ACCEPTABILITY OF SOYA BASED RECIPES IN FOOD SERVICE

By

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A THESIS SUBMITTED TO THE AVINASHILINGAM INSTITUTE FOR HOME SCIENCE AND HIGHER EDUCATION FOR WOMEN (DEEMED UNIVERSITY), COIMBATORE - 641 043. IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR

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CERTIFICATE

This is to certify that the Dissertation entitled **"Acceptability of Soya based Recipes in Food Service"**, submitted to the Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore, for the award of **The Degree of Doctor of Philosophy** in Food Science and Nutrition, is a record of original research work done by **Mrs.K.S.Sarojini,** during the period of her study in the Department of Food Service Management and dietetics, Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore, under my supervision and guidance and the dissertation has not formed Degree/Diploma/Associationship/ Fellowship or other similar title to any other University.

Signature of the Guide

DECLARATION

I hereby declare that the matter embodied in this dissertation is the result of investigation carried out by me in the Department of Food Service Management and Dietetics, Avinashilingam Institute for Home Science and Higher Education for Women (deemed University), Coimbatore, under the supervision and guidance of **Dr. (Tmt) P.Parvathi Easwaran, M.S. (Columbia), Ph.D (Madras)**, Professor and Head, Department of Food Service Management and dietetics, and that it has not been submitted for the award of any Degree/Diploma/Associateship/Fellowship or other similar title of any candidate of any other University or Institute.

Signature of the Candidate

Signature of the Guide

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INTRODUCTION

INTRODUCTION

The food service industry in its broadest sense includes all establishments where food is regularly served outside the home, such as formal restaurants, hotel or motel and department stores, dining rooms, coffee shops, family restaurants, speciality and ethnic restaurants and fast-food outlets. And this apart, there are other food service also on non-profit basis which includes those in institutions, schools and colleges and welfare homes.

Food service as welfare catering is an old tradition followed in India. Royal people used to feed nourishing food to poor people in the various parts of India through well established inns and taverns.

Historically, the evolution of public eating places came into existence on account of people's desire to travel for commercial gain and spiritual enrichment. Merchants travelling from place to place to buy or sell their wares also necessitated for places to stop over for food and rest. These early inns and taverns providing for the needs of travellers, were perhaps the forerunners of our present restaurants, cafeterias and star hotels, and the commercial food service establishments.

Technological and scientific development has brought about considerable change in day to day life of an average Indian. More and more urbanization has improved the capital income of people. Added to this, working women population is also on the increase. These create changes in life style to a great extent. In view of these aspects, more and more people go out for eating. Various types of food service catering to the needs of all income levels of population are emerging fast.

Though different types of food service are available to cater to masses, they do not provide nutritionally adequate food. Life cannot be sustained without adequate nourishment. According to Gopalan (1993), gross inequalities in the world today are reflected in wide variations in food consumption patterns of populations. Food consumption falls well below minimum physiological needs in a large proportion of the world's population; and considerably exceeds requirements in a smaller proportion. Populations at both these ends of the food consumption spectrum suffer ill-health - the former because of poverty and ignorance, and the latter because of unbridled affluence and lack of dietary discipline.

Hence it is essential to improve the nutritional quality of the foods served in the food service. If nutritionally adequate food is made available in the food service where masses are fed, it will improve the nutritional status of the masses.

Better nutrition makes better citizens. Swami-Vivekananda once said that a sound mind exists only in a sound body. A properly nourished individual is happy and peacefull, co-operative and inquisite and hence successful in all his endeavours. On the whole, improved nutrition can improve the productivity of labour resulting in the increased production of goods and services. Hence it is very essential to provide wholesome food in food service.

The foods provided in the food service falls short of the required nutrients. Among all the nutrients, the quantity of protein in the foods served in food service is deplorably less. It is essential to include protein rich foods in particular and other nutrients in general for quality improvement of the foods served in the food service.

In order to improve the protein content of the foods provided in the food service, according to Devadas et al, (1984) animal proteins are in short supply and costly also. Plant proteins have received considerable attention by virtue of their availability, low cost, nutritional and functional attributes. Soyabeans, as a legume has double the amount of protein when compared to other legumes and over 50 per cent of the fat present in soya is polyunsaturated. Besides, it is a useful source of carotene, thiamin, riboflavin, niacin and folic acid.

