

Acceptability and nutrient composition of supplementary foods developed for vulnerable groups

T.N. KHAN, V.S. ZANVAR, A.B. ARYA AND J.P. NERLEKAR

Accepted : September, 2008

ABSTRACT

Malnutrition is wide spread in most of the developing countries. It is regarded as a spectrum of disease arising from an inadequate diet, especially in childhood. Malnutrition is a disease of complex interactions. Twelve supplementary foods were developed utilizing food stuffs which are locally available, low cost, rich in protein, calorie, iron, calcium and vitamin C and suitable for preschool children, school going children, and for lactating and pregnant women. These developed supplementary foods were analyzed for Proximate composition *i.e.* moisture, fat, fibre, protein, ash, calcium, iron and vitamin C by using standard procedures (AOAC, 1975). Among developed supplementary food two from each group were selected for field acceptability depending on the simple and easy method of preparation. The Supplementary foods which can be stored for longer duration were selected for storage study. The effect of storage duration on organoleptic characteristic of developed was carried out at 0, 15, 30, 45, 60 days. Effect of storage duration on different parameters of selected supplementary foods *i.e.* free fatty acid, peroxide value, reducing and non reducing sugar, total sugar content of recipe was also determined at 0, 15, 30, 45, 60 days.

See end of the article for authors' affiliations

Correspondence to:

T.N. KHAN

Department of Food and Nutrition, College of Home Science, Marathwada Agricultural University, Parbhani (M.S.) INDIA

Key words : Nutrition, Supplementary foods, Vulnerable.

Malnutrition is wide spread in most of the developing countries. It is regarded as a spectrum of disease arising from an inadequate diet, especially in childhood. Malnutrition is a disease of complex interactions. Its course and severity are determined by the cumulative effects of a negative balance of various biological, social, cultural, economic and environmental factors (Anonymous, 1996). There is increasing evidence that malnutrition during early childhood can lead not only to the stunting of the physical growth but also the impairment of vital function such as resistance to infection, work capacity as well as learning ability. World Health Organization (1989) defines malnutrition as the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance and specific functions during the first few years of life. The body grows at a very fast rate and required good nutrition for foundation growth of children.

Growing children requires large amounts of body building and energy giving foods rich in proteins and calories, apart from this other nutrients such as calcium, iron, vitamin A, Vitamin B complex, Vitamin C and other trace elements. Majority of the children in developing countries consume inadequate diets and suffer from malnutrition (ICMR, 1986).

The nutritious supplementary foods are the dependable sources to overcome the nutrition gap and to protect the child from revenges of malnutrition. The supplement provided, must be enough to bridge the gap

between actual nutrient intake and recommended levels. The supplementary foods supplied to children should be rich in protein and energy. It should have a longer shelf-life and must be easy to store at room temperature. Supplement should provide 1/3 of day's requirement and should be given in addition to daily diet. Appropriate use of all type foods in preparation of the supplementary foods will helpful in providing the required nutritional needs. The preparation of supplementary foods must be based on locally available, low cost nutritious food and easy to prepare. By considering these facts the present study was undertaken to develop the nutritious supplementary foods for different vulnerable groups and acceptability, nutritional composition and storage effect on organoleptic characters and selected parameters were studied

METHODOLOGY

Twelve supplementary foods were developed utilizing food stuffs which are locally available, low cost, rich in protein calorie, iron, calcium and vitamin C and suitable for preschool children, school going children and for lactating and pregnant women. Supplementary foods developed for preschool children were *Ragi poori*, *Ragi biscuit*, *Soya poha laddu*, for school going children *Sago biscuit*, *Bajra mathri*, *Sandwich* and for pregnant women *Soya Burfi*, *Drumstick chutney*, *Cauliflower greens dhapata*. However, supplementary foods developed for lactating women were *Poori mix*, *Paratha mix*, *Dal chiwada*. The developed products were evaluated

for acceptability by trained panel members. These developed supplementary foods were analyzed for proximate composition *i.e.* moisture, fat, fiber, protein, ash, calcium, iron and vitamin C by using standard procedures (AOAC, 1975). The field acceptability of these developed supplementary foods was carried out by selected preschool children (25), school going children (25), adult women (25). Among developed supplementary food two from each group were selected for field acceptability depending on the simple and easy method of preparation.

The supplementary foods which can be stored for longer duration were selected for storage study. The effect of storage duration on organoleptic characteristic of develop was carried out at 0, 15, 30, 45, 60 days. Effect of storage duration on different parameters of selected supplementary foods *i.e.* free fatty acid, peroxide value, reducing and non reducing sugars, total sugar content of recipe was also determined at 0, 15, 30, 45, 60 days.

