

## Evaluation of Community Balwadi Children Growth Rate as Effected by Feeding the Protein Rich Biscuit

K. B. Kamaliya<sup>1</sup> and R. K. Mishra<sup>2</sup>

<sup>1</sup> Professor (Foods & Nutrition), School of Baking, Polytechnic in Food Science and Home Economics, AAU, Anand - 388110

<sup>2</sup> Associate Professor, Poultry Complex, Veterinary College, AAU, Anand - 388 110

Email : kb\_kamaliya@yahoo.co.in

### ABSTRACT

*Protein is an essential nutrient for growth and development of children. Defatted Soya Flour (DSF) contains good quality and quantity (50%) of protein. Biscuits are popular among children and can easily be modified as health food. Therefore, the present study was planned to develop soya fortified biscuit (SFB) to increase the protein content and to check its effect on the growth rate of the children. The formula and procedure was standardized and optimized through sensory evaluation. The developed biscuit were fed to balwadi children. Biscuit prepared 30% DSF replaced biscuit was selected as the experimental biscuit. Protein content was doubled while calcium, phosphorus and iron content increased. Percent weight gain in the group of children fed SFB was 37.80% higher as compared to the group of children fed regular snack. Thus the SFB can be successfully incorporated in community feeding programmes or sold out at retail counter as health food.*

**Keywords :** Biscuit, Soya biscuit, Soya flour, Protein, Bakery product, Health food

### INTRODUCTION

Now a days an Indian-mothers give biscuits to their children as soon as they learn to eat. The protein content of such commercial biscuits is low (Kamaliya and Rema 2006). Protein energy malnutrition (PEM) is the major nutritional deficiency diseases particularly among children in third world countries including India (WHO 2003). Defatted Soya flour contains around 50 % protein with good amino acid pattern (Kamaliya 2005). Therefore, the present study was planned to develop biscuit using DSF to improve the protein quantity and quality of commercial biscuit and evaluate its effect on the growth of the children.

### METHODOLOGY

Good quality raw ingredients were procured from the local market of Vallabh Vidhyanagar and Anand except DSF, which was procured from "Sakthi sugars Ltd. (Soya Division)", Coimbtore. Two recipes namely vanilla biscuit (Kamaliya and Patel 1997) and glucose biscuit (AACC 1995) were selected through survey of local market. The formula and procedure standardized in the laboratory conditions

through sensory evaluation and considered as control biscuit (CB). To that formula DSF was replaced to RWF and subsequent changes were made and evaluated sensorily to optimized experimental formula. The biscuit showing highest score was considered as THE experimental biscuit (EB).

The CB and EB were analysed for various nutrients as per the standard methods. The production cost of developed products was calculated on the current cost (at the time of experiments) of the raw ingredients in the commercial market and compared with control products.

To assess the growth promoting effect of soya fortified biscuits, 149 children from local pre-schools (*balwadies*) were selected and divided into 3 groups depending on sex and weight. One group were fed 70 g soya fortified biscuit another one fed control biscuit, and third one continued with their regular snack for 60 days. The enrolled subjects were weighed at the beginning of the feeding trial and were repeated after every 15 days until the end of the experiment. Data for only 128 subjects were analysed for experimental purpose as some subjects dropped out of the

study.

**RESULTS AND DISCUSSIONS**

**Product Development:**

The mean score of all the sensory characteristics of the DSF replaced and CB (on the day of preparation and after 4 day) is presented in Table 1.

