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Formulation of Value Added Biscuits Using Defatted Coconut Flour

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ABSTRACT

An ideal food for prevention and control of under nutrition should be of high nutritive value, acceptable, readily available at economical price, familiar to the community and have good tolerance both in illness and good health. A food based approach appears to be the most practical solution in addressing the root causes of the deficiencies in providing immediate relief. The present study was taken as an effort in that direction, to formulate value added biscuits using deoiled coconut meal, rice flakes and defatted soya flour as the major nutrients for supplementation. Defatted coconut flour (*Cocous nucifera*) was used as the major ingredient for the formulation of the supplement, because deoiled coconut meal has high energy density, high in food grade protein source. Coconut meal flour is now also being marketed as functional foods it has high dietary fiber content that aids in lowering cholesterol and provides other health benefits to the human body. Totally ten variations were formulated using different ingredients like deoiled coconut meal flour, rice flakes flour, defatted soya flour, ragi flour, samai flour, garden cress seed and whole wheat flour. The proportions of the ingredients were chosen such that iron and protein were high. With its easily digestible, it is also rich in lysine and low in sulphur amino acids were the other ingredients used for the supplement. Refined wheat flour, powdered sugar and fat were used along with other ingredients for preparing the supplement. Biscuit prepared from deoiled coconut meal flour were found to be rich in all the nutrients and it can be used for the production of processed protein foods suitable for supplementing the diets of children, expectant and nursing mother.

Key words: Deoiled coconut meal flour, rice flakes powder, defatted soy flour, media

INTRODUCTION

India is a unique country where super nutrients of nature receive due recognition in social life. The nutritional importance of coconut was un knowingly sparked in the early 1800 AD. Edible component of the nuts are the nutritional value The ripe kernel and the various end products out of are natural food and drink and considered as health foods in the traditional medical system of India (Bhattacharyya and Bhattacharyya, 2002).

Defatted coconut flour is the ground solid residue/flakes obtained after immediate extraction of oil from dried communicated coconut meal that is processed under sanitary conditions. But it has low market value and is normally sold as an animal feed and in some cases it is just been thrown away (Woodroof, 2001).

Coconut flour is now also being marketed as a functional food as much as studies have shown that it has high dietary fiber content that aids in lowering cholesterol and provides other health

benefits to the human body. The dietary fiber content of coconut flour and low fat desiccated coconut is much higher than oatmeal and flax seed (www.whfoods.com).

Coconut cake or the deoiled coconut meal (*Thenga punnakku*) as called in Tamil contains the coagulated proteins which have low molecular weight amino acids. Here, it has to be specified that, amino acids of low molecular weight increases the absorption of dietary iron (as ferrous form) in the mucosal wall, thereby increasing the bioavailability of iron in the gut (Shills *et al*., 1994).

The ICMR values indicate that 100 g of deoiled coconut meal contains 69.4 mg of iron. The availability of proteins as amino acids is enhanced by the addition of proteolytic enzyme in the colloid milling process. The fibre is also broken by the method of homogenization to get extra-fine grind product. Integrated Coconut Process (ICP) is useful to produce food grade coconut meal. The proportion of protein to carbohydrate and fat is about 1:4 in the food grade coconut meal (Gopalan *et al*., 2002).

Coconut proteins are high in nutritive values and are fairly rich in lysine, methionine and tryptophan. As the fibre contained in the meal interferes with adequate utilization of protein, attempts are being made to eliminate the fiber content (Rastogi and Raghavarao, 1996).

To meet the increasing demands, one of the largely untapped sources is the byproduct of the edible oil industry, namely oilseed meal. It is estimated that 195 million tones of oilseeds can theoretically yield nearly 100 million tones of meal, which is used for the preparation of a number of nutritious and relatively inexpensive foods, particularly for the developing countries. The hull of the edible oilseed imparts undesirable colour to the meal and also increases the crude fibre content of the meal. This problem can be eliminated by dehulling the seeds before oil extraction (Raghavendra Rao *et al*., 1989).