RESULTS AND DISCUSSION

Data regarding the acceptability scores of sensory evaluation of developed supplementary foods is presented in Table 1. It was observed from the Table that among

the developed supplementary foods for preschool children soya poha laddu scored high ranking followed by *ragi biscuits* for all sensory characters. In case of supplementary foods developed for school going children sandwich and sago biscuit recorded almost same marks for taste, texture, colour, and overall acceptability. However, bajra mathri scored low ranking for all sensory characters. Further it was pointed out that the soya burfi and drumstick chutney were liked by all panel members and they had given good scores for all sensory characters. Comparatively cauliflower greens dhapate recorded lower scores for all sensory characters. Statistically significant difference was noted when compared between the mean values of supplementary foods developed for different groups. On the whole soya poha laddu, sago biscuit, soya burfi and poori mix were most acceptable among all developed supplementary foods.

Table 2 reveals data regarding nutrient composition of products developed for preschool children per 100 g on dry weight basis. Among the recipes developed for preschool children soya poha laddu contained good amount of protein (14g/100g), energy (516.22kcal/100g) and iron (5.62mg/100g). However, ragi poori provided 222mg/100g

Table 1: Acceptability scores of sensory evaluation of developed supplementary foods

Name of product	Appearance	Taste	Flavour	Texture	Colour	Doneness	Overall acceptability
Preschool children							
Soya Poha laddu	4.8	4.9	4.85	4.9	4.9	4.85	4.9
Ragi puri	3.8	4.1	4	4.1	3.85	4	4.1
Ragi biscuits	4.5	4.9	4.85	5	4.75	4.85	4.8
Mean	4.37	4.63	4.57	4.67	4.50	4.57	4.60
S.D.	0.513	0.462	0.491	0.493	0.568	0.491	0.436
School going children							
Sandwich	4.3	4.75	4.2	4.2	4.5	4.3	4.5
Sago biscuit	4.5	4.5	4.5	4.2	4.65	4.5	4.5
Bajra Mathri	4.3	4.4	4.3	4	4.3	4.2	4.3
Mean	4.37	4.55	4.33	4.13	4.48	4.33	4.43
S.D.	0.115	0.180	0.153	0.115	0.176	0.153	0.115
Pregnant women							
Burfi	4.5	4.2	4.1	4.6	4.5	4.1	4.4
Cauliflower greens dhapate	3.7	3.6	3.5	3.7	3.6	3.7	3.5
Drumstick chutney	4.5	4.6	4.5	4.2	4.3	4.5	4.5
Mean	4.23	4.13	4.03	4.17	4.13	4.10	4.13
S.D.	0.462	0.503	0.503	0.451	0.473	0.40	0.551
Lactating women							
Poori mix	4.1	4.5	4.5	4.3	4.3	4.4	4.4
Paratha mix	4	4.1	4	4	4.5	4	4.2
Mix Dal Chiwada	4.3	4.4	4.1	4.3	4.3	4.2	4.3
Mean	4.13	4.33	4.20	4.20	4.37	4.20	4.30
S.D.	0.153	0.208	0.265	0.173	0.115	0.20	0.10

Table 2 : Nutrient composition of products developed for different vulnerable groups per 100g (Dryweightbasis)									
Name of product	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	Energy(Kcal)	Calcium (mg)	Iron (mg)	Vitamin C (mg)
For preschool children									
Ragi poori	9.33	23.11	37.29	1.12	2.49	394.47	222.00	4.66	8.66
Ragi biscuit	11.08	25.17	46.32	2.01	1.34	456.13	156.00	3.15	0.00
Soya poha laddu	14.00	28.26	51.47	1.02	1.27	516.22	60.00	5.62	0.00
For school going children									
Sago biscuit	9.91	28.96	42.44	0.89	0.82	470.04	53.33	0.81	0.00
Bajra mathri	7.58	13.91	56.70	0.93	1.76	382.31	160.66	5.46	0.00
Sandwich	7.00	0.68	54.83	0.86	1.57	253.44	182.00	6.75	26.66
For pregnant women									
Burfi	16.91	16.85	49.34	0.61	1.30	416.65	188.66	2.30	1.00
Cantiflower dhapata	12.25	6.86	48.77	1.71	2.61	305.82	125.33	7.91	0.00
Drumstic chutney	3.50	0.93	11.89	1.45	3.47	69.93	244.66	4.27	94.58
For lactating women									
Poori mix	14.58	22.08	32.84	2.99	2.11	388.40	250.00	3.95	4.60
Parath mix	15.16	11.66	40.71	2.25	2.42	328.42	155.33	9.16	5.66
Dalchiwada	14.58	25.06	49.79	0.75	2.36	483.02	133.33	5.19	1.75

