RESEARCH ARTICLE

FOOD SCIENCE RESEARCH JOURNAL;
Volume 2 Issue 2
(October, 2011) Page : 125-128

Received : May, 2011; Revised: June, 2011; Accepted : July, 2011

Designing of biscuits to overcome dual burden of malnutrition

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ABSTRACT

The aim of this study was to find out designing of biscuits to overcome dual burden of malnutrition. It was found from the results that the incorporation of sources of fibre and protein in biscuits or in other food products can improve the circumstances of co-existance of both under-nutrition in children and over-nutrition in adults.

Kumari, Mamta and Jain, Shashi (2011). Designing of biscuits to overcome dual burden of malnutrition, *Food Sci. Res. J.,* **2**(2) : 125-128.

Key Words: Biscuits, Protein energy malnutrition (PEM) Cardiovascular Disease (CVD)

INTRODUCTION

Biscuits are popular and well-accepted snack food throughout the world. People from different age groups and background eat biscuits. Biscuits are available in wide variety and are nutritious and simple to produce. It can be made easily with readily available ingredients. Biscuits have the potential to be a significant contributor of essential nutrient in the human diet. This is primarily because biscuits are very popular and well accepted by consumers and children. A successful way to improve nutritional aspects of biscuit is the fortification.

Rapidly growing economies often experience coexistence of underweight and overweight problems, referred to as the double burden of nutrition (Delisle, 2008; Popkin, 2004). The implications of both overnutrition and undernutrition indicates that a country can exert rates of infectious diseases and chronic diseases simultaneously. A situation that has not been observed before in history.

Good nutrition is a fundamental right. In India, protein energy malnutrition (PEM) among children under five years still constitutes a major public health problem, poor infant feeding and weaning practices are major contributory factors in malnutrition especially among the under fives. Over the last two decades, overnutrition and obesity have emerged as public health problems; there have been increases in the prevalence of diabetes and cardiovascular disease (CVD), especially in urban areas. The increase in income has made it possible for people living in urban areas to have access to a wider range of food outlets, to afford transportation and other luxuries of western society that have led to an increase in fast food consumption and a more sedentary lifestyle.

Today the emphasis should be given on consumption of variety of food that contain high amount of fibre, protein, vitamins, minerals etc. In the developing countries there is demand to substantially increase protein quality and quantity in daily diet of common masses through food habits which not only will improve general public health but also prevent protein energy malnutrition. However, fibre intake is commonly lower than recommended. In consequence, the development of foods with high fibre content should be desirable. Fibre intake could easily be increased by selecting foods naturally higher in fibre and also by addition of fibre to foods. A good correlation has become evident between fibre consumption and the reduction of coronary heart-related diseases and diabetes incidence.

Since snacks like biscuits are acceptable to all age group people, the present study has developed a formula for the preparation of biscuits from locally available foods which can be used as a tool to fight against the dual burden of malnutrition.

METHODOLOGY

All the raw ingredients like refined flour, butter, sugar, milk, baking powder and soda, etc. were purchased from the local market of Udaipur.

Preparation of biscuits:

A standardized recipe with some modifications was used for the preparation of biscuits (Table A). The biscuits

Table a: Composition of dough with varying proportions of ingredients for preparation of different types of biscuits

Ingredients	Control	Low energy biscuits	High protein biscuits
Refined flour (g)	50	45	45
Butter (g)	25	25	25
Sugar (g)	25	25	25
Baking powder (g)	0.25	0.25	0.25
Baking soda	Pinch	Pinch	Pinch
Milk	For dough	For dough	For dough
Fiber (g)	---	5	---
Groundnut (g)	---	---	7
Sesame seeds (g)	---	---	3

were prepared as follows; refined flour, baking powder and soda were sifted together. Sugar and butter was creamed till fluffy then sifted mixtures were added and mixed. Milk was added for dough binding and kneaded till a soft doug was formed. Dough was rolled and cut with biscuit cutters. Then baked at 170°C for 20 min in OTG which was preheated at 250°C for 10 min.

Low energy biscuits:

The low energy biscuits were prepared by adding 10 per cent fibre in the refined flour after sifting the flour mixture without altering the remaining procedures.

High protein biscuits:

Similarly the high protein biscuits were prepared by replacing the refined flour with 3.5 per cent and 1.5 per cent groundnut and sesame seeds, respectively but these were ground coarsely and embedded on dough after rolling. Remaining procedures were same as above mentioned for control biscuits.

Sensory evaluation:

The sensory analysis was done using 9 Point Hedonic Scale (1- dislike extremely, 9- like extremely) by 10 panel members randomly selected from the deptt. of Food and Nutrition, College of Home Science, MPUAT, Udaipur, Rajasthan. The biscuits were analyzed for sensory attributes like colour, flavour, texture, taste and overall acceptability (Srilakshmi, 2005). The scores obtained were then statistically analyzed.

Chemical analysis:

Nutrients such as moisture, protein, fat, ash, fibre were analyzed as per AOAC (1997) methods. All determinations were made in duplicates and the average values were adopted. All the analysis was done on dry weight basis.

