

SUMMARY, CONCLUSIONS AND RECOMMENDATION

The purpose of the present study was to formulate a food supplement for underprivileged pregnant and lactating women beneficiaries of the Integrated Child Development Services (ICDS), with an aim to reduce sharing of the supplement with other family members, and to investigate the feasibility of using it in this program.

The product selected was a biscuit with the flavor of methi or fenugreek seeds (*Trigonella foenum graecum*). This was based on a traditional maternal food called as **methipak**. It was hypothesized that the sharing of methi biscuits would be reduced because :

- (1) It has a characteristic bitter taste which may be less acceptable to the children who are reported to be the main sharers of the maternal supplement.
- (2) Methi is recognised for its therapeutic properties for pregnant and lactating women and therefore the women might not be inhibited from consuming the food themselves.

Four inter-linked studies were undertaken to achieve the above aim. These studies were :

1. Habits, beliefs and consumption practices of **methipak**, the traditional mother food of Western India.
2. Animal experiments, to investigate the effect of fenugreek seed powder based diets on the birth outcome and lactational performance in albino rats.
3. Product development including studies on sensory evaluation, shelf life and nutrient composition.
4. Extended product testing of the product in the ICDS community (pregnant and lactating women) to study the acceptability, regularity of collection, sharing and consumption characteristics of the product.

The summary and the conclusions of each study have been presented in this chapter.

Study I

Habits, beliefs, and consumption practices of methipak- a special mother food of Western India.

Since **methipak** formed the basis of the product to be developed, a survey was conducted to study the habits, beliefs and practices of the traditional methipak.

The objectives of the study were to determine (a) if methipak was a popular pregnancy and lactation food (b) the reasons for consuming methipak during pregnancy and lactation (c) the period, duration, time and amounts of methipak consumed by pregnant and lactating women (d) sharing characteristics of methipak and (e) the composition and the method of preparation of methipak.

Material and methods

The sample for the study consisted of 585 pregnant and lactating women from low (n = 200); middle (n = 200) and high income groups (n = 185). The monthly income of these families was Rs. 600/- or less; Rs. 601 - 1500; and Rs.1501/- or more respectively. A group of non-pregnant non-lactating elderly women (n=77) from high income group was also included since methipak was generally prepared in the homes by these women and the pregnant or lactating women sought their advice regarding the diet.

Data were collected with the help of a structured questionnaire which was pretested on a sample of 50 women. Interviews were conducted at the antenatal and post natal clinics of two local hospitals or at homes of the women.

Frequency distribution, percentages, means and standard errors were computed. Chisquare test was used to determine if there were differences in the responses of the three income groups.

Results

1. **Consumption of methipak :** Methipak was found to be a popular lactation food rather than a pregnancy food. The practice of consuming methipak was almost universal in lactation, as 85% of the respondents considered it a good food for lactation. On the other hand only 27% reported of practice of consuming methipak during pregnancy. The practice of consuming methipak was more prevalent in the low and middle income groups than in the high income group.
2. **Beneficial effects of consuming methipak :** Major benefits of consuming methipak during lactation were stated to be minimizing body aches, its strength giving and galactogogic properties. During pregnancy, it was considered to reduce body aches and prevent indigestion.

Most of the beneficial effects were ascribed to fenugreek seeds and the herbs and spices added to methipak. A review of literature supported many of these beliefs regarding the medicinal properties.

3. Reasons for not consuming methipak during pregnancy

There was a belief among several respondents that methipak if consumed during

pregnancy could cause abortions. Some women believed that it had no beneficial effect during pregnancy. Other reasons for nonconsumption were that it could cause difficult labor and if eaten once had to be consumed every year.

4. Period, duration, time and amounts of methipak consumed

Majority of the respondents consumed methipak for one to one and a half months after 10 days of parturition or in the third trimester of pregnancy. Approximately 50 g were consumed every day early in the morning. It was believed that the beneficial effect of methipak was more pronounced if consumed on an empty stomach.

5. Sharing of methipak

In 61% of the families, methipak prepared for a pregnant or lactating woman was not shared by other members of the family. Sharing was stated to be least (20%) in low income group as compared to 40 and 72 % in the middle and high income groups respectively.