of calcium. In case of recipes developed for school going children sago biscuits was found to supply good amount of protein (9.91g), fat (28.96g), energy (470 kcal) followed by bajra mathari. Whereas sandwich provided more amount of calcium (182mg), iron (6.75mg) and vitamin C (26.66mg). Further, it was noted from the Table that among the supplementary food developed for pregnant women, soya burfi was proved to be good source of protein (16.91g), fat (16.85) and energy (416.65 kcal) where as cauliflower greens dhapata provided good amount of iron (7.91mg) and drumstic chutney supplied 244.66mg calcium and 94.58mg of vitamin C. The recipes like poori mix, paratha mix, and mix dal chiwada were developed for lactating women. Among these recipes, it was found that paratha mix provided more amount of protein, iron and vitamin C followed by poori mix, and mix dal chiwada. Whereas dal chiwada contained more amount of fat, carbohydrate and energy than Poori mix, Paratha mix. In nut shell it can be inferred from the Table 2 that all the developed recipes provided good amount protein, energy, calcium, iron, vitamin C. The developed supplementary foods were prepared utilizing the food stuffs which are rich in nutrients and provide 1/3 of daily requirement. Hence, the developed supplementary foods can be propagated for consumption among vulnerable group which can enhance the nutritional status

Table 3.1 reveals the information about field acceptability trial of formulated products developed for preschool children. The products ragi poori and soyapoha laddu were taken to village and administered to preschool children. Care was taken that the child consume the

supplementary food in front of investigator. Both the products, ragi poori and soyapoha laddu were fully consumed by all 25 preschool children. Further, it is noted (Table3.2) that among school going children, bajra mathri and sandwich were liked very much by 60 and 20 per cent children and liked by 40 and 80 per cent children,

Table 3.1 : Acceptability trials of formulated products among preschoolers (N=25)

Name of product	Level of acceptance		
	Fully consumed n (%)	Partially consumed	Not consumed
Ragi poori	25 (100)		
Soyapoha laddu	25 (100)		

Table 3.2 : Acceptability trials of formulated products among school going children (N=25)

Name of product	Level of acceptance		
	Liked very much n (%)	Liked	Disliked
Bajra mathri	15 (60.0)	10 (40.0)	
Sandwich	5 (20)	20 (80)	

Table 3.3 : Acceptability trials of formulated products among adult women (N=25)

Name of product	Level of acceptance			
	Very good n (%)	good	Neither liked nor disliked	Disliked
Dhapate	7 (28)	18 (72)		
Drumstic chutney	2 (8)	15 (60)	8 (32)	
Dal chiwada	2 (8)	23 (82)		

n-number of subjects, Figures in parenthesis indicate percentage

respectively. When considered, the field acceptability of supplementary foods developed for pregnant and lactating women (Table 3.3). Majority of adult women recorded the good scores for dhapate (72 per cent), drumstick chutney (60 per cent) and chiwada (82 per cent) where as very good scores for dhapate (28%) drumstick chutney (8%) and dal chiwada(8%).

The data regarding effect of storage duration on sensory scores of different products is given in Table 4. Among the developed supplementary foods, four products namely, sago biscuit, ragi biscuit, soyapoha laddu and dal chiwada were prepared and stored for 60 days. The observations for sensory characteristic were recorded for 0,15,30,45 and 60 days of storage period. In case of sago biscuit, the sensory scores for colour, taste, texture and overall appearance were decreased from 4.6 (at 0 days) to 3.3 (at 60 days). The products like ragi biscuits and dal

chiwada were recorded sensory scores at 0 days were 4.5 to 4.75 and the acceptability scores decreased up to 3 to 3.5 at the end of 60 days. However, soya poha laddu recorded highest acceptability scores for all sensory characters at 0 days and decreased up to 4.2 at the end of 60 days. In a nut shell it was found that as the period of storage was increased the sensory scores decreased for all the developed supplementary foods.

The results of effect of storage duration on different parameters of sago biscuits are shown in Table 5. The parameters like free fatty acid, peroxide value, reducing sugar, non-reducing sugar and total sugar were analyzed for 0, 15, 30, 45, and 60 days. Free fatty acid, peroxide values and reducing sugar increased from 3.2 to 7.43 mg /100mg, 1971.22 to 3013.25 me equi O₂/kg and 5.66 to 19.38 g/100, respectively. Significant increment was noticed with increased period of storage duration.