As the adage goes that habits die hard, eating patterns and food habits are deep rooted and very difficult

to change. Soyabean and its products should be incorporated in the traditional recipes without affecting the taste, flavour and appearance of the product for hundred percent acceptance.

In India, especially in the Southern region, people would like to eat traditional food preparations more frequently than the newer ones. Since more women are employed outside the home today than ever before, time available to them for preparation of the traditional foods is very little. Instant foods are becoming increasingly popular among Indian households. In view of kitchen convenience as well as to meet the urgent and exigency situations of offering hospitality to unexpected guests, instant foods have become an innovation born out of necessity. Development of instant mixes for several traditional snack foods, offering convenience to housewives has become a fast growing trend among the processed food industries (Singh et al, 1995).

The consumer may go in for the purchase of food daily, or may only purchase food at intervals, and expect the food to have sufficient shelf life before consumption. One quality attribute which people look for, in the instant mixes is maximum shelf life (Campbell, 1992).

It is imperative to improve the quality of the foods served in food service without affecting their palatability in order to improve the nutritional status of heterogenous group of population who visit the food service.

It is also important to make the traditional foods available in the form of instant mixes to reduce the intensive labour involved in the preparation.

The culinary practices in many Indian homes require various items of food to be prepared afresh. This requires a lot of precious time and labour. So it causes drudgery and also expensive. If some simplification and convenience are offered and made available to people in food preparation, every one particularly the housewife would feel most happy as she is relieved of this monotonous work. This is especially true when more and more urbanization comes through industrialisation and women seek job outside the home. The extra expense for purchasing a convenience food is not a burden for the working class people when there is saving of time and labour.

There is an advantage in upgrading traditional technologies for making familiar consumer product, rather than introducing foreign technologies for making new or novel products. Only a very little effort is needed for promotion and marketing these products. People will gladly accept these innovations and also the traditional products if they are offered in clean hygienic and convenient form.

Experiments on animals have shown that soyabean protein has hypocholesterolemic and antiatherogenic properties. In human beings, substitution of soya protein for dietary animal protein or addition of soya protein to

the diet, lowers total and low-density lipoprotein cholesterol levels in individuals with hypercholesterolemia (Carroll, 1991).

The investigator, realising the importance of improving the quality of foods served in the food service, providing convenience to the homemakers by making available the traditional recipes in the form of instant mixes, supplementing the foods served in group feeding and management of major diseases with incorporation of soyaflour, undertook the present study with the following objectives :

A. Development of soya based instant mixes for selected four Indian recipes
B. Assessment of shelf life of the instant mixes and their acceptability
C. Acceptability of instant mixes in selected food service
D. Supplementation of soyaflour incorporated recipes to pre-school children and assessment of the impact on their nutritional status
E. Assessment of the effect of soyaflour on the lipid profile of selected hyperlipidemic patients.

The hypothesis set by the investigator for the study are

1. There will be increase in the nutrient content of instant mixes
2. Instant mixes will have better shelf life and acceptability
3. Recipes prepared with instant mixes will be accepted by the clientele of the food service
4. Supplementation of soya incorporated recipes will improve the nutritional status of pre-school children and
5. Soyaflour has got hypolipidemic property.

REVIEW OF LITERATURE

II REVIEW OF LITERATURE

The available literature pertaining to the study "Acceptability of Soya Based Recipes in Food Service" were collected and reviewed under the following heads :

A. Quest for the Best in Food Service

B. Soya - Nutritional Contributions

C. Soya Based Products - Pattern of Acceptability

D. Soya - Studies on Therapeutic Values

A. Quest for the Best in Food Service

All food service operations are very competitive and, as a result the pressure is on to function profitably and to attract customers, particularly in the commercial segments. One way this can be done is to offer customers good, wholesome, tasty foods at reasonable prices (Rakosky, 1989).