Biscuits are capable of being enriched with additional proteins, vitamins and minerals to enhance their nutritive value. They are suited for promotion of protein rich foods for middle and low income group (Fox and Cameron, 1999). The consumption of cereal foods such as biscuits and bread has become very popular in India. Most of these foods are however poor sources of protein and iron. According to the Federation of biscuit manufacturers, the per capita consumption in India is about 1.2 kg per annum, compared to 15 kg per annum in developed countries.

Biscuit prepared from coconut deoiled meal flour were found to be rich in all the nutrients and it can be used for the production of processed protein foods suitable for supplementing the diets of children, expectant and nursing mother. Refined and processed meal will be edible for human consumption. The main aim of this present study is to formulate highly nutritious deoiled coconut meal biscuit at a lower cost with deoiled coconut meal flour, rice flakes powder, defatted soy flour and maida that can be easily affordable by low income people.

MATERIALS AND METHODS

Formulation of the value added biscuit source of raw materials: Bakery products are gaining extreme popularity as processed foods which offer ready to eat convenience as well as have comparatively long shelf life. Biscuits are more convenient and are ideally suited for storage and distribution to a large number of people. Totally ten variations were formulated using different ingredients like deoiled coconut meal flour, rice flakes flour, defatted soya flour, ragi flour, samai flour, garden cress seeds and whole wheat flour. The proportions of the ingredients were chosen such that iron and protein were high. Deoiled coconut meal (cocous nucifera) was used as the major ingredient for the formulation of the supplement, because

deoiled coconut meal has high energy density, high in iron (69.4 mg), protein (23.8 g) and fibre (9.8 g) besides being rich in carbohydrates (47.9 g) and phosphorus (649 mg) (Gopalan *et al*., 2002). Rice flakes a traditional rice based product of India is rich in iron (20 mg) and calories (346 kcals) and defatted soya flour which has high quality protein (40 g) and it is an excellent source of iron, calcium and vitamin B, it is also rich in lysine and low in sulphur amino acids were the other ingredients used for the supplement. Refined wheat flour, powdered sugar and fat were used along with other ingredients for preparing the supplement.

Deoiled coconut meal which was hexane free was procured from oil mills in Coimbatore and Kangayam, Tamilnadu. The meal available as thin flakes was shade dried for 5-7 days and finally powdered using micropulverizer. Rice flakes were powdered separately to fine texture. By changing the proportion of the ingredients, ten variations were finally selected for acceptability trials.

Blending formulation: All the ingredients were sieved and measured. Then, the margarine and powdered sugar was combined in the pastry board and blended to a smooth paste and the measured flour was also added to the pastry board and made in to soft dough. The soft dough was rolled out in to a sheet about 4 mm thickness. With the help of the biscuit cutter round shaped biscuits were obtained and they were placed on the greased baking tray. It was finally baked in the oven at 180% centigrade for 20 min in a country oven. For the present study biscuits were prepared by traditional "creamery method" described by Whitley (1970).

The nutrient content was determined as part of the study the various nutrients like energy, proteins, fats, carbohydrates, iron and fiber was computed based on ICMR (Gopalan *et al*., 2002).

Sensory quality of biscuits: Organoleptic evaluations of the ten variations of biscuits were carried out by a panel of 10 judges. All the ten variations of biscuits were given different code numbers. Each judges were given three biscuits per sample to assess. The quality factor such as colour, flavor, texture, taste and overall acceptability using 5 point hedonic structure scale followed by Ihekorinye and Ngoddy (1985) were adopted for scoring the biscuits .The scoring scale were 6 = Excellent, 5 = Very Good, 4 = Good, 3 = Fair, 2 = Poor and 1 = Very poor.

Chemical analysis of biscuits: Each value added biscuit samples was dried separately in a hot air oven at 55°C for 12 h to 96% dry matter. The dried samples were milled separately in a laboratory hammer mill to a fine flour (70 mm mesh screen). The samples were stored in separate kilner jars at room temperature (28+2°C) for chemical analyses. All the determinations were done in triplicate using the AOAC standard methods. The crude proteins was determined by the Macrokjeldals method: Crude fibre was by acid hydrolysis: Fat was by soxhlet extraction method ash by dry ashing method while carbohydrates were determined by AOAC method while minerals were determined by atomic absorption spectrophotometer (AOAC, 1995).