Table 4 : Effect of storage duration on mean sensory scores of different products

Name of product	Storage duration (Days)	Appearance	Taste	Flavour	Texture	Colour	Doneness	Overall acceptability
Sago biscuit	0	4.5	4.6	4.75	4.65	4.7	4.7	4.8
	15	4.2	4.5	4.5	4.5	4.5	4.4	4.5
	30	4	3.85	3.85	3.85	4.5	4.4	4.4
	45	3.8	3.6	3.4	3.4	3.8	3.85	3.8
	60	3.5	3.4	3.2	3	3.5	3.5	3.5
	Mean	4.00	3.99	3.94	3.88	4.20	4.17	4.20
	S.D.	0.38	0.53	0.67	0.70	0.51	0.48	0.53
Ragi biscuit	0	4.4	4.65	4.5	4.7	4.3	4.2	4.5
	15	4.2	4.5	4.2	4.52	4	4	4.4
	30	4	3.85	4	4.3	4	3.58	3.8
	45	3.85	3.4	3.8	4	3.7	3.4	3.75
	60	3.65	3	3.5	3.45	3.56	3.4	3.5
	Mean	4.02	3.88	4.0	4.19	3.91	3.71	3.99
	S.D.	0.29	0.70	0.38	0.49	0.28	0.36	0.43
Soya poha laddu	0	5	5	5	5	5	5	5
	15	5	4.8	4.8	4.8	4.75	4.75	4.75
	30	4.8	4.6	4.6	4.7	4.6	4.5	4.5
	45	4.6	4.4	4.4	4.35	4.3	4.2	4.2
	60	4.2	4.2	4	4	4	4.2	4.2
	Mean	4.85	4.70	4.70	4.71	4.66	4.61	4.61
	S.D.	0.19	0.25	0.25	0.27	0.29	0.34	0.34
Dalchiwada	0	4.8	4.8	4.75	4.75	4.75	4.6	4.75
	15	4.6	4.52	4.5	4.5	4.6	4.5	4.5
	30	4.2	4.1	4.2	4.1	4.1	4	4.2
	45	3.85	3.8	3.8	3.85	3.85	3.7	3.75
	60	3.5	3.5	3.5	3	3	3	3.5
	Mean	4.19	4.144	4.15	4.04	4.06	3.96	4.14
	S.D.	0.53	0.52	0.50	0.67	0.69	0.65	0.51

However, non-reducing sugar decreased from 16.48 to 0.62 mg/100mg, and total sugar decreased (22.50 to 20) as storage period increased.

Table 6 infers data regarding effect of storage duration on different parameters of ragi biscuit. It was noticed that free fatty acid, peroxide value and reducing sugar increased from 4.90 to 6.87 mg/100g, 2418.00 to 3323.20 me eqiO₂/kg and 4.66 to 16.33g/, respectively. On the contrary total sugar content decreased slightly from 48.5 to 46.60. Significant increment was noticed with increased period of storage duration.

Effect of storage duration was analyzed for free

fatty acid, peroxide oxide value and reducing sugar, non-reducing and sugar total sugar content of soya poha laddu (Table7). It was found that as storage period increased free fatty acid, peroxide oxide value and reducing sugar increased significantly from 7.99 to 15.98mg/100, 781.20 to 2343.6 me eqiO₂/kg and 4.0 to 15.33 /100g, respectively. However non-reducing and total sugar content decreased significantly from 24.5 to 3.17 g/100g and 28.50 to 18.50g/100g, respectively.

Table 8 reveals data regarding effect of storage duration on free fatty acid, peroxide oxide value and reducing sugar, non-reducing and sugar total sugar content

Table 5 : Effect of storage duration on different parameters of sago biscuit

Storage duration	Free fatty acid (mg/100g)	Peroxide value (me eqiO ₂ /kg)	Reducing sugar (g/100g)	Non-reducing sugar (g/100g)	Total sugar (g/100g)
0 Day	3.2	1971.22	5.66	16.84	22.50
15 days	3.7	1380.80	8.32	13.92	22.25
30 days	4.64	2455.27	13.33	7.92	21.25
45 days	5.46	2740.46	18.33	2.67	21.00
60 days	7.43	3013.25	19.38	0.62	20.00
Mean	4.88	2512.28	13.0	8.39	21.40
S.E.±	0.06	0.35	0.017	0.0031	0.31
C.D.	0.022**	1.16**	0.057**	0.010**	1.02**

