

Nutrient Analysis and Formulation of Antioxidant Enriched Wheat Flour and Formulation of Wheat based Recipes from COFA Flour

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Abstract

Among the varieties of fruits and vegetables, carrot and orange have colorful flesh and antioxidant property. Nuts like almond have been increasingly paid attention on the basis of their nutritional aspects and powerful natural antioxidants, which provide various beneficial health effects. As a consequence, a successful combination of Carrot, Orange Flesh and Almond (COFA) were processed in to COFA flour. The prepared COFA flour was incorporated into wheat flour for enriching its nutritional quality. The antioxidant enriched wheat flour was used for recipe preparation. The physico-chemical analysis of flour and sensory evaluation were done to know the acceptability of developed wheat based recipes. The antioxidants vitamins like A, C and E had increased when compared with normal wheat flour. From the results it was found that the developed flour and recipes have not only improved in terms of nutritional value and health benefits, but also have high potential of being accepted by consumers.

Keywords: Antioxidant Vitamins, COFA Flour, Formulated Wheat Flour, Nutritional Value, Physico-Chemical Analysis, Sensory Evaluation

1. Introduction

Fruits and vegetables are very important to prevent many diseases. Vegetables especially have the antioxidants, minerals and phytochemical in correct combination that helps to keep the blood sugar in balance and along with fruits build up the immune system. Each color found in fruits and vegetables focus on building the immune system in its own way¹. Foods rich in antioxidants may be good for heart. According to Bone², “increased antioxidant intake by eating more nuts, seeds, legumes, fruits and vegetables may also help to lower risk of infections and some forms of cancer”.

The nuts are excellent source of Vitamin E. Almond contains about 25 g of Vitamin E per 100 g (about 170%

of RDA). Vitamin E helps in lipid membrane integrity of mucus membrane and protects skin from harmful free radicals. It is also rich in dietary fiber, vitamins and minerals and packed with numerous healths' promoting phytochemical and is a kind of well balanced food-ensuring protection against diseases³.

The food fortification has been recognized as a safe and effective strategy to combat micronutrients malnutrition⁴. According to Hannon et al⁵, it can be a commercial choice to provide extra nutrients in a food or sometimes it is a public health policy, which aims to reduce numbers of people with dietary deficiencies in a population.

So an attempt was made to prepare antioxidants enriched flour to replenish the nutrients in order to give a new fortified product to the society. The objectives of

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the study are to formulate and evaluate the antioxidant enriched COFA flour incorporated wheat based recipes, to determine the sensory attributes, and to popularize the antioxidant enriched COFA flour incorporated chapathi mix to school going children (6-12 years).

2. Methods and Materials

2.1 Collection and Proportion of Raw Materials for Making Flour

The raw materials used for processing were procured from the local market. The exact proportion of raw materials like carrot, orange flesh and almond used for the COFA flour preparation is given in (Table 1).

Table 1. Proportion of raw material for making COFA flour

S. No.	Raw Materials	Quantity
1	Carrot	1kg
2	Orange Flesh (Pulp)	1kg
3	Almond	100g

2.2 Preparation of COFA Flour

Raw materials like carrot and orange flesh were dried in ideally set oven temperature of 125°F to 135°F/52°C to

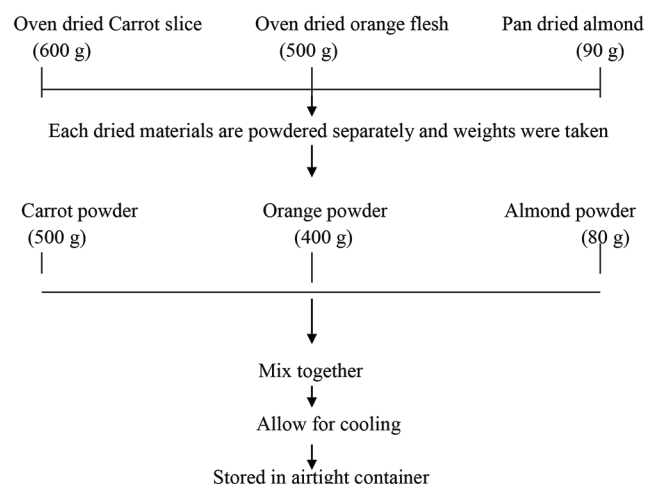


Figure 1. Preparation of COFA flour

57°C and (125°F to 145°F). The almonds were roasted in a pan for 3 to 5 minutes and ingredients were stored in cool place.