RESULTS AND DISCUSSION

Ten selected variations: The composition of the ten variations is presented in Table 1.

From the above table ten variations in different composition was used to develop value added biscuits. Deoiled coconut meal flour was the prime and major ingredients, which was used in varied proportions. Rice flakes powder was 15 g in variations I, II, IV and V. Whereas, in variation

Table 1: Composition of the ten selected variations

	Variations in amount (g)									
Ingredients	I	II	III	IV	V	VI	VII	VIII	IX	X
Deoiled coconut meal flour	25.0	22.5	20.0	20.0	20.0	17.5	17.5	17.5	15.0	14.0
Rice flakes flour	15.0	15.0	20.0	15.0	15.0	17.5	17.5	17.5	25.0	6.0
Defatted soya flour	2.5	5.0	2.5	2.5	7.5	7.5	5.0	7.5	2.5	22.5
Refined wheat flour	7.5	7.5	7.5	7.5	7.5	7.5	7.5	-	7.5	7.5
Powdered sugar	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Fat	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Garden cress seeds powder	-	-	-	-	-	-	2.5	-	-	-
Whole wheat flour	-	-	-	-	-	-	-	7.5	-	-
Ragi flour	-	-	-	5.0	-	-	-	-	-	-
Total	100	100	100	100	100	100	100	100	100	100

Table 2: Nutrient content of the value added biscuits

Variations	Amt (g)	Energy (kcal)	Proteins (g)	Fats (g)	Carbo-hydrates (g)	Iron (mg)	Fibre (g)
I	100	489	8.96	25.97	54.91	20.81	2.68
II	100	489	9.54	25.93	54.60	19.30	2.54
III	100	490	8.10	25.89	56.39	18.34	2.22
IV	100	489	8.14	25.90	56.11	17.54	2.37
V	100	490	10.12	25.89	54.44	17.80	2.40
VI	100	490	9.68	25.85	55.17	16.57	2.18
VII	100	492	9.14	26.43	55.03	18.84	2.26
VIII	100	490	9.76	25.91	54.86	16.73	2.30
IX	100	492	7.24	25.81	57.85	15.87	1.77
X	100	490	15.15	34.17	42.00	13.22	2.40

VI, VII, VIII 17.5 g was incorporated. In variation IX and III 25 and 20 g of rice flakes was used, so that the iron content in the value added biscuits can be improved. To increase the quality of protein 22.5 g of defatted soya flour was incorporated in variation X.

Refined wheat flour was used as constant (7.5 g) to obtain soft dough and good texture. Only in variation XI garden cress seed was used to improve the iron level but due to the bitter taste it was used in rest of the variation.

Nutritive value of the value added biscuits: All the raw ingredients used in ten variations were weighed accurately and the energy, proteins, fats, carbohydrates, iron and fibre contents were calculated using the nutritive value of Indian foods (Gopalan *et al*., 2002) is shown in Table 2.

The protein level of the biscuits ranged from 15-7.24 g in different variations. On an average majority of the variations of value added biscuits was 8-10 g this might have been due to the increased amount of defatted soya flour. Fat levels of the biscuits of the various variations were same (25 g) this might be attributed in part to the high fat used in the preparation of biscuits. All the variations developed from I-X contained more or less the same amount of energy (489-492 kcals).

All the biscuits from the processed flour contain lower (2 g) fiber, the lower fibre of biscuits might be attributed to the processing methods employed during the preparation of the flours. Preparation had same effects on the carbohydrate levels of the products. Carbohydrates contain