Whether based on cereals, millets or pulses, traditional foods occupy very important place in the Indian dietaries. Indian consumer naturally prefers chapathi, paratha, roti, nan, batura or puri to bread. Likewise, he opts for idli, dosa, vada, bajji, pakoda, upma, pickles, chutney, kesaribath, halwa, gulabjamun or payasam in preference to Western products (Singh and Shurpalekar, 1989). Hence it is essential to improve the nutritional quality of the traditional foods to improve the nutritional status of Indians.

Protein in bread can be increased from 9 to 14 per cent by incorporating soyaflour, concentrate or isolate, along with vital wheat gluten and, if necessary, a lipid emulsifier. Soyaprotein products, including soya isolate-whey blends, can replace upto 100 percent of the non fat dry milk without impairing quality in pound cakes and other types of cakes (Pomeranz, 1991).

Apart from the above products, Tyagi and Mital (1991) have developed a process to prepare ice cream using soyabeans. Use of soya solids upto 8 per cent in mix preparation exhibited a smooth texture, flat surface, soft body and absence of ice crystals.

Nasim et al, (1986) has prepared an acceptable soyapaneer to serve as a substitute for milk paneer. Chopra et al, (1984) developed a process for manufacturing soy-yoghurt. Attempts have also been made to prepare a cheese-like product from soyabeans (Hofman and Marshal, 1985).

Along with the above preparations, Rawat et al, (1994) have prepared chapathis with wheat flour fortified with defatted soyaflour at ten per cent level. Soya fortified chapathis contained 28.8 and 19 per cent higher protein and available lysine, than the whole wheat chapathis.

According to Ranjani and Vaidehi (1988) the nutritive value can be made superior in cereal based recipes by the addition of pulses. Soyabean, as a pulse can be incorporated effectively by all and at the same time meet the nutritional requirements and at cost affordable by all.

B. Soya - Nutritional Contributions

The protein in soyabeans is of good nutritional quality, especially when soyabeans are combined with cereals (FAO, 1989).

Young (1991) opines that well processed, isolated soya proteins and soya protein concentrates can serve as an excellent source of protein for meeting the physiologic needs of human beings at all ages. They are, in effect, 'Complete' thus, they can be used in, and for the design of diets that are adequate in essential nutrient content and may help the interested consumer follow the dietary guidelines and advice of various authorities for purposes of maintaining long term health.

Soyabean containing about 40 per cent good quality protein and 20 per cent cholesterol free oil has tremendous potential to meet protein-calorie deficit in cereal based Indian diets at a very low cost (Cheng et al, 1990; Nawab Ali, 1992 and Chhabra, 1992).

Singh and Ali (1993) also state that blending wheat with medium fat soyaflour in traditional food items can offer an unique opportunity for combating protein-calorie malnutrition prevailing among our masses.

Recently, world wide attention has been paid to soyabeans as an economical and quality protein source. As a result, various types of new soyabean protein foods like

soya milk, tofu, textured protein products and soya sauce have been developed and are found in today's industrial, institutional, and domestic markets as new, healthy and or functional vegetable protein products (Fukushima, 1991).

As Slavin (1991) points out soya protein and soya fiber are common ingredients in many foods stuffs. Various kinds of soya protein, including soyaflour, soya protein concentrate, and isolated soya protein, are currently used in human food. Soya protein are used in infant formulae and enteral nutrition products, as ingredients in meat products, and as protein supplements. Although it is a plant protein, the protein quality of soya protein is excellent.

Results of series of metabolic nitrogen balance experiments carried out in young adult male subjects brings out the protein quality of soya proteins. Soya protein isolates and soya protein concentrates were given as the sole source of dietary protein to young adult males and various metabolic nitrogen balance studies conducted by Young et al, (1977) concluded that soya protein isolates were approximately 83 per cent of value for egg proteins and soya protein concentrates were equivalent to value for egg proteins.

C. Soya Based Products - Pattern of Acceptability

Studies done by Cheman et al, (1992) on four high protein rich-soya snack formulations reveal that four

different formulations of rice-soya snack containing 4.5 per cent, 13.5 per cent and 18 per cent full-fat soyaflour were well accepted but at the highest level of 18 per cent soyaflour, the acceptability was significantly reduced.