6. Composition and the method of preparation.

The major ingredients of methipak were cereal (wheat) and pulse (bengal gram, black gram and green gram) flours; fenugreek seed powder, ghee or clarified butter; jaggery or sugar, dried and dessicated coconut, edible gum and a number of herbs and spices. Gum and spices were generally excluded from the methipak prepared for pregnant women, in the belief that spices were hot in nature and gum could have an adhering action of the fetus to the uterus.

The method of preparation consisted of roasting the flour with ghee and mixing it with the syrup of jaggery or sugar followed by addition of fenugreek seed powder, shredded coconut and ground spices. The product was then hand-shaped into round balls or squares of about 50-100 g each.

Study II

Animal experiments to determine the effect of feeding fenugreek seed based diets on the birth outcome and lactational performance in albino rats.

Since many respondents in study I believed that methipak was a hot food and could cause abortions if consumed during pregnancy, an experiment was planned to establish the safety of consumption of fenugreek seed powder during pregnancy in albino rats. A second study on the lactational performance was conducted to determine if fenugreek seed powder enhanced the milk production (as indicated by growth of the pups) as it was believed to be a galactagogue.

The objective of the first experiment was to determine the effect of feeding diets containing 5% or 20% fenugreek seed powder or diets containing 5% fenugreek seed powder incorporated into biscuits with and without casein on the birth outcome in albino rats.

The objective of the second experiment was to determine the effect of feeding 5% and 20% fenugreek seed powder diets on the growth of the pups in albino rats.

Material and methods

Experiment I (Effect on birth outcome)

This experiment was conducted on 45 virgin female rats of Charles Foster strain, weighing atleast 170 g. After overnight mating and confirming pregnancy by presence of sperm in the vaginal smears, the rats were placed in individual cages and were assigned randomly to experimental and control groups of 5-8 rats in each group.

Following diets were fed to the groups for a period of 21 days.

Group	n	Diet fed
E1	6	5% fenugreek seed powder diet.
E2	8	20% fenugreek seed powder diet.
C1	6	10.7% casein protein
C2	8	13.3% casein protein
FB	6	5% fenugreek biscuits
FBC	6	5% fenugreek biscuits with casein
PB	5	Sweet biscuits (no fenugreek)

Food intake and weights were recorded every alternate day. On day 22, the dams were mildly anaesthetized by ether and laparatomized. The uterus was examined intact and the number of implantation sites was determined. A record of number of resorptions if any and weight of the placenta and fetus was also maintained.

Experiment II (Effect on the lactational performance)

For this experiment, 30 rats (same strain and weight as in Experiment I) were taken. The experimental diets were similar to those in experiment I (E1, E2, C1 and C2). For this study the biscuit diets were not included.

The experimental groups were : E1E1 - given a 5% fenugreek seed powder diet during pregnancy (P) and lactation (L); E2E2 - given a 20% fenugreek seed powder diet during P and L; C1C1 given a 10.7 % casein protein diet during P and L; C2C2 - given a 13.3% casein protein diet during P and L; C1E1 - given diet C1 during P and E1 during L; and C2E2 given C2 during P and E2 during L. The dams were fed these diets throughout pregnancy and upto 21st day of lactation. At parturition, the litter size was maintained to eight pups per dam. The pups were weighed immediately after parturition and subsequently every alternate day upto day 22. The weaning weight was considered as an indicator of the lactational performance.

Results

Experiment I The food intake and the maternal weight gain in fenugreek fed groups i.e. E1E1, and FBC were comparable to the control groups C1 and C2. The weight gain in the biscuit fed groups i.e. FB and PB was low because of inadequate protein content of the diets. There was no significant difference in the number of implantations (10.8 to 12.3), number of resorptions (0.25 to 0.6) the litter size, fetal weights and placental weights in the control and experimental groups.

Experiment II

The pups in the fenugreek fed groups i.e. E1E1, E2E2, C1E1 and C2E2, grew as well as the pups in control groups i.e. C1C1 and C2C2. There was no additional beneficial effect of feeding fenugreek powder diets continuously through pregnancy and lactation or only during lactation on the growth of the pups.