Table 3: Comparison of mean scores obtained for different variations

Variations	Appearance	Flavour	Taste	Texture	Overall acceptability
I	2.80±0.42	2.50±0.53	2.90±0.57	2.30±0.82	2.62±0.58
II	2.70±0.48	2.70±0.67	2.80±0.63	3.00±0.47	2.80±0.56
III	2.90±0.74	2.90±0.74	2.40±0.70	2.80±0.42	2.75±0.65
IV	3.00±0.47	2.50±0.85	2.20±0.79	2.90±0.32	2.65±0.60
V	4.10±0.74	3.90±0.74	4.10±0.74	4.10±0.74	4.05±0.74
VI	3.40±0.70	2.80±0.90	2.60±0.90	3.20±0.42	3.00±0.73
VII	3.80±0.63	2.40±0.97	2.70±0.67	3.00±0.47	2.97±0.68
VIII	2.80±0.42	3.30±0.67	2.90±0.57	2.60±0.70	2.90±0.59
IX	2.50±0.53	2.70±0.67	2.80±0.42	2.80±0.63	2.70±0.56
X	2.90±0.74	3.00±0.47	3.00±0.47	3.00±0.47	2.97±0.53

Values are presented as Mean±SD

Table 4: Chemical analysis of value added biscuits

Nutrients	Determined value (Gopalan *et al.*, 2002)	Chemical analysed value	Difference
Proteins (g)	10.12	8.56	1.56
Fat (g)	25.89	35.00	-9.11
Carbohydrates (g)	54.44	28.70	25.74
Iron (mg)	17.80	14.00	3.80
Crude fiber (mg)	2.40	0.82	1.58
Calories (kcals)	490.00	464.00	26.00

ranged from 54-57 g. The highest iron level was absorbed in variations I, II, III, VII that is (21, 19, 18, 18.8 mg, respectively). This might be attributed to the high iron level of deoiled coconut meal (63 mg/100 g).

Sensory evaluation and chemical analysis of the supplement: The mean scores obtained by the panel judges for the ten variations is presented in Table 3.

The organoleptic properties of the biscuits from various flour are shown in Table 3. The panelist like the colour of all the biscuits, the possible reason for the preferences might be due to an increased quantity of deoiled coconut meal flour, rice flour this showed the beneficial effect of flour processing to remove the unwanted particles and improve colour. The panel list preferred the flour of the products due to the baking processing, starch is being converted into dextrin, so that it can be used even for children.

Processing improved the texture of the biscuits, the biscuits from the variation V scored highest level (4.10±0.74). The general acceptability of the value added biscuits were influenced by processing, the ratio of ingredients in the flour mixture and organoleptic attributes of flavour, texture and colour. In terms of overall acceptability, the panel list preferred the product of the variation V (4.05±0.74), this could be attributed to the beneficial of processing which improved colour, flavour and texture of the products. All the biscuits sample variation had acceptability scores expect variation VII due to incorporation of garden cress seed at 2.5 g. The acceptability of the products, particularly those from incorporation of high amount of deoiled coconut meal and rice flakes mixture indicates possible opportunity for further use of the biscuits in confectionery products and formulation of complementary foods.

Chemical analysis of value added biscuits: The variation V of biscuit which has got maximum mean score was analyzed in the laboratory for its nutrient content, the results are shown in Table 4.

Chemical analysis of nutrient biscuits (100 g): Iron content of the baked biscuits was about 14 mg, in addition it provide 35 g of fat, 8.56 g of protein and 29 g of carbohydrate, totally 100 g of value added biscuits provide 464 kcal energy. Amount of crude fibre present in value added biscuits was 0.82 mg. When analyzed value was compared with the computed nutritive value of biscuits (Gopalan *et al*., 2002) this decrease in nutrient values may be due to destruction of nutrients during baking process. In spite of the destruction of the nutrients, biscuit developed was rich in protein and iron thus validating the study. The present study was correlated with the Mathew (2000) study, destruction of nutrients in bakery foods is related primarily to the temperature and duration of the oven exposure during the baking process and to the pH of the dough or batter. It does not appear that significant amounts of vitamins or proteins are lost in the mixing fermentation and make-up phases.

CONCLUSION

To combat the micro and macro nutrient deficiencies, several intervention programmes have been initiated. The entire intervention strategy comes under four major categories namely diversification, supplementation and food fortification and public health measures. Strategies selected should be appropriate to the need, the existing delivery mechanism and available technologies.

A food based approach appears to be the most practical solution in addressing the root causes of the deficiencies in providing immediate relief. If the deficiency is wide spread supplementation may be designed to cover the entire population. If not it will be targeted at vulnerable groups based on age, gender and geographic condition.

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