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Research Paper

Studies on standardization and physico-chemical properties of Amaranth flour cakes

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■ **ABSTRACT :** Egg cakes were prepared by using different levels of amaranth flour into refined wheat flour with the constant level of whey protein concentrate by method of U.S. Wheat Associates in 1983. Physical characteristics of amaranth grains and functional properties of flour were studied. It was found that seed weight, volume are less than other cereal as Amaranth seeds are tiny and lighter in weight. The water absorption and fat absorption capacity of variety PRA-3 was recorded as 1.6 per g of flour and 1.9 ml/g flour. Volume and specific volume of control cake was higher than the amaranth flour incorporated cakes. There was significant difference between volume index, symmetry index and uniformity index of control and 40 per cent amaranth flour cake. The overall acceptability scores of 40 per cent Amaranth flour cake was maximum and more than control for cakes (8.3).

■ **KEY WORDS:** Cakes, Amaranth flour, Wheat flour, Whey protein concentrate, Physical charateristics, Physical indices

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Amaranth (*Amaranthus*) is an annual plant whose name derives from the Greek. Amaranth belongs to Amaranthaceae family which consists of hardy, weedy, herbaceous and fast growing cereal like plants (Opute, 1979). Amaranth is one of those rare plants whose leaves are eaten as a vegetable while the seeds are used as a cereal. Amaranth is a gluten free cereal and due to the increasing demands of gluten free products amaranth can be used in bakery products. It is a major challenge to develop gluten free bakery products. Rising demands for gluten free products parallels the apparent or real increase in celiac disease, or other allergic reactions/intolerances to gluten. Therefore, amaranth grains are taken into consideration for development of bakery products. In addition to the unique characteristics of the major components *i.e.* protein, carbohydrates and lipids, amaranth grain also contain high levels of calcium, iron and sodium when compared to other cereal grain (Becker *et al.*, 1981). Bakery products are important source of nutrients *viz.*, energy, calcium, iron, and several vitamins and also are ready to eat processed foods. Among popular bakery products cakes rank at number one position. The bakery products are more popular as they are easily digested, masticated, attractive and nutritious. Bakery products can easily be enrich, fortified at lower cost with proteins,

fibre, various vitamins and minerals to meet the specific need of the target groups and vulnerable sections of the population who are undernourished and malnourished (Sharma *et al.*, 1998). The nutritional value of bakery products can be improved by using quality wheat for milling, high extraction rates and by supplementation of refined flour with other non-wheat flours *i.e*. using composite flours. Whole amaranth flour, a good source of protein seems to be suitable for the preparation of bakery products. The production of baked goods from other grains that have similar texture to those from wheat is a challenge.

The main aim of the study was to determine the physical characteristics of amaranth grains and functional properties of amaranth flour and formulation of cakes using amaranth flour. The objective of the study was sensory and nutritional quality evaluation and cost calculation of formulated cakes and to determine the physical characteristics of the cakes.

■ RESEARCH METHODS

PRA-3 amaranth variety was obtained from amaranth grains for the research work was procured from College of Forestry, Hill campus, G.B. Pant University of Agriculture and Technology, Pantnagar, Ranichauri, Uttarakhand. Whey Protein Concentrate was procure from Mahan Proteins Pvt. Ltd. Delhi. For the analysis of physical characteristic whole grains were used. After sun drying the grains were oven dried at 60ºC for 3 hours. The oven dried grains were then milled and sieved to give fine flour and kept in air tight container for further use.

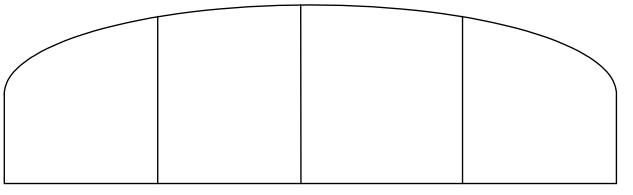
Product formulation:

The sponge cake method was used to prepare egg cake of recipe of (U.S. Wheat Associates, 1983). Standardization of whey protein concentrate was done in basic recipe of cake without egg. Three different trials were done at 4, 6 and 8 per cent level and the cakes were prepared.

Third trial gave successful results by panel members and this recipe was used for standardized control egg cake. Then different levels of incorporation of amaranth flour were done in control standardized recipe. Refined wheat flour and amaranth flour were added in the above recipe with the proportions of 0:100, 20:80, 40:60, 60:40, 80:20, and 100:0, respectively and the whey protein concentrate levels were kept constant *i.e*. 8 per cent in all the above variations. All the other ingredients were constant.