Study III

Product Development

The objective of this study was to formulate a food supplement (methi biscuits) which would be acceptable to the underprivileged pregnant and lactating women and at the same time have minimal sharing characteristics or be less acceptable to children who are reported to be the main sharers of the maternal food supplement. The product type chosen was 'biscuit' because it is a popular snack food of Western India. Besides it is easy to manufacture in bulk, easy to distribute, has a long shelf life and is an energy dense food. The flavor of fenugreek seed was selected because it imparts a characteristic bitter taste which may make it less acceptable to children. Development was carried out in four steps which have been discussed below :

The first step was to select the type and amounts of the ingredients for the biscuit. For this purpose, sensory evaluation trials were conducted on a labora-

tory panel consisting of students from the Foods and Nutrition Department, ²⁰⁰S. University, Baroda. Preference testings, were carried out between sugar vs jaggery biscuits; refined wheat flour vs whole wheat flour biscuits; biscuits with soya flour vs bengal gram flour, and biscuits with or without lecithin. There was no significant difference between any of these comparisons. A decision was made to prepare the biscuits with sugar, refined wheat flour, soya flour and lecithin because of the ease of using these in the factory. After selecting the ingredients, the optimum amounts of each were established by a ranking test.

2. The next step was to determine that level of fenugreek seed powder at which the acceptability of the biscuits by preschoolers (3-6 yrs) would be the least. For this purpose, biscuits were prepared with varying levels (2-6 %) of fenugreek seed powder and were tested for acceptability on the preschool beneficiaries of the ICDS program. The tests were conducted on 85 to 128 children attending three ICDS centres. A record of the number of children asking for more than 2 biscuits and the number of biscuits consumed by each child was maintained. For comparison, sweet biscuits (without fenugreek) were also tested.

It was observed that 96% of the children consumed 2 sweet biscuits each and asked for more. At a level of 2% fenugreek seed powder, 58% children asked for more than 2 biscuits. When the level of fenugreek was further raised from 3% to 6%, the number of children asking for more than 2 biscuits ranged from 24 to 31%. There was no significant difference in the number of children demanding more biscuits at levels of 3,4,5 or 6%.

The data on consumption also gave similar trends. At levels of 3-6 % fenugreek seed powder, only 4-9 % children could consume more than 5 biscuits. At level of 2% fenugreek seed powder, 34 % children could consume more than 5 biscuits and 83% children ate more than 5 biscuits when they were sweet or did not contain any fenugreek. Thus, a level of 3% was selected as the cut off point at which the acceptability of the methi biscuits was least among the preschool children.

3. The third step was a pilot trial carried out on pregnant and lactating women beneficiaries of the ICDS, to determine the acceptability of biscuits with 3% fenugreek seed powder. The study was conducted on 61 subjects. Biscuits were given to them for 15 days (100 g/day/beneficiary). The subjects were asked to come to the centre every alternate day for collection. A record was maintained for regularity of collection of the biscuits. It was observed that 69 % subjects collected the biscuits regularly; 18% dropped out because they did not like the taste of the biscuits and 13% dropped out because of other reasons such as falling sick or being out of town.

Since majority of the pregnant and lactating women accepted the biscuits with 3 % fenugreek seed powder and the acceptability among children was least at this level, a recipe with 3 % fenugreek seed powder was finalised.

4. The last step in the development process was accomplished by a local biscuit manufacturer i.e. the Windsor Foods Ltd, Baroda. This was necessary because the biscuits in bulk required for the extended product testing were to be made by the Windsor Foods Ltd. The recipe standardized in the laboratory was given to the manufacturers and they were requested to prepare a sample of biscuits. The bitterness of these biscuits was compared with that of the biscuits prepared in the laboratory by the investigator, through sensory evaluation by the laboratory panel. It was observed that the bitterness of the 4 % fenugreek biscuits made by Windsor was equivalent to that of 3 % fenugreek biscuits prepared by the investigator. Thus for the final product, a level of 4 % fenugreek seed powder was selected.