When the food is dehydrated, 80% of the moisture is removed from fruits and up to 90% of the moisture is removed from vegetable making the dried weight of foods much less than the fresh weight. The prepared COFA flour was mixed with whole wheat flour and antioxidant enriched wheat flour is ready to use for recipe preparation.

The whole wheat grain was manually cleaned by winnowing and sifting to remove dust and other impurities. It was then milled in local mills and passed through a mesh size of 1 mm and were packed and stored in containers.

2.3 Proportion and Preparation of Antioxidant Enriched Wheat based Recipes

The proportion of ingredients used for chapathi, wheat dosa, wheat rotti and wheat adai are given in (Table 2) and (Table 3).

The antioxidant enriched COFA flour incorporated chapathi, wheat dosa and wheat rotti were prepared in different ratio like 90:10, 80:20, 70:30.

The antioxidant enriched COFA flour incorporated wheat adai was prepared with different ratio like 90:10, 80:20 and 70:30. The ingredients like small onion, Green chilies, Curry leaves, coriander leaves, salt and cooking oil (25 g, 10 g, 2 g, 2 g, 2 g and 10 ml respectively) were used for this preparation.

Table 2. Proportion of ingredients used for chapathi, wheat dosa and wheat rotti

S.No.	Products	Wheat flour (g)	COFA flour (g)	Salt (g)	Cooking oil (ml)
1	Control	100	-	2	5
2	Variation-I	90	10	2	5
3	Variation-II	80	20	2	5
4	Variation-III	70	30	2	5

Table 3. Proportion of ingredients used for wheat adai

S.No.	Product	Wheat flour (g)	COFA flour (g)	Small onion (g)	Green chillies (g)	Curry leaves (g)	Coriander leaves (g)	Salt (g)	Cooking oil (ml)
1	Control	100	-	25	10	2	2	2	10
2	Variation I	90	10	25	10	2	2	2	10
3	Variation II	80	20	25	10	2	2	2	10
4	Variation III	70	30	25	10	2	2	2	10

2.4 Nutrient Analysis, Storage Stability and Microbial Content of COFA Flour using Different Containers

The antioxidant vitamins like A, C, E and other nutrients like carbohydrates, protein, fat, ash, moisture, calcium, iron and fiber were analyzed using standard procedure⁶.

Control and experimental flour were packed and sealed in airtight containers (plastic, silver container and polyethylene cover) and stored at room temperature [30°C-35°C] for 60 days. The storage stability of COFA flour was evaluated initially on 0th day and after 10, 15 and 30 days from the date of preparation. The products were analyzed periodically for microbial content by determining standard count⁷.

2.5 Sensory Evaluation

The sensory quality of the developed product with respect to color, appearance, aroma, texture and taste was judged by twenty panelists using 5-point hedonic scale⁸. The scores ranged from poor (1) to excellent (5).

2.6 Consumer Acceptability

Twenty panel members were selected from S. K. Medical Foundation at Erode district for testing the consumer acceptance of antioxidant enriched wheat based recipes, using 9-point hedonic rating scale ranging from “like extremely” to “dislike extremely” for each recipe.

2.7 Popularization of Antioxidant Enriched Wheat-based Recipe among School going Children (6-12 Years)

Forty school going children between the age group of 6-12 years (20 boys and 20 girls) from Vairapalayam Government Higher Secondary School, Erode were

selected to popularize COFA flour enriched wheat-based recipes, after obtaining prior permission from School Head Master. Details regarding general information, socio economic status, food consumption pattern and knowledge about antioxidant enriched foods and nutrients deficiencies were collected from the selected children using interview schedule. Finally, the prepared wheat based recipes like chapathi, wheat dosa, wheat adai and wheat rotti were popularized among the selected school going children.

2.8 Statistical Analysis

The collected data was statistically analyzed using mean, standard deviation and t-test.

3. Results and Discussion

3.1 Nutrient Content of COFA Flour

The nutrients in the packs are chemically analyzed for antioxidants, vitamins like A, C, E and other nutrients like carbohydrates, protein, fat, moisture, ash, calcium and iron and presented in (Table 4).

