Development of value added Multi-Grain Flour Biscuits for School Age Children

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Abstract

The school age (6-12 years) period has been called the latent time of growth as the rate of growth slows and body changes occur gradually. A well balanced diet is needed during this time. Patterns of eating have a significant influence on health and well-being. An attempt has been made in the present study to develop biscuits from two combinations of Multi Grain Flours (MGFs), and carry out their value addition by incorporating dry carrot and coconut powders. The MGF were in varied proportions ranging from 5% to 25%

Evaluation of various sensory attributes revealed that biscuit having Wheat flour, Barley flour and Ragi flour in proportion of (70: 15: 15) in A2 combination of flours and B2 combination of flours of Wheat Flour, Barley Flour, Pearl Millet of (70: 15: 15) was found to be most acceptable. Value addition of these biscuits (A2 and B2) was done by incorporating carrot and coconut powders. On sensory evaluation A2CC2 and B2CC2 variations were found to be the best which had carrot powder 5 % and coconut powder 5%.

A2CC2 biscuit revealed higher values for protein(9.5g ± 0.92), fat (6.9g ± 0.1), carbohydrate(61.5g ± 7.21), calcium (115mg ± 4.9) and iron (5.0mg ± 0.11) per 100g. The biscuit B2CC2 revealed higher values for protein (10g ± 1.12), fat (7.0g ± 0.57), carbohydrate (58.5g ± 4.29), iron (4.2mg ± 0.06) per 100g.

The cost calculated for the most acceptable value added biscuits, having code A2CC2 was Rs.16.48 per 100g and that of B2CC2 was Rs. 15.58 per 100g.

INTRODUCTION

The school age (6-12 years) period has been called the latent time of growth as the rate of growth slows and body changes occur gradually. It is a critical period for health and development as the physiological need for nutrients increases. Therefore, consumption of a diet of high nutritional quality is particularly important. Eating habits, lifestyle and behaviour patterns are established during this period that may persist throughout adulthood. A healthy diet during childhood reduces the risk of immediate nutrition related health problems of primary concern . The children in this age group are generally restless and do not spend too much time at the table for eating. Besides, they feel rushed in the morning because they

must reach their classes on time. So menus have to provide dishes that are quick to eat and yet satisfying nutritionally. The foods such as milk, eggs, carrots, greens, fruits, whole grams and unrefined cereals need to be included in the diet on daily basis(2).

India is an agriculture based country. The variety of cereals grown here are not available at other parts of the world. If the eastern part of India is rich in the cultivation of paddy, north- western region is flourished with wheat. *Ragi* is cultivated at the southern and western part of the country. Cereals are rich in complex carbohydrates, proteins, fats, minerals and vitamins, besides being staple food in our diet.

Among cereals, wheat is a prime cereal and is a major ingredient in foods like bread, biscuits, chapattis, porridge, cakes, etc. Barely is another popular and highly nutritious cereal that is an excellent source of both soluble and insoluble fiber, protein, vitamins and minerals. Other than these two cereals, *ragi* is an important cereal rich in nutrition and packed with many benefits. It is a great source of calcium, fiber, iron , amino acid and antioxidants. Pearl millet is an important staple food in semi aired region of India, is rich in iron and zinc, besides fiber. Despite recommendation made for fruits and vegetables, children eat fewer of these fruits than that is considered desirable.Vast range of essential vitamins and minerals are provided by consuming this food group to ensure optional functioning of a child's body . Among vegetables, carrots are one of the most widely used and enjoyed vegetables. Carrots are rich source of vitamin A,.Whereas, coconut is high in **calcium,** fiber, protein and healthy fats, helps digestive system and maintains healthy blood sugar level.

Therefore, in the present study an attempt has been made to develop value added Multi Grain Flour biscuits for school age children, rich in calories, protein and calcium.

Materials and Method

The present study, two flour combinations were developed, using different cereals. Combination A had wheat flour, barley flour, ragi flour in proportions and combination B had wheat flour, barley flour and pearl millet flour.

A panel of judges evaluated the developed biscuits using 5 pont rating scale. Sensory evaluation of the developed biscuits was carried out.

At 2 stages, dry carrot and coconut powders were added together to the best acceptable biscuits for value addition, in varied proportions ranging from 5 % to 25 %. Thereafter, estimation of proximate nutrients and minerals of the developed value added Multi Grain Flour biscuits

Cost estimation of the developed value

added biscuits per 100 gm was calculated as per the market rate existed at the time of formulation of the biscuits.

3. Result and Discussion

In the present study two combinations (A and B) of multigrain flours were developed, one having wheat flour, barley flour and *ragi* (finger millet) flour, which was named as Combination A and the other one was a mix of wheat flour, barley flour and pearl millet flour, named as

Combination B. In both the combinations, amount of wheat flour was kept fixed (70g), whereas the amount varied for the other two cereal flours.