**Table 1 : Mean sensory score of control and developed biscuits**

Characteristics / Products	Mean Sample Score									
	Evaluated After 24 hrs of Preparation					Evaluated After 4 Days of Preparation				
	Control Biscuit	Developed Biscuit				Control Biscuit	Developed Biscuit			
		25 % DSF	30 % DSF	35 % DSF	'F' Value		25 % DSF	30 % DSF	35 % DSF	'F' Value
Volume (10)	8.69 <sup>b</sup> ± 0.10	8.37 <sup>b</sup> ± 0.14	7.90 <sup>a</sup> ± 0.18	7.81 <sup>a</sup> ± 0.19	1.59 <sup>**</sup>	8.65 <sup>c</sup> ± 0.14	8.13 <sup>b</sup> ± 0.18	7.81 <sup>ab</sup> ± 0.18	7.52 <sup>a±</sup> 0.22	7.00 <sup>**</sup>
Crust Character (10)	8.60 <sup>c</sup> ± 0.13	7.96 <sup>b</sup> ± 0.15	7.48 <sup>a</sup> ± 0.17	7.42 <sup>a±</sup> 0.20	10.82 <sup>**</sup>	8.29 <sup>c</sup> ± 0.16	7.85 <sup>bc</sup> ± 0.15	7.46 <sup>ab</sup> ± 0.17	7.21 <sup>a±</sup> 0.19	7.80 <sup>**</sup>
Crumb Colour (10)	8.79 <sup>c</sup> ± 0.08	7.85 <sup>b</sup> ± 0.14	7.21 <sup>a</sup> ± 0.16	7.10 <sup>a±</sup> 0.15	33.11 <sup>**</sup>	8.42 <sup>c</sup> ± 0.18	7.52 <sup>b</sup> ± 0.14	7.02 <sup>a</sup> ± 0.15	6.71 <sup>a±</sup> 0.20	19.73 <sup>**</sup>
Crumb Texture (20)	17.71 <sup>c</sup> ± 0.24	15.63 <sup>b</sup> ± 0.36	14.79 <sup>ab</sup> ± 0.37	14.50 <sup>a±</sup> 0.49	14.92 <sup>**</sup>	17.08 <sup>c</sup> ± 0.33	15.33 <sup>b</sup> ± 0.38	13.92 <sup>a</sup> ± 0.42	13.17 <sup>a±</sup> 0.46	18.43 <sup>**</sup>
Taste and Aroma (30)	26.38 <sup>c</sup> ± 0.40	22.81 <sup>b</sup> ± 0.40	21.50 <sup>a</sup> ± 0.41	20.44 <sup>a±</sup> 0.61	30.83 <sup>**</sup>	25.63 <sup>c</sup> ± 0.49	23.00 <sup>b</sup> ± 0.58	20.88 <sup>a</sup> ± 0.63	19.75 <sup>a±</sup> 0.70	18.43 <sup>**</sup>
Mouth Feel (10)	8.65 <sup>c</sup> ± 0.12	7.73 <sup>b</sup> ± 0.18	7.25 <sup>a</sup> ± 0.17	6.92 <sup>a±</sup> 0.21	19.47 <sup>**</sup>	8.31 <sup>c</sup> ± 0.20	7.40 <sup>b</sup> ± 0.16	6.65 <sup>a</sup> ± 0.19	6.38 <sup>a±</sup> 0.19	21.98 <sup>**</sup>
Over All Quality (10)	8.90 <sup>c</sup> ± 0.09	7.88 <sup>b</sup> ± 0.12	7.35 <sup>a</sup> ± 0.14	7.06 <sup>a±</sup> 0.20	31.52 <sup>**</sup>	8.54 <sup>c</sup> ± 0.16	7.73 <sup>b</sup> ± 0.14	7.10 <sup>a</sup> ± 0.10	6.85 <sup>a±</sup> 0.17	27.98 <sup>**</sup>

DSF = Defatted soya flour

\* Control = 100% Refined white flour, 25% Margarine, 25% Cotton seed oil and 40% Sugar (Baker's %)

All the replacements are based on baker's percentage

Values are Mean ± SEM scores of a composite scoring test by a panel of 8 judges X 3 replications

Means bearing the same superscript within the column do not differ significantly (p ≤ 0.05)

\*\* p ≤ 0.01

Values in parentheses are the number of maximum scores

The biscuit prepared using 25% replacement of DSF, ranked highest (p ≤ 0.05) in all the sensory characteristics followed by 30% replacement with only a marginal difference for all sensory characteristics. There was slight decrease in the all most all the sensory characteristics when the biscuits were analysed after four days of preparation. Awasthi et al. (1999) found maximum acceptability for 15% while Singh et al. (1996) found for 20% and Gandhi et al (2001) found 40% DSF replacement in biscuit preparation.

**Nutrient Composition**

The nutrients content of developed biscuits were

compared with CB. The data shown in table 2. The protein content of developed biscuits was more than doubled (i.e. increased to 127.85%) as compared to CB. The quantity of protein supplied by seven biscuits of 30 % DSF can meet 1/3<sup>rd</sup> RDA of pre school children Gopalan (1999). thus the 30% DSF replaced biscuit was selected as the experimental biscuit (EB) though the sensory score obtained by 25% DSF replaced biscuit was slightly higher. The fiber level was also doubled in EB as compared to CB. That is an additional benefit to preschool children as it helps in the digestion. Calcium, phosphorus and iron was increased from 4.10 to 66.20, 30.19 to 198.07 and 0.25 to 2.82 mg per 100 gm product, respectively. All these nutrients are essential for children for bone and blood development.