The COFA flour was found to contain 700 µg of vitamin A, 100 mg of vitamin C and 1200 µg vitamin E. Due to incorporation of COFA flour, the antioxidant vitamin content increased when compared with normal wheat flour.

3.2 Organoleptic Evaluation of Antioxidant Enriched Wheat based Recipes

The overall acceptability of 30% antioxidant enriched chapathi, wheat dosa, wheat adai and wheat rotti was highly acceptable and statistically there was no significant difference between control and all the variations.

Table 4. Nutrient content of COFA flour

S.No.	Nutrients	Nutritive value for 100 g of COFA flour*	Normal wheat flour/100 g
	Antioxidant Vitamins		
1	Vitamin- A	700 µg	29 µg
2	Vitamin- C	100 mg	0 mg
3	Vitamin- E	1200 µg	0.2 µg
	Other Nutrients		
4	Carbohydrates	32.2 g	69.4 g
5	Protein	22.4 g	12.1 g
6	Fat	58.2 g	1.7 g
7	Calcium	540 mg	48 mg
8	Iron	160 mg	4.9 mg
9	Moisture	8.6 g	12.2 g
10	Ash	1.9 g	0.4 g
11	Fibre	6.4 g	1.9 g

*COFA flour – Carrot Orange Flesh and Almond flour

3.3 Nutritive Value of Formulated Antioxidant Enriched Recipes

The nutrient content of the products like chapathi, wheat dosa and wheat adai and wheat rotti is presented in the (Table 5).

From the results, it was observed that COFA flour enriched recipes provided more antioxidants and other nutrients especially protein, iron, calcium and energy.

Table 5. Nutritive value of formulated antioxidant enriched recipes

S.No	Name of Recipes (100g)	Nutrient Present in the Recipes Per 100 gm									
		Energy (Kcal)	Protein (g)	Fat (g)	CHO (g)	Vit- A (µg)	Vit- C (mg)	Vit- E (µg)	Calcium (mg)	Iron (mg)	Fibre (g)
1	Chapathi	673	49.5	110	64.9	732	103	1300	602	170	9.8
2	Wheat dosa	673	49.5	110	64.9	732	103	1300	602	170	9.8
3	Wheat adai	720	62.0	125	73.2	1298	126	1312	632	178	12.1
4	Wheat rotti	673	49.5	110	64.9	732	103	1300	602	170	9.8

3.4 Microbial Count and Storage Stability of Antioxidant Enriched Wheat Flour

The following (Table 6) describes the microbial storage stability of formulated flour.

Table 6. Microbial count of antioxidant enriched wheat flour

Name of the Product	Total viable Bacteria in cfu/g			
	Initial	10 th day	15 th day	30 th day
Antioxidant enriched Wheat flour	0 x 10 ²	0 x 10 ²	1 x 10 ³	1 x 10 ³

From the above Table, it was noted that the microbial count of antioxidant enriched wheat flour at the initial and 10th day was 0 x 10² cfu/g, after 15th day and 30th day it showed slight increase in count, however was within the acceptable limits.

The storage stability of the formulated antioxidant enriched wheat flour was assessed with different containers. It was noted s there was no change in flavor and taste in COFA flour. The antioxidant enriched wheat flour stored in plastic container received maximum score than the storage in polyethylene cover and silver container. On microbial analysis, there was minimum microbial growth in plastic container than the polyethylene cover and silver container. Hence, it can be stored up to 30 days at room temperature as well as in refrigerator.

3.5 Consumer Acceptability of Formulated Antioxidant Enriched Recipes

Consumer acceptability of formulated antioxidant enriched wheat based recipe, showed that mean overall

acceptability of chapathi was 8.3 ± 1.19 , wheat dosa was 7.6 ± 1.04 , wheat adai was 9.2 ± 1.39 and wheat rotti was 8.1 ± 1.15 . Among all the wheat based recipes wheat adai received high score than the other recipes.

4. Conclusion

The major implication of this research is that the COFA flour can be efficient strategy to improve the antioxidant content of wheat flour with enhancement of health linked functionality. From the above results it may be concluded that COFA flour enriched wheat flour have appreciable amount of antioxidant level and also other nutrients like protein, iron, calcium and fiber. The formulated recipes were highly acceptable by the consumer. Hence, the COFA flour enriched wheat flour can be given for the infants and young children for the improvement of their health. The cost of the flour is also low and economic.

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