For developing multigrain flour biscuits, first a basic recipe was selected and standardized in the Foods and Nutrition laboratory of the Department of Home Science. Thereafter, the multigrain flour biscuits were developed using the two flour combinations, in which flours were used in varied proportions. Once the biscuits were developed sensory evaluation was carried out using 5 point rating scale(3).

The biscuits developed from combination A for sensory evaluation revealed most acceptable biscuit to be A2 (WF:BF:RF= 70:15:15). The mean scores for its taste (4.8 ± 0.4), after taste (4.6 ± 0.5) and over all acceptability (4.8 ± 0.4) were found to be highest in comparison to other combinations(Table 1)

MultiGrain Flour Biscuits Codes	Appearance	Colour	Taste	After Taste	Overall acceptability
A (standard) (WF= 100)	5.0 ± 0	4.6 ± 0.5	4.7 ± 0.4	4.5 ± 0.4	4.8 ± 0.2
A1(WF:BF:RF) (70:20:10)	4.6 ± 0.5	4.6 ± 0.5	4.7 ± 0.4	4.5 ± 0.4	4.6 ± 0.4
A2(WF:BF:RF) (70:15:15)	**4.5 ± 0.5**	**4.3 ± 0.3**	**4.8 ± 0.4**	**4.6 ± 0.5**	**4.8 ± 0.4**
A3(WF:BF:RF) (70:10:20)	4.3 ± 0.3	4 ± 0.6	3.9 ± 0.2	3.9 ± 0.2	4.0 ± 0
A4(WF:BF:RF) (70:5:25)	4.3 ± 0.8	4 ± 0.6	3.5 ± 1.0	3.1 ± 0.7	3.4 ± 0.4

The biscuits developed from combination B for sensory evaluation revealed most acceptable biscuit to be B2 (WF:BF:PF = 70:15:15). The overall acceptability of this variation was higher (4.7±0.4) in comparison to standard.

Multi Grain Flour Biscuits Codes	Appearance	Colour	Taste	After Taste	Over all Acceptability
B (Standard) (WF=100)	4.3 ± 0.3	4.5 ± 0.8	4.3 ± 0.8	4.5 ± 0.8	4.3 ± 0.8
B1 (WF:BF:PF) (70:20:10)	4.3 ± 0.8	4.1 ± 0.7	4.3 ± 0.8	4.2 ± 0.7	4.3 ± 0.8

B2 (WF:BF:PF (70:15:15)	**4.6 ± 0.5**	**4.3 ± 0.8**	**4.5 ± 0.4**	**4.3 ± 0.5**	**4.7 ± 0.4**
B3 (WF:BF:PF) (70:10:20)	4.1 ± 0.7	4.0 ± 0.9	4.1 ± 0.4	3.8 ± 0.4	4.4 ± 0.4
B4 (WF:BF:PF) (70:5:25)	4.3 ± 0.5	4.1 ± 0.7	4.1 ± 0.4	3.5 ± 0.5	3.8 ± 0.7

Mean ± Standard Deviation
WF = Wheat flour, BF = Barley flour, PF = Pearl millet flour

Once the most acceptable biscuit variation was identified, value addition was carried out, using coconut powder and carrot powder, to make it rich in nutrients, *viz.* calcium and beta carotene.

The mean scores obtained for various sensory attributes (appearance, colour, taste, after taste and over all acceptability) of value added multigrain flour biscuits, developed from cereal Combination A (Variation A2). The results revealed most acceptable biscuit to be A2CC2, which had 10 per cent of coconut and carrot powders, which were incorporated for value addition.

MGF biscuit A2 with carrot and coconut powder incorporation	**Appearance**	**Colour**	**Taste**	**After Taste**	**Over all Acceptability**
A2 (WF:BF:RF) (70:15:15)	--	4.3 ± 0.3	4.8 ± 0.4	4.6 ± 0.5	4.8 ± 0.4
A2CC1 (A2: CC) (95: 5)	4.6 ± 0.5	4.3 ± 0.5	4.3 ± 0.5	3.6 ± 0.5	4.0 ± 0.6
A2CC2 (A2:CC) (90: 10)	**4.5 ± 0.5**	**4.5 ± 0.5**	**4.5 ± 0.8**	**4 ± 0**	**4.3 ± 0.5**
A2CC3 (A2: CC) (85 : 15)	4.1 ± 0.4	4.1 ± 0.7	3.8 ± 0.4	3.5 ± 0.4	3.9 ± 0.6
A2CC4 (A2 : CC) (80 : 20)	4 ± 0.6	4 ± 0.8	3.8 ± 0.7	3.3 ± 0.5	3.6 ± 0.5