Seven varieties of soyabeans were evaluated for their potential in making puffed soya snacks by Kanchana and Neelakantan (1994). The crisp and tasty soya was found to be well accepted. The study revealed that puffed soya can be introduced as a protein-rich snack foods, and as a substitute for other costly nuts.

In 1992 Santosh Kumari et al, carried out a study on the effect of soyaflour supplementation on the sensory characteristics of some traditional foods. In the preparation of five traditional foods pakoda, bread rolls, potato rolls, burfi and ladoo, besan was substituted upto 40 per cent with soyaflour. The replacement of besan with defatted soyaflour upto 20 to 30 per cent did not lower the sensory properties of the products but rather improved them.

Singh and Singh (1989) blended besan flour with defatted soyaflour at 10 to 30 per cent level for sev preparation. Organoleptic characteristics revealed that product with 20 per cent soyaflour was comparable to standard in acceptability. Similar results were obtained by Dhawan and Singh (1991) with incorporation of 10 to 30 per cent of defatted soyaflour in 'Sev'.

Three formulae of cookies prepared from 50:45:5 (I), 50:40:10 (II) and 50:35:15 (III) wheat flour, broken rice flour and defatted soyaflour, respectively baked in microwave oven for 240 sec. were rated as the best three formulae for flavour and texture by a trained panel. The consumer type panel preferred cookies of formulae I and II over formula III (Galan et al, 1991).

Deepa et al, (1992) and Singh et al, (1993) showed that the black gram could be used in papad making substituted by defatted soyaflour upto 25 per cent. The papad was rated as very good on a ten point scale in a consumer acceptance survey of 60 families.

Rawat et al, (1994) observed that rats fed on wheat flour - defatted soyaflour (90:10) blend chapathis were found to have higher weights in liver and heart than rats fed on wheat chapathi diet. They also noticed that soya - fortified chapathis were softer than whole wheat chapathis.

Milk like beverages from defatted soyaflour in combination with skim milk, sesame seeds and coconut were tested for acceptability, protein and energy content by Javalagi and Vaidehi (1986). Among these beverage wheat malt combination and soya with coconut and skim milk blends were found best acceptable with high protein and energy content.

Vaidehi and Shivaleela (1989) prepared instant jamun mixes with 15 per cent defatted soyaflour in place of whole milk powder. The results showed that very good jamun mix could be prepared with acceptable sensory qualities, increased volume and yield and equally good keeping quality as that of commercially available jamun mix.

In the preparation of ice cream, use of soya solids upto 8 per cent exhibited smooth texture, flat surface, soft body and absence of ice crystals. On organoleptic evaluation the product was found acceptable by Tyagi and Mital (1993).

Sharma et al, (1993) tried out recipes with defatted soyaflour. Chickpea flour and wheat flour were substituted by defatted soyaflour in three snacks, namely Murukku, Nankhatai and Mysorepauk. The sensory properties of the products were evaluated. The results showed that defatted soyaflour can replace chickpea flour in murukku and mysorepauk without affecting their acceptability adverseiy. Consumer acceptance tests returned 82.8 per cent positive results and indicated that the snacks were well-liked.

Similarly Gandhi et al, (1993) conducted studies on organoleptic assessment of full fat soyaflour in various indigenous products. In this study full fat soyaflour was blended with cereal, millet or pulse flours to make a variety of Indian traditional products. It was judged by a

trained panel that all the products, namely chapathi, puri, pakoda, sev, bread pakoda, soya peanut crisps, burfi, mysorepauk and halwa were acceptable with no significant difference among the products.

The effect of addition of defatted soyaflour (5 to 30 per cent) on physio-chemical characteristics and acceptability of green gram barian was investigated by Tandon and Singh (1987). There was an increase in protein, ash and crude fibre contents and decrease in crude fat and total carbohydrates with the the increase in the level of defatted soyaflour in the product. The consumer acceptability of barian decreased with the increase in the level of defatted soyaflour. Addition of defatted soyaflour upto 10 per cent did not make any significant difference to the overall acceptability.