**Table 2 : Nutrient Composition of the Control and Experimental Biscuit**

Nutrient/ Product	Control #	30 % DSF
Moisture (g %)	9.16 <sup>c</sup> ± 0.10	8.19 <sup>a</sup> ± 0.01
Protein (g %)	5.96 <sup>a</sup> ± 0.03	13.58 <sup>d</sup> ± 0.03
Fat (g %)	29.42 <sup>b</sup> ± 0.20	29.33 <sup>b</sup> ± 0.10
Carbohydrate (g %)	70.64 <sup>c</sup> ± 0.39	60.38 <sup>c</sup> ± 0.34
Energy (K Cal)	609.50 <sup>c</sup> ± 2.13	596.80 <sup>cd</sup> ± 1.81
Total Fiber (g %)	0.56 <sup>a</sup> ± 0.02	1.12 <sup>bc</sup> ± 0.02
Soluble Fiber (g %)	0.20 ± 0.01	0.28 <sup>a</sup> ± 0.01
Insoluble Fiber (g %)	0.40 ± 0.00	0.56 <sup>a</sup> ± 0.01
Ash (g %)	0.37 <sup>a</sup> ± 0.00	1.43 <sup>d</sup> ± 0.02
Calcium (mg %)	4.10 <sup>a</sup> ± 0.05	66.20 <sup>c</sup> ± 0.48

Nutrient/ Product	Control #	30 % DSF
Phosphorus (mg %)	30.19 <sup>a</sup> ± 0.34	198.07 <sup>d</sup> ± 1.58
Iron (mg %)	0.25 <sup>a</sup> ± 0.01	2.82 <sup>d</sup> ± 0.02

RWF = Refined white flour, DSF = Defatted soya flour

# Control = 100% Refined white flour, 25% Margarine, 25% Cotton seed oil and 40% Sugar (Baker's %)

Values are Mean ± SEM of 8 replications

All the replacements are based on baker's percentage

Means bearing the same superscript within the column do not differ significantly ( $p \leq 0.05$ )

\*\*  $p \leq 0.01$

\$= Except for moisture content all parameters are expressed on dry weight basis

#### Production Cost

The cost price of the EB was just higher by ₹ 4/- than the cost price of the CB because the cost of DSF is double than RWF. Looking to the protein value possessed by EB, the cost difference can easily met in terms of saving lots of national fund spending for the proper growth of children and medical treatment, if PEM occurred.

**Table 3 : Gain in Weight of Pre School Children Fed Experimental or Control Biscuit or Regular Snack**

Group	Boys/ Girls	Initial weight (kg)	Final weight (kg)	Gain in weight (kg)	Percent gain in weight
Soya biscuit	Boys (25)	13.280 ± 0.39	13.667 ± 0.418	0.387 ± 0.07	2.825 ± 0.49
	Girls (18)	12.735 ± 0.38	13.10 ± 0.41	0.362 ± 0.07	2.762 ± 0.56
	Total (43)	13.050 ± 0.27	13.431 ± 0.30	0.376 ± 0.05	2.798 ± 0.36
Control biscuit	Boys (25)	13.502 ± 0.40	13.84 ± 0.40	0.342 ± 0.10	2.635 ± 0.74
	Girls (19)	12.402 ± 0.26	12.738 ± 0.26	0.336 ± 0.06	2.741 ± 0.47
	Total (44)	13.012 ± 0.26	13.352 ± 0.26	0.339 ± 0.06	2.682 ± 0.46
Regular snack	Boys (23)	13.271 ± 0.31	13.534 ± 0.31	0.263 ± 0.09	2.059 ± 0.68
	Girls (18)	12.677 ± 0.27	12.950 ± 0.28	0.273 ± 0.06	2.144 ± 0.51
	Total (41)	13.000 ± 0.21	13.269 ± 0.21	0.268 ± 0.06	2.097 ± 0.44
'F' Value		1.53 <sup>NS</sup>	1.47 <sup>NS</sup>	0.30 <sup>NS</sup>	0.31 <sup>NS</sup>

NS = Non significant

Values are Mean ± SEM

Values in parentheses are the number of children

### Clinical Evaluation

Gain in weight is the main parameter used to assess the effect of protein on the body. Therefore, initial and final weights of children were recorded and from this data gain in weight and percent gain in weight were calculated. The results obtained are presented in Table 3. Subjects fed EB or CB showed an average weight gain of 0.376 or 0.339 kg, respectively. The group which continued on the routine snack of the *balwadi* showed the lowest average weight gain (0.268 kg). Percent weight gain in the group fed EB and CB was 37.80% and 13.40%, respectively as compared to the group fed regular snack. The beneficial effect of the soya fortified biscuits indicates that it can be successfully incorporated in community feeding programmes like mid day meal programmes and also for individual consumption. Such health food thus would also be helpful to provide new avenues of development of the bakery and food processing industry as a whole.

### CONCLUSION

It may be concluded that the Biscuit prepared by replacing 30% DSF is acceptable and could be useful in the growth and development of the children. That could be utilised in the community feeding programmes like Integrated Child Development Services (ICDS) and Midday School Meal (MSM) for promoting health of the children and expecting mother with special reference to rural and poor urban population.

### FUTURE SCOPE

Like protein rich biscuit various health bakery products could be developed that would be a win-win situation for both food industries as well as community.

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