Mean ± Standard Deviation
C= Coconut, C= Carrot

Value addition of most acceptable biscuits developed out of cereal Combination B (Variation B2) was carried out, using coconut and carrot powders, in similar way as was done for variation A2

MGF biscuit B2 with carrot and coconut powder incorporation	Appearance	Colour	Taste	After Taste	Over all Acceptability
B2 (WF:BF:BF) (70:15:15)	4.6 ± 0.5	4.3 ± 0.8	4.5 ± 0.4	4.3 ± 0.5	4.7 ± 0.4
B2CC1 (B2 : CC) (95 : 05)	4.66 ± 0.81	4.5±0.83	4.66 ± 0.51	4.16± 0.75	4.5 ± 0.83
B2CC2 (B2 :CC) (90: 10)	**4.66 ± 0.51**	**4.5 ± 0.83**	**4.5 ± 0.5**	**4.5 ± 0.54**	**4.5 ± 0.54**
B2CC3 (B2 :CC) (85 : 15)	4.33 ± 0.51	4.25 ± 0.61	4.33 ± 0.51	4.25 ± 0.75	4.33 ± 0.51
B2CC4 (B2 :CC) (80 : 20)	4.0 ± 0.63	3.75 ± 0.75	3.75 ± 0.75	3.5 ± 0.83	3.75 ± 0.75

Mean ± Standard Deviation
C= Coconut, C= Carrot

The mean scores obtained for various sensory attributes, like appearance, colour, taste, after taste and over all acceptability for multigrain flour biscuits evaluated using five point rating scale. The sensory evaluation revealed most acceptable biscuits to be B2CC2, which had 70 per cent of wheat flour, 15 per cent of barley flour and 15 per cent pearl millet flour with 5 per cent carrot and 5 per cent coconut powders, incorporated for value addition

Nutrient estimation of the most acceptable value added MGF biscuits

The nutrient content of the most acceptable value added biscuits (A2CC2 and B2CC2) were evaluated biochemically, using standard techniques and analytical grade chemicals.

S.No	Nutrients	Mean Content
1.	Moisture(%)	16.7 ± 0.75
2.	Protein(g)	9.5 ± 0.92
3.	Fat(g)	6.9 ± 0.1

4.	Crude Fiber(g)	3 ± 0.2
5.	Ash (g)	2.4 ± 0.23
6.	Carbohydrate(g)	61.5 ± 7.21
7.	Calcium(mg)	115 ± 4.9
8.	Iron(mg)	5.0 ± 0.11

The estimated values, of various nutrients, present in most acceptable value added biscuit A2CC2 were found to be for moisture 16.7 % ± 0.75, protein 9.5g ± 0.92, fat 6.9g ± 0.1, crude fiber g 3 ± 0.2, ash 2.4 g ± 0.23, carbohydrate 61.5 g ± 7.21, calcium 115 mg ± 4.9 and iron 5.0 mg ± 0.11. The carbohydrate value was calculated using composite method.

Using standard methods, nutrient content of various nutrients present in value added biscuit B2CC2 were also estimated and the results revealed moisture content to be 19.5% ± 0.76, protein 10 g ± 1.12, fat 7.0 g ± 0.57, crude fiber 2 g ± 0.5, ash 3 g ± 0.28, carbohydrate 58.5 g ± 4.29, calcium 70.0 mg ± 1.0 and iron 4.2 mg ± 0.06(1,4).

Mean Nutrient content of most acceptable value added Multi Grain Flour Biscuits combination B2CC2 (per 100g)

S.No	**Nutrients**	**Mean Content**
1.	Moisture (%)	19.5 ± 0.76
2.	Protein (g)	10.0 ± 1.12
3.	Fat (g)	7.0 ± 0.57
4.	Crude Fiber (g)	2.0 ± 0.5
5..	Ash (g)	3.0 ± 0.28
6.	Carbohydrate (g)	58.5 ± 4.29
7.	Calcium (mg)	70.0 ± 1.0
8.	Iron (mg)	4.2 ± 0.06

Cost of the most acceptable value added biscuits

Cost of most acceptable value added Multi Grain Flour Biscuits (MGF A2CC2 and MGF B2CC2) (per 100 g)

Multi grain flour biscuits	Cost (Rs)
Combination A2CC2	20.6
Combination B2CC2	16.48

