on volume of bread is given in table 4. It is obvious that, as the incorporation of grain amaranth flour increased the volume of the bread decreased. Wide variation was observed in the volume of bread between the control and that with 50 per cent substitution of grain amaranth flour. However, no statistical analysis were carried out on this aspect. The decrease in volume of grain amaranth substituted bread than control may be due to poor quality and lower amount of gluten , which is characterized by important physical properties such as elasticity, extensibility and binding power. This decrease in volume of bread may also be due to insufficiency of damaged starch and interaction

Table 4. Mean volumes (cc) of *bread* prepared from substituting grain amaranth

Percentage of substitution	Varieties	
	IC-42258-1	R-104-1-1
Control (W)	800	800
W + A (90:10)	720	790
W + A (75:25)	630	650
W + A (50:50)	550	550

W - Wheat flour A - Grain Amaranth flour

of added fat with flour components (Myasnikova *et al.,* 1969).

The result of the present investigation are in agreement with the study conducted by Sanchez *et al.* (1985) who reported that wheat : grain amaranth flour (90:10) was best for sandwitch bread preparation. The incorporation of 10 per cent grain amaranth flour is better suited for bread making as the palatability of bread did not differ much from that of 100 per cent wheat bread (Koppa, 1989).

The mean organoleptic characteristics of the porridge and weaning mix of poshak, popped grain amaranth flour + roasted Bengal gram + skimmed milk powder (4:2:1) and popped grain amaranth (100%) and poshak are given in table 5. There was no significant difference observed in different weaning mix and porridge studied. In the overall acceptability score, there was a slight variation which was statistically non significant. This variation may be due to varietal differences. The results of the present study are comparable with the study conducted by Rathod and Udipi (1991) on acceptability of weaning mixes prepared from cereal, amaranth flour in roasted, malted and puffed forms and leafy vegetables. Hundred per cent popped grain amaranth flour can be adopted for infant feeding in the form of porridge and weaning mix, due to its bland taste , ease of cooking, lack of anti nutritional factors

Table 5. Mean scores of organoleptic characteristics of weaning mix and *porridge* prepared with grain amaranth flour in milk

Treatments	Weaning mix					*porridge*				
	Appearance	Texture	Taste	Doneness	Flavor	Appearance	Texture	Taste	Doneness	Flavor
Poshak	3.700	3.633	3.700	3.800	3.833	3.867	3.733	3.767	3.767	3.800
A + RBG + SMP (4:2:1)	3.633	3.667	3.633	3.500	2.633	3.833	3.900	3.900	3.567	2.733
100 % A (IC-42258-1)	3.633	3.700	3.533	3.567	3.733	3.700	3.600	3.633	3.367	3.633
100 % A (R-104-1-1)	3.700	3.667	3.700	3.633	3.700	3.700	3.800	3.667	3.667	3.733
SE	0.075	0.066	0.048	0.070	0.069	0.136	0.115	0.096	0.111	0.054
CD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS- Non significant
SMP –Skimmed Milk Powder
A – Popped Grain amaranth flour
RBG- Roasted Bengal gram flour

and more than 5 per cent calories provided by protein (Kaul,1975).

It may be concluded form the present study that the grain amaranth was well suited in the preparation of cakes and biscuits up to 50 per cent substitution. Wheat flour can be substituted with 10 per cent grain amaranth flour in bread which gives a product similar to 100 per cent wheat flour and 100 per cent popped grain amaranth flour can be adopted for infant feeding in the form of porridge and weaning mix.

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