The shelf life of the biscuits manufactured by the Windsor Foods Ltd. was evaluated by sensory evaluation (laboratory panel) and chemical analysis including moisture content, peroxide value and free fatty acid value. The trial period was 4 months after which the testing was terminated. At the end of four months the biscuits were acceptable by the laboratory panel and the moisture content, peroxide value and free fatty acid value were within the limits set by Indian Standards Institute for deterioration of biscuits.

The biscuits contained 470 Kcal (calculated from food composition tables), and about 11-12 g of protein (Kjeldahl's nitrogen estimation). The amounts of vitamins (B1 & B2) and minerals (calcium and iron) were not appreciable. the bio-availability of lysine was not increased by the addition of fenugreek.

The composition of the biscuits so developed was as follows :

Ingredients	Amount (g/100g)
Wheat flour refined	38.00
Soya flour	13.00
Fenugreek seed powder.	4.00
Shortening	20.00
Sugar	25.00
Total	100.00
+ baking powder 0.5 %	
+ Lecithin 0.5 %	



The cost of the biscuits was Rs.1.40 per 100 g. The present allocation in the ICDS budget for maternal supplement is Rs1.05/-. If the Government exempts the taxes and excise duty on biscuits; the cost could be considerably brought down.

Study IV

Extended product testing of methi biscuits in the ICDS community (pregnant and lactating beneficiaries).

The objectives of this study were to determine :

(1) the acceptability of methi biscuits (2) the regularity of collection (3) the sharing characteristics and (4) the consumption of the biscuits when given as a 'take home' food supplement for a long duration (one month) .

Material and methods

The sample consisted of 334 pregnant and lactating women enrolled in ten ICDS centres of Baroda city. The sample was divided into two groups of 5 ICDS centres in each group. One group (women in 5 centres) received methi biscuits and the other group (5 centres) received sweet biscuits (both were bulk produced by the Windsor Foods Ltd and packed in 100g rolls of 16 biscuits each) for the first month of the trial i.e. the former group received sweet biscuits and the latter received methi biscuits. Thus a cross over experimental design was used. The distribution of the biscuits was carried out at the centres by the Anganwadi Workers who were recruited for this purpose and to maintain the records.

Information on various characteristics such as sharing and consumption was obtained by interviewing the subjects.

Results

(a) Acceptability of methi biscuits by the target group and preschool children.

Approximately 90 % of the subjects i.e. the pregnant and lactating women, accepted the biscuits or were ready to eat them inspite of the bitter taste. Ten percent subjects could not tolerate the bitterness of the biscuits. In contrast, 75% of the preschool children rejected the biscuits completely i.e. they were not able to consume more than 1 biscuit. Twenty five percent children could consume more than one biscuit, however only 8 % children ate more than 4 biscuits. Thus even though some children ate the biscuits, the amount consumed by them was not too high.

(b) **Regularity of collection of biscuits.** There was a significant difference in the regularity of collection of sweet biscuits vs that of methi biscuits. However,

the collection was high even for methi biscuits as 70 % of the subjects collected the biscuits quite regularly. Seventeen percent women were poor collectors of methi biscuits i.e. they came for less than 50 % of the distribution days to the centres to collect them. This was perhaps due to a dislike for the taste of the methi biscuits.

Thus although the acceptability of methi biscuits as indicated by regularity of collection was not universal it was quite high.

(c) Sharing of the biscuits : In the total sample, 25 % women reported that they shared methi biscuits as against 63 % who reportedly shared sweet biscuits. This difference was highly significant. The subjects shared their biscuits mostly with the preschool children.

(d) Consumption of the biscuits by the subjects

When sweet biscuits were given, 36% of the subjects reported that they consumed one packet per day, whereas in case of methi biscuits 57 % women claimed to have consumed one packet per day without sharing. This difference was found to be significant. It is possible that women who did not consume one packet of sweet biscuits might have shared them with their children.

(e) Acceptability, regularity of collection-sharing and consumption of biscuits by pregnant versus lactating subjects.

Since methipak was a popular food of lactation rather than pregnancy, a comparison was made between the responses of pregnant vs lactating women to the biscuits. Table 103 summarises these responses. As shown, there was no significant difference in any of the comparisons made i.e. pregnant vs lactating subjects; between trimesters and between month of lactation except in the acceptability which was significantly higher for lactating subjects as compared to the pregnant subjects. However, for both the groups i.e. pregnant and lactating women acceptability was high.