Result

For the present study, the flours of selected cereals(wheat flour, barley flour, ragi flour and pearl millet) were procured from the local market. The standardized method was then followed for developing biscuits out of combinations of MGFs. The developed biscuits were then organoleptically evaluated by a panel of 5 semi-trained members. For assessing acceptability of the biscuits five point rating scale was used for evaluating, different sensory attributes like colour, appearance, flavour, texture, taste and overall acceptability. Value addition of the developed biscuits was done by adding dry carrot and dessicated coconut powders, keeping in mind micronutrient requirement of the school age children. Coconut, being rich in calcium and carrot being rich in β- carotene were selected for value addition of the biscuits. Both these ingredients are easily available, commonly consumed, as well as, are cost effective.Carrot and desiccated coconut powders were incorporated in varied proportions (5%, 10%, 15%, 20%, 25%) in the most acceptable Multi Grain Flour biscuits developed from two flour combinations (A & B). Proximate nutrients like moisture, protein, crude fiber, fat ,ash , carbohydrates, iron and calcium of the developed biscuits (per 100g) were estimated using standard techniques and chemicals of analytical grade. Biscuits developed from multi grain flour combination A(wheat flour, barley flour and ragi flour) revealed most acceptable biscuit to be A2 from combination A (WF: BF: RF= 70:15:15). The mean score for its taste, after taste and over all acceptance were found to be highest in comparison to other combination Biscuits developed from multi grain flour combination B(wheat flour, barley flour and pearl millet) most acceptable recipe to be B2 from combination B(WF: BF: RF= 70:15:15). The mean score for its taste, after taste and over all acceptance were found to be highest in comparison to other

combination.

To the most acceptable biscuits developed from combination A and B i..e, A2 and B2, respectively, coconut and carrot powders were added for value addition.

The sensory evaluation of the value added Multi Grain Flour Biscuits revealed most acceptable ones to be A2CC2, which had 70 per cent of Wheat flour, 15 per cent of Barley flour and 15 per cent ragi flour with 5 per cent coconut and carrot powder incorporated as value addition.

The sensory evaluation of the value added Multi Grain Flour Biscuits revealed most acceptable recipe to be B2CC2, which had 70 per cent of wheat flour, 15 per cent of barley flour and 15 percent pearl millet with 10 per cent coconut and carrot powders.

The nutrient content of the most acceptable value added Multi Grain Flour Biscuits was estimated biochemically. For A2CC2 biscuit, the nutrient value for moisture was, 16.7 per cent ± 0.75, protein 9.5 g ± 0.92, fat 6.9 g ± 0.1, crude fiber g 3 ± 0.2, carbohydrate 61.5 g ± 7.21, ash 2.4 g ± 0.23, calcium 115 mg ± 4.9, iron 5.0 mg ± 0.11 per 100 g.

The nutrient content of the most acceptable value added Multi Grain Flour Biscuits was estimated biochemically.. For B2CC2 the nutrient value for moisture was, 19.5 per cent ± 0.76, protein 10 g ± 1.12, fat 7.0 g ± 0.57, crude fiber 2 g ± 0.5, carbohydrate 58.5 g ± 4.29, ash 3 g ± 0.28, calcium 70.0 mg ± 1.0, iron 4.2 mg ± 0.06 per 100 g.

The cost calculated for the most acceptable value added biscuits, having code A2CC2 was found to be Rs 30.58 for 247 g and Rs 16.48 per 100g. This included food cost (75%), labour cost(15%) and over head expenses(10%).

The cost calculated for the most acceptable value added biscuits, having code B2CC2 70g was found to be Rs 28.93 for 247 g and Rs 15.58. This included food cost (75%), labour cost(15%)and over head expenses(10%).

Conculsion

Childhood is an important period of development presenting a substantial opportunity for health promotion interventions, since many eating habits, lifestyle and behavior patterns are established that persist throughout adulthood.

Among cereals, wheat is a prime cereal and a major ingredient in foods like bread, biscuits, chapattis etc. Barely another popular and highly nutritious cereal, excellent source of both soluble and insoluble fiber, protein, vitamins and minerals. Ragi a great source of calcium, fiber, iron, amino acids. Pearl millet an important staple food in semi aired region of India, rich in iron and zinc. Despite recommendation made for fruits and vegetables, children eat fewer of these fruits than is considered desirable. Among vegetables, carrots are one of the most widely used and enjoyed vegetables. Carrots are rich in beta carotene, which is converted to vitamin A in the liver and helps for vision in dim light. Whereas, coconut is high in calcium, fiber, protein, helps digestive system.

India has a high prevalence of micronutrient deficiency related health risks, especially among school age children which can be improved by value addition. Kumar et al., 2016 conducted study on the health and nutritional problem and the findings revealed that out of 334 children 137 suffer from various grades of malnutrition, Vitamin A deficiency was observed in 7.29 per cent , Vitamin D deficiency in 11.67 per cent , Vitamin B deficiency in 18.97 per cent malnourished children(2,5).

Therefore, an attempt has been made in the study to develop biscuits from Multi Grain Flours, using selected cereals and carry out their value addition, by adding carrot and coconut powders.

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