Physical characteristics and physical indices of cake:

Physical characteristics volume, weight, specific volume, diameter were studied. Physical indices volume index, symmetry index, uniformity index were studied. Cakes were cut carefully through the centre. The cut section of cakes was placed on a shelf and a template was held in front and against cake, lining up as in Fig. A and necessary observations were made. The indices were estimated by following formulae (AACC, 1969):



Volume Index = B + C + D Symmetry Index = 2C – B – D
Uniformity Index = B – D where A, B, C, D and E are given in cm

Fig. A : Physical indices of cake

Various parameters of physical characteristics of grains were measured by the method reported by Williams *et al.* (1983). Water absorption capacity (WAC) of amaranth flour was estimated according to the method given by Smith and Circle (1972) for soy flour. Fat absorption capacity (FAC) was determined by the method described by Lin *et al.* (1974).

The colour of the cakes prepared from blends of refined wheat and amaranth flour were estimated by the Munsell Colour System as developed by Munsell (Rathore, 1954). Cakes were evaluated for sensory characteristics using sensory score card (Amerine *et al.*, 1965). Nutrient composition of prepared cake was computed per 100 g by calculation of nutritive values given by Gopalan *et al.* (1989). The statistical analysis of various data was done using ANOVA technique to find out significant differences between control with different levels of amaranth flour incorporated egg cakes as described by Snedecor and Cochran (1967).

■ RESEARCH FINDINGS AND DISCUSSION

Physical characteristics of grains were presented in Table 1. Seed weight of amaranth grain was obtained

Table 1: Physical characteristic of amaranth grains

Physical characteristic	Value
1000 Grain weight	0.786g
1000 Grain volume	2.2ml
100 Grain density	4.355g per ml
100 Grain hydration capacity	0.006g
100 Grain hydration index	0.0075g
100 Grain swelling capacity	0.11ml
1000 Grain swelling index	0.55ml

as 0.786 g/1000 grains, seed volume 22ml/1000 grains and seed density was recorded 4355 g/ml. Hydration capacity of amaranth was obtained as 0.006g/100 grains, swelling capacity of amaranth was recorded as 0.11 ml /100 grains. The swelling index of cereal grain is associated with the swelling capacity of the cereal grains. The swelling index of amaranth grain was obtained as 0.55ml/100 grains.

Functional properties of Amaranth flour :

The water absorption and fat absorption capacity of variety PRA-3 was recorded as 1.6 per g of flour and 1.9 ml/g flour.

Physical characteristics of amaranth flours egg cakes were shown in (Table 2). In case of amaranth cake weight of the cakes increased as the level of incorporation of amaranth flour was increased from 0 to 100 per cent. Volume and specific volume of control cake was higher than the amaranth flour incorporated cakes. The volume of cake varied from 129.0 to 142.0cc. Control cake shows maximum volume *i.e.*142.00cc while increasing the amount of amaranth flour in cake (with egg) the volume of formulated cakes was decreased.

Table 3 shows that there was significant difference between volume index, symmetry index and uniformity index of control and 40 per cent amaranth flour incorporated cake.

Colour of amaranth flour cake was varied from pale yellow to light grey (Fig. 1). Cakes containing 20, 40, 60 and control cake had same colour *i.e.* pale yellow and there was slight differences in the value of chroma. Cake containing 80 and 100 per cent amaranth flour cake had same colour that was light grey but having slight difference in the value of chroma. The variation in the

Table 2 : Physical characteristics of amaranth flours cakes

Flour blends (%) Refined wheat flour + Amaranth flour	Volume (cc)	Weight (g)	Specific volume (cc/g)	Diameter (cm)
100 : 0	141.5	347.0	0.40	13.027
80 : 20	140.5	348.5	0.39	13.016
60 : 40	139.0	351.0	0.385	13.053
40 : 60	136.5	353.0	0.355	13.000
20 :80	134.0	340.0	0.335	13.015
0 :100	129.0	341.0	0.320	13.105
F value	**	*	*	NS
C.D. (P=0.05)	5.2314	5.41	0.122	0.151

* and ** indicate significance of values at P=0.05 and 0.01, respectively NS=Non-significant

Table 3 : Physical indices of amaranth flour cakes

Flour blends (%) Wheat flour + Amaranth flour	Volume index	Symmetry index	Uniformity index
100 : 0	16.75	3.65	-0.65
80 : 20	16.55	3.05	0.35
60 : 40	16.15	2.70	0.15
40 : 60	16.25	2.70	0.25
20 :80	16.15	2.50	0.25
0 : 100	16.60	2.30	0.10
F-value	*	*	**
C.D. (P=0.05)	0.5132	0.5372	0.1577

All the values are average of two observations
* and ** indicate significance of values at P=0.05 and 0.01, respectively

value of colour it was due to increased concentration of amaranth flour.

Sensory quality evaluation of amaranth flour egg cake :

Sensory quality evaluation of amaranth flour egg cake was done for their acceptability using score card method. The results are presented in Fig. 2.The sensory score for appearance of cakes with egg varied from 7.20 to 8.35. Cake containing 40 per cent amaranth flour had maximum value of 8.35.