** indicate significance of levels at P=0.01

Table 6 : Effect of storage duration on different parameters of ragi biscuit

Storage duration	Free fatty acid (m/100g)	Peroxide value (me eqiO ₂ /kg)	Reducing sugar (g/100g)	Non-reducing sugar (g/100g)	Total sugar (g/100g)
0 Day	4.90	2418.0	4.66	43.84	48.50
15 days	5.75	2728.0	8.60	40.90	47.50
30 days	6.31	3075.20	11.33	34.67	46.60
45 days	6.87	3323.20	16.33	30.17	46.50
60 days	9.39	3757.2	17.0	27.50	46.45
Mean	6.64	3060.30	11.58	35.41	46.60
S.E.±	0.0264	0.411	0.259	0.0051	0.256
C.D.	0.00861**	1.33**	0.844**	0.0168**	0.836**

** indicate significance of levels at P=0.01

Table 7 : Effect of storage duration on different parameters of soya poha laddu

Storage duration	Free fatty acid(mg/100g)	Peroxide value (me eqiO ₂ /kg)	Reducing sugar (g/100g)	Non-reducing sugar (g/100g)	Total sugar (g/100g)
0 Day	7.99	781.20	4.0	24.50	28.50
15 days	9.11	1364.0	6.53	21.47	28.00
30 days	10.51	1822.8	10.0	16.50	26.50
45 days	12.20	1996.4	12.66	12.34	25.00
60 days	15.98	2343.6	15.33	3.17	18.50
Mean	11.15	1528.30	9.70	11.59	25.30
S.E.±	0.0063	149.01	0.40	0.006	0.40
C.D.	0.020**	48.52**	1.32**	0.019**	1.22**

** indicate significance of levels at P=0.01

Table 8 : Effect of storage duration on different parameters of dal chiwada

Storage duration	Free fatty acid (mg/100g)	Peroxide value (me eqiO2/kg)	Reducing sugar (g/100g)	Non-reducing sugar (g/100g)	Total sugar (g/100g)
0 Day	7.83	2046.0	-	-	-
15 days	8.27	2479.6	-	-	-
30 days	9.25	2951.2	-	-	-
45 days	10.23	3112.4	-	-	-
60 days	13.32	3360.4	-	-	-
Mean	9.78	2789.9	-	-	-
S.E.±	0.006	0.025	-	-	-
C.D.	0.02**	0.833**	-	-	-

** indicate significance of value at P=0.01

of dalchiwada. As the period of storage increased from 0 days to 60 days free fatty acid content and peroxide value significantly increased from 7.83 to 13.32 mg/100g and 2046 to 3360.4 me eqiO2/kg, respectively.

CONCLUSION

The developed supplementary foods obtained good (>3) to excellent (5) scores for overall acceptability on five point scale. Among the recipes developed for different vulnerable groups soya poha laddu, sago biscuit, soya burfi, dal chiwada contained good amount of protein fat, energy, calcium and iron. The developed recipes were highly nutritious providing 1/3 of daily requirement. Therefore, additional supplementation of food will have beneficial effect on growth, nutritional status and health situation of vulnerable groups. The developed supplementary foods were organoleptically acceptable even after 60 days of storage period. As the period of storage increased, the sensory scores for acceptability decreased. The free fatty acid, peroxide value and reducing sugar increased significantly as storage period increased. The total sugar and non-reducing sugar significantly decreased as storage period increased. The developed supplementary foods were prepared utilizing low cost, nutritious, locally available food stuffs. It can be prepared easily and stored for 60

days. Even at urban and rural household level, these supplementary foods can be prepared to ensure the nutrient requirement of vulnerable groups. These supplementary foods can be propagated at ICDS scheme which will be helpful for the malnourished children.

Authors' affiliations:

V.S. ZANVAR, A.B. ARYA AND J.P. NERLEKAR,
Department of Food and Nutrition, College of Home
Science, Marathwada Agricultural University,
PARBHANI (M.S.) INDIA

REFERENCES

- A.O.A.C.** (1975). *Official method of analysis*, 12th edition. Association of the Official Agril. Chemists, Washington.
- Anonymous** (1996). A passage malnutrition. Poverty and health status of vulnerable group.
- ICMR** (1986). Growth and physical development of Indian infants and children. Tech. Rep. Ser. No.18.
- WHO** (1989). World Health Organization. Malnutrition and children Monograph series : Geneva