(f) Acceptability, regularity of collection, sharing and consumption of sweet and methi biscuits in relation to parity, ethnic group, type of family, education of the subject and per capita income.

In order to determine the profile of the subjects among whom the biscuits were popular, an attempt was made to see if there was an association between the parameters studied and certain background variables such as parity, ethnic group, type of family (nuclear or joint), education of the subject and the per capita income.

Table 103 : Summary of acceptability, regularity of collection, sharing and consumption of sweet and methi biscuits by pregnant vs lactating subjects

Parameter	Sweet Biscuits			Methi Biscuits		
	P vs L	P	L	P vs L	P	L
		I vs II vs III	0 - 2 2 - 4 4 - 6 month		I vs II vs III	0 - 2 vs 2 - 4 vs 4 - 6 month
Acceptability	-	-	-	P < * L	NS	NS
Regularity of collection	NS	NS	NS	NS	NS	NS
Sharing	NS	NS	NS	NS	NS	NS
Consumption	NS	NS	NS	NS	NS	NS

P - Pregnant women; L - Lactating women

I, II, III - Trimesters of pregnancy

0-2, 2-4, 4-6 - months of lactation

* significantly different at $P < 0.05$

NS : Not significant.

The summary of the analysis is presented in Table 104. As revealed by the table all these variables did not influence the acceptability of the methi biscuits. Type of the family and education of the subject also were not associated with any of the parameters studied. Parity was associated with regularity of collection of sweet biscuits, sharing of sweet and bitter biscuits and the consumption. The more the number of children, the greater was the regularity of collection and sharing of sweet biscuits. Although there was a significant difference in the sharing and consumption of methi biscuits by women in different parities there was no definite trend.

In the ethnic group Gujaratis were better collectors of both the types of biscuits as compared to muslims and other ethnic groups. However ethnic group did not influence sharing and consumption of biscuits.

Per capita income also was associated with the regularity of collection but only for sweet biscuits. The lower the per capita income, the better was the collection rate.

The other parameters studied were (a) perceived beneficial effects of consuming methi biscuits and sweet biscuits on the mother and child, (b) Changes in body weight of the mother and child (c) efficiency of distribution of biscuits by the Anganwadi workers (d) willingness of the subjects to purchase the biscuits and (e) attitudes of the Anganwadi Workers towards the intervention.

The most important beneficial effect perceived by the women on themselves was the reduction in body aches after consuming methi biscuits. The other benefits such as 'gives energy' and 'good for health' were stated after consuming both the sweet and the methi biscuits. Several lactating subjects felt that the health of their infants was better and because of increased secretion of milk the weight gain was more. However, such effects were perceived after consuming both the sweet and methi biscuits.

There was no appreciable difference in the weight gain of either the mothers or the infants. However, this could be due to the fact that there are several confounding factors which affect the weight.

The Anganwadi workers in all the centres were efficient in distributing the biscuits and could maintain the records properly.

The subjects, although expressed their willingness to buy the biscuits when interviewed, did not come forward when the biscuits were kept for sale at the centres. This could be due to inability to purchase the biscuits.

Table 104 : Summary of acceptability, regularity of collection, sharing and consumption of sweet and methi biscuits in relation to the background variables

Back ground variable	Acceptability	Regularity of collection	Sharing	Consumption
Parity				
SB	-	*	*	NS
MB	NS	NS	*	***
Ethnic group				
SB	-	*	NS	NS
MB	NS	*	NS	NS
Type of family				
SB	-	NS	NS	NS
MB	NS	NS	NS	NS
Education				
SB	-	NS	NS	NS
MB	NS	NS	NS	NS
Per capita income				
SB	-	*	NS	NS
MB	NS	NS	NS	NS

SB - Sweet Biscuits; MB - Methi Biscuits

NS - Not significantly different

* - Difference significant at $p < .05$

*** - Difference significant at $p < .001$

Acceptability of sweet biscuits was not studied.