Evaluation of protein quality:

Net dietary calorie per cent (NDpCal%), a method of evaluation of protein quality was calculated on the basis of their "chemical score" and "protein calorie percentage" (Miller and Payne, 1961)

OBSERVATIONS AND ASSESSMENT

The results of the present research have been discussed under the following heads:

Sensory analysis of biscuits:

Table 1 shows the organoleptic scores of developed biscuits. The scores of colour, flavour, texture, taste and overall acceptability of the biscuit were in range of 7.5 to 8.0 indicating 'liked moderately' to 'liked very much'. The data on sensory scores indicated that there were no significant differences for flavour, texture, taste and overall acceptability between the control, low energy and high energy biscuits. This showed that replacement of *maida* with fibre (10%), groundnut (3.5%) and sesame seeds (1.5%) did not affect the sensory parameters of the biscuits.

Table 1: Sensory evaluation of high and low energy biscuits

Biscuits	Colour	Flavour	Texture	Taste	Overall acceptability
Control	7.5 ± 0.15	7.9 ± 0.09	7.8 ± 0.18	7.9 ± 0.22	7.7 ± 0.14
Low energy	8.0 ± 0.14	7.9 ± 0.16	7.9 ± 0.16	7.9 ± 0.16	7.9 ± 0.16
T cal (0.05)	2.27^{S}	0^{NS}	0^{NS}	0^{NS}	0.9^{NS}
High protein	8.4 ± 0.16	8.0 ± 0.2	7.4 ± 0.22	8.1 ± 0.27	8.0 ± 0.25
T cal (0.05)	3.94^{S}	0.43^{NS}	1.37^{NS}	0.57^{NS}	1.03^{NS}

*The scores are expressed as Mean ±S.E of ten determinations

Proximate composition of biscuits:

Table 2 shows information regarding the mean nutrient composition of low energy and high protein biscuits per 100g. Results revealed that the proximate composition of low energy biscuits were better than the control in terms of protein, ash, moisture and fibre content. This is due to dietary fibre which is gaining importance now-a-days due to its beneficial effects on the reduction of cholesterol levels and the risk of colon cancer. The RDI of dietary fibre is 21-38g/day though on an average consumers are receiving less than half of this recommendation. (Heart Stroke Foundation 2009). Thus, low energy biscuits are beneficial in minimizing the load of overnutrition. Table also showed that high protein biscuits were having higher content of carbohydrate, protein and energy in comparison with control. This revealed that the incorporation of little amount of nuts and oilseeds in biscuits were highly beneficial from nutrition point of view. Biscuits can be easily fortified with protein rich flours to provide convenient food in order to supplement protein in the diet (Mishra *et al.,* 1991). Supplementation with nuts and oilseeds is one way to meet the needs for protein foods, particularly baked foods. Nuts and oilseeds can have the potential to provide good quality protein and nutritionally improves the product. The energy content of high protein biscuits and control were almost at par because of little addition of nuts and oilseeds but there was much difference in the protein content. The energy content of high protein and low energy biscuits were incomparable, therefore if these biscuits were taken in daily diet they will reduce/ increase the calories by 50 per cent and without changing the food habits.

Protein quality of biscuits:

Protein quality of biscuits was measured by calculating chemical score and total energy content and expressed as net dietary protein calorie per cent (NDpCal %).

Table 3 represents the protein quality of the biscuits. The most limiting amino acid in all the biscuits were lysine.

Table 2: Proximate composition of low-energy and high-energy biscuits as compared with control

Nutrient	Control	Low energy biscuits	High protein biscuits
Carbohydrate (g)	71.375	69.155	76.24
Protein (g)	4.9	5.5	6.05
Fat (g)	16.45	12.15	14.15
Ash (g)	1.3	1.4	0.66
Moisture (g)	2.645	3.135	1.34
Fiber (g)	1.0	8.66	1.56
Energy (kcal)	453.15	407.97	456.51

Table 3: Protein, calories, chemical score and NDpCal% of the recipes

Sr. No.	Recipes	N(g)	Calories	Chemical score	NDpCal%
1.	Control biscuit	0.931	453.15	38.6	7.87
2.	Low energy biscuits	0.841	407.97	39.3	7.14
3.	High protein biscuits	1.298	456.51	45.65	7.54

Table 4: Chemical score of biscuits

Sr. No.	Amino acids	Control biscuits	Low energy biscuits	High protein biscuits
1.	Lysine	38.6	39.3	45.65
2.	Tryptophan	102.73	103	104.18
3.	Phylalanine	153.47	153.57	158.34
4.	Tyrosine	73.3	73.8	87.95
5.	Methionine	85.27	85.67	83.91
6.	Cystine	122.78	122.30	111.07
7.	Threonine	62.84	63.15	65.91
8.	Leucine	93.39	93.66	94.21
9.	Isoleucine	90.62	90.90	92.41
10.	Valine	80.24	80.54	83.30

The chemical score of control, low energy and high energy biscuits were 38.6, 39.3 and 45.56 and NDpCal% were 7.87, 7.14 and 7.54, respectively.

The minimum percentage of net dietary protein calories recommended by FAO/WHO (1973) is 8 per cent for children for their proper growth and maintenance and 5 per cent for adults. But the NDpCal% of control biscuit is higher than the low energy and high protein biscuits, this may be due to replacement and addition of ingredients. As it can be seen from the Table 4 that chemical score of low energy and high protein biscuits were better than the control one. Therefore, NDpCal% for biscuits were at par with the levels recommended and depicts that the biscuits were of good quality protein.

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