D. Soya - Studies on Therapeutic Values

Supplementation of soya foods in human diet has proved beneficial in many disease conditions viz., protein energy malnutrition, gall stones, chronic hepatitis, gastric ulcers, hyperlipidemia, hypercholesterolemia, gout, rheumatism, breast and colon cancer and inborn metabolic disorders like lactase deficiency and diabetes mellitus (Vaidehi et al, 1985 and Judy Ria, 1989).

Soya milk rich in proteins and vitamin B and devoid of lactose was acceptable by children. The symptoms of diarrhoea and vomitting stopped in 4 to 8 days. There

was decrease in stool volume with reduced frequency. There was quick increase in body weight, mental alertness and reduction in oedema was seen at the end of 2 days. Soya milk is suitable for people having lactose intolerance and about 60 per cent of Indian population suffer from lactose intolerance (Butta et al, 1992 and Awasthi, 1990).

Soyabean is a mean to combat nutritional anaemia and plays an effective role in preventing anaemia in expectant mothers and nursing mothers. This high fibre product also alleviates early pregnancy problems like nausea and constipation (Saraswat, 1993).

As soyabean contains an abundance of phosphate it can be used with advantage in the cure of nervous diseases. Some medical authorities have used soya bean in the treatment of rickets, pulmonary diseases and anaemia (Kale, 1985).

As soyabeans have less starch complex carbohydrates and more protein they are preferred by over weight people (Dermott et al, 1987). Jenkins et al, (1990) carried out a study in which obese persons took part for 12 weeks. During 8 weeks, 2 meals of their control (1000 Kcal) was replaced by soya based liquid formulae and the mean weight loss per month was 2.5 kg.

According to Raghuram et al, (1994) diabetes is the fifth major disease in India and about 2-4 per cent population suffer from this disease. Moderate carbohydrate, high protein and low fat diet is prescribed

for the control of diabetes. So soyabean containing 40 per cent of good quality protein, 12 per cent carbohydrate, mineral and vitamin is one of the most suitable food ingredient for diabetics (Gandhi, 1992).

In a study conducted by Naganwa et al, (1991) it was found that soya protein can be given to patients with cirrhosis in order to prevent protein calorie malnutrition.

In a study conducted by Komatsu and Yamagishi (1991) of 4 patients studied 2 had hypoproteinemia due to protein loosing gastroenteropathy and other 2 due to nephrotic syndrome. All the 4 patients were given jelly containing 10g soya peptide (SPT) for 20 weeks and 20g SPT for 10 weeks respectively. Intake of SPT improved the hypoproteinemia of the two protein loosing patients. Nitrogen balance of the nephrotic patients was negative before SPT supplementation but became positive when SPT was given.

Recently attention has been focused on soyabean consumption in reducing cancer risks. It contains high concentrations of several compounds with demonstrated anticarcinogenic activity. Soyabean protease inhibitors can inhibit or prevent development of experimentally induced colon, oral, lung, liver and oesophagal cancers. Protease inhibitors are unique in their irreversible suppressive effect on the carcinogenic process (Boonyee, 1991, Barnes and Messina, 1991).

Naturally occuring compound in soyabean called genisten blocks cancer causing genes and it is found in all soyabean products (Lowellponte, 1993).

According to microbiologist Pariza (1992) the principal flavour component of traditional (fermented) soya sauce contains a substance called HEME [4 - Hydroxy - 2 (or 5) Ethyl - 5 (or 2) - methyl- 3 (2H) furanone] which is one of the more powerful anticancer agents and was particularly effective in quantities as small as 4 mg/kg of body weight.

In premenopausal women a high intake of animal protein was associated with increased risk of breast cancer. Decreased risk was associated with a high intake of soya protein (Lee et al, 1991).

Soyabean protein has hypocholesterolemic and anti atherogenic property (Boonyee, 1991). When compared with casein, soya protein decreases the absorption of intestinal cholesterol and reduces the reabsorption of bile acids. These effects are the key to the hypocholesterolemic action of soya protein. In hypercholesterolemic patients lowering of serum total cholesterol upto 20 per cent occurs after the transfer from a mixed protein diet to a diet containing predominantly in soya protein (Beyen, 1993).

Wolfe and Grace, (1987) reported that the substitution of soya protein for meat and dairy protein resulted in substantial lowering of mean serum cholesterol in healthy adults of both sexes.

Van Raaij et al, (1981) reported that substitution of 65 per cent soya protein for casein in diet containing 13 per cent of total calories from protein resulted in a marked decline in LDL cholesterol and weaker but still significant increase in HDL cholesterol.

In a study conducted by Lavin et al, (1992) the results indicated that administration of soya protein may induce clinically beneficial effects in children with familial hypercholesterolemia.

Soyabean is an excellent source of unsaturated fatty acids. A number of recent reports indicated that dietary omega 3 fatty acid has a beneficial effect on cardiovascular disease. Raw soyabean oil contains an average of 7.8 per cent naturally occuring omega 3 in the form of alfalinolenic acid (Pushpendra et al, 1992).

The linoleic acid content of soya bean oil in the diet has been correlated with lower cholesterol level in the body. Because of these attributes consumption of soyabean oil is considered desirable in view of increased incidence of cardiovascular ailments (Ramakrishna et al, 1990).

Regular use of soyabean oil (one table spoon a day) has also been known to cure chronic constipation and lecithin present in soya oil is useful for proper functioning of brain (Awasthi, 1990).

Soyabean contains both the linolenic (n-6) and linoleic (n-3) acids which decreases total and LDL cholesterol and therefore are antiatherogenic and antithrombogenic (Ghafoorunisa, 1992 and Ulbrigat, 1991).

Carroll (1991) reports 13 per cent decrease in serum cholesterol, 23 per cent decrease in serum triglyceride level in hypercholesterolemic subjects when their low lipid diet was supplemented with soya protein isolate instead of casein.

Vessby (1989) says that substitution of soyabean protein for animal protein in a lipid lowering diet may cause a further reduction of the serum cholesterol levels. The reduction seems to be confirmed to the potentially atherogenic LDL lipoprotein while no effect has been demonstrated on the protective HDL lipoprotein.

Fifteen children 3-12 years of age with hypercholesterolemia fed with the soya protein diet for 8 weeks had a highly significant decrease in total cholesterol an average of 20 per cent against base line (Gaddi, 1987).

The effects of soya protein (35 per cent of protein energy) given as a beverage for children with familial hypercholesterolemia for a period of 4 weeks indicate that it significantly reduced the concentration of triglyceride and VLDL cholesterol ($P<0.05$) and significantly increased the concentration of HDL cholesterol and HDL_3 - C ($P<0.04$ and <0.03 respectively) (Danielle, 1990).

Number of suggestive mechanisms on action of soyabean protein in comparison to animal protein (usually casein) have been listed by Khare (1992) which includes :

1. Dietary soyaprotein in contrast to casein improve the catabolism of cholesterol rich VLDL
2. Absorption of lipid from gastrointenstinal tract may be more rapid
3. Soya protein may increase biliary cholesterol excretion compared to casein
4. Reduce cholesterol biosynthesis
5. Faecal steroid excretion may increase and
6. Involves horomone mediated cholesterolemic effect of some type of dietary proteins.

METHODOLOGY

III METHODOLOGY

Methodology for the study on "Acceptability of Soya Based Recipes in Food Service" included the following steps.

A. Development of Soya Based Instant Mixes for Four Selected Common Indian Recipes

B. Studying the Shelf Life and Acceptability of the Instant Mixes Developed

C. Conducting Acceptability Trials of the Instant Mixes in Selected Commercial and Non-commercial Food Service

D. Formulating Suitable Soyaflour Incorporated Recipes for Pre-school Children and Assessing their Impact on Nutritional Status and

E. Assessing the Effect of Administration of Soyaflour on the Lipid Profile of Selected Hyperlipidemic Patients.

A. Development of Soya Based Instant Mixes for Four Common Indian Recipes

1. Selection of recipes and raw ingredients

Sweets and savouries prepared from bengal gram flour (Cicer arietinum), black gram dhal (Phaseolus mungo roxb), refined flour (Triticum aestivum), and rice flour (Oryza sativa) form favourite items of the menu in the Indian cuisine. Snacks based on cereals, millets or pulses

have been traditionaly relished by all, of which Bajji and Pakoda (savoury items) and sweets namely Halwa and Gulabjamun, (Given in Appendix I as Glossary of Indian food items) are popular among the South Indian Dishes. These four recipes were selected to develop instant mixes. Soyaflour was incorporated at 10, 15 and 20 per cent replacing the main ingredient namely Bengal gram flour or refined wheat flour of the four recipes (Plate I to IV). Recipes are given in Appendix II.

The most convenient form of foods are ready-to-eat products like the baked, extruded or deep fried products which are familiar items in Western markets. Such products can be made for most of the dietary items even in India. However, the cost of production and packaging and the exact requirement of anticipated shelf-life for commercialisation will increase the cost of the product, to such an extent that only a few can afford them. Hence, instead of a ready-to-eat food product, on intermediate level of convenience-product like a ready mix or instant mix which could be offered in a dry powdered form and which could be made available for consumption by boiling, steaming, baking or frying, will be more appropriate. The cost of such products should be expected to be reasonable so that larger section of the population could afford to purchase and use them. Hence, instant mixes for Bajji, Pakoda, Gulabjamun and Halwa incorporating defatted soyaflour were formulated to improve the nutritional quality of the traditional recipes and to offer convenience to women.


Bajji with 10% Soya.

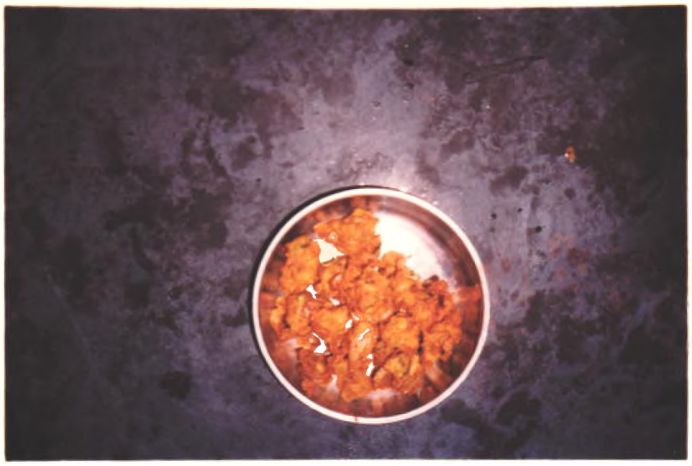

BAJJI
MIX


Bajji with 15% Soya.


Bajji with 20% Soya.

PLATE I

Pakoda with 10 per cent Soya



Pakoda with 15 per cent Soya

Pakoda with 20 per cent Soya

PLATE II


HALWA WITH 10%
SOYA


HALWA
MIX

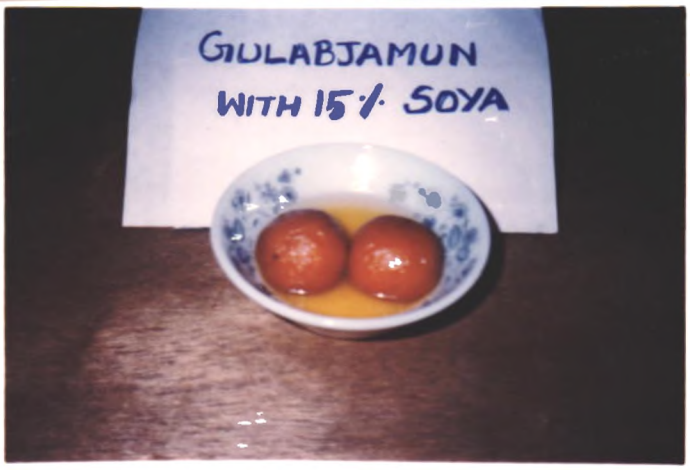

HALWA WITH 15%
SOYA


HALWA WITH 20%
SOYA

PLATE III


GULABJAMUN
WITH
10 % SOYA


GULABJAMUN
MIX


GULABJAMUN
WITH 15 % SOYA

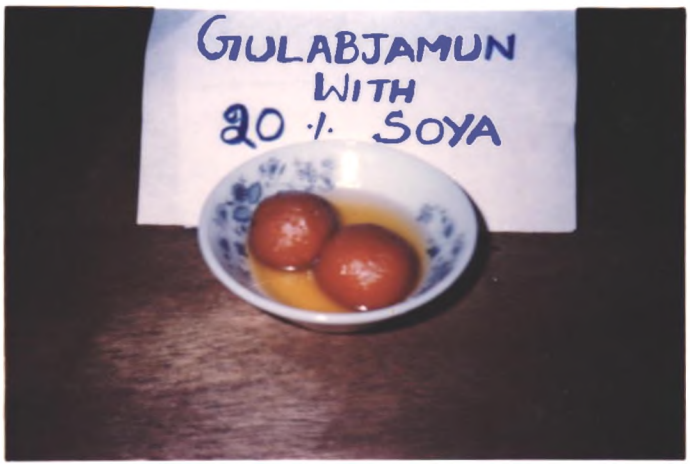

GULABJAMUN
WITH
20 % SOYA

PLATE IV

Care was taken to procure good quality ingredients for the preparation of instant mixes. Bengal gram dhal was purchased, dried and made into flour. Raw rice was cleaned and made into flour. Good quality refined flour and skimmed milk powder were obtained to prepare Halwa and Gulabjamun mix. Chilly powder was obtained from good qualitydried red chillies. Defatted soyaflour was obtained from Sakthi Soyas Ltd, Coimbatore for incorporation in the instant mixes. The weight of the main ingredients of the instant mixes was 100g except Pakoda mix. The weight of Pakoda mix was 110g. Five portions were obtained in the case of Bajji mix and Pakoda mix but in the case of Halwa mix and Gulabjamun mix ten portions were obtained.

The composition of the instant mixes are presented in Tables I, II, III and IV along with standard. Standard refers to the normal ingredients and amounts used in traditional preparation.

TABLE I

COMPOSITION OF BAJJI MIX

Ingredients	Standard	Amount in g Substitution with soyaflour		
		10%	15%	20%
Bengal gramflour	75	67.5	63.75	60
Rice flour	25	25	25	25
Chilly powder	5	5	5	5
Omum seeds	2.5	2.5	2.5	2.5
Cooking soda	One pinch	One pinch	One pinch	One pinch
Salt	2.5	2.5	2.5	2.5
Defatted soya flour	-	7.5	11.25	15

TABLE II

COMPOSITION OF PAKODA MIX

Ingredients	Standard	Amount in g Substitution with soyaflour		
		10%	15%	20%
Bengal gram flour	80	72	68	64
Rice flour	30	30	30	30
Chilly powder	5	5	5	5
Omum seeds	2.5	2.5	2.5	2.5
Cooking soda	One pinch	One pinch	One pinch	One pinch
Salt	2.5	2.5	2.5	2.5
Defatted soyaflour	-	9	12	16

TABLE III

COMPOSITION OF HALWA MIX

Ingredients	Standard	Amount in g Substitution with Soyaflour		
		10%	15%	20%
Refined wheat flour	90	81	76.5	72
Skimmed milk powder	10	10	10	10
Defatted soyaflour	-	9	13.5	18

TABLE IV

COMPOSITION OF GULABJAMUN MIX

Ingredients	Standard	Amount in g Subsitution with soyaflour		
		10%	15%	20%
Refined wheat flour	75	65.5	63.75	60
Skimmed milk powder	25	25	25	25
Defatted soyaflour	-	7.5	11.25	15
Cooking soda	One pinch	One pinch	One pinch	One pinch

The nutrient content of the developed mixes were computed using the nutritive value of Indian foods (Gopalan et al, 1994) and analysed using the methods given by National Institute of Nutrition (1983). Care was taken to have all the ingredients moisture-free and all ingredients were mixed well and packed in dry polythene bags and sealed.

B. Studying the Shelf-life and Acceptability of the Developed Mixes

Proper packaging preserves and protects the packaged food by preventing from contaminant micro-organisms in the environment. The over riding criterion in the selection of suitable packaging material for a