Table 4 indicates the nutritive value of formulated cake and it was obtained by calculation method. Nutritive value was calculated per 100g of cakes. In the current study it was found that formulated cake (with egg) showed decreased in the energy level on increasing amount amaranth flour. Energy value of cakes ranges from 515 to 535 KCl. Nutritive value of amaranth cake was found to be higher in protein calcium and iron as compared to control cake.

Cost calculations of amaranth flour cakes were ranged from 7.88 to 8.86 Rs. and it was low cost and nutritious than locally available cakes. In this labour charge, electricity, packaging cost was not included.

Conclusion :

– PRA-3 amaranth flour variety is suitable for baked products especially cakes as it contained higher amount of protein. More amount of amaranth flour might be incorporated in the formulation of cookies, breads

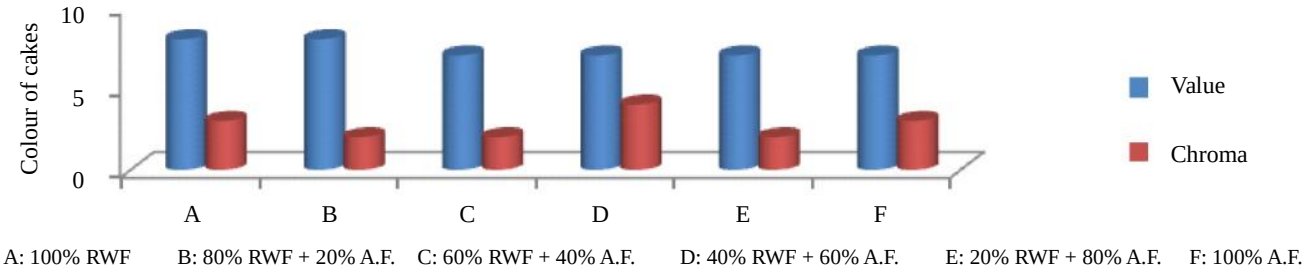


Fig. 1 : Colour of formulated amaranth flour cakes

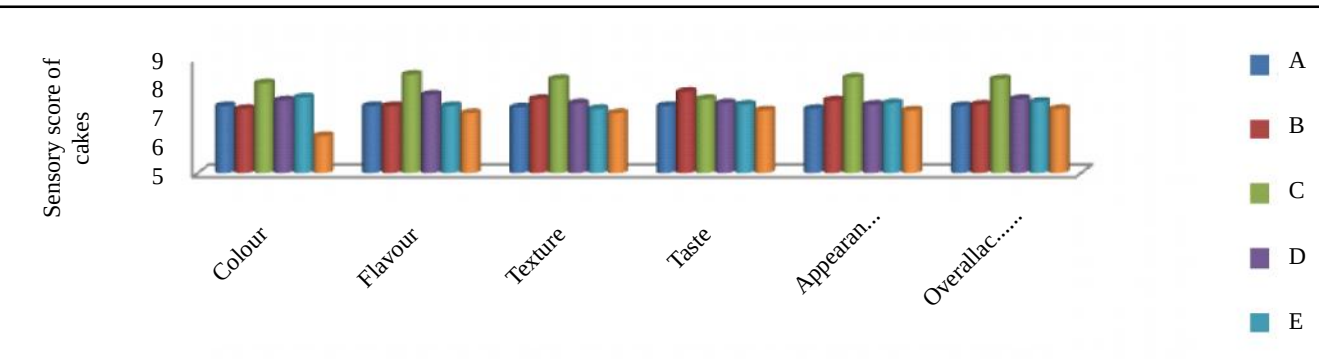


Fig. 2 : Mean sensory score of formulated amaranth flour cake

Table 4 : Nutritive value of formulated amaranth flour cakes

Flour blends	Energy (kcl)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ca(mg)	Iron (mg)
100 : 0	535	11.62	21.97	54.11	3.60	105.18	1.45
80 : 20	531	11.78	21.75	53.12	3.42	126.7	1.93
60 : 40	525	11.89	21.80	51.91	3.26	165.17	2.36
40 : 60	520	12.03	21.58	50.87	3.04	191.79	2.84
20 :80	518	12.21	21.71	50.05	2.88	219.03	3.31
0 : 100	515	12.34	22.04	49.17	2.70	245.85	3.76

and doughnuts as the crispness and hardness are suitable characteristics for them. Amaranth flour is rich in iron and it can be used for preparation of iron rich food supplements. There is need to popularize the use of amaranth flour in daily diet.

– Amaranth flour is rich in iron and it can be used for preparation of iron rich food supplements. There is need to popularize the use of amaranth flour in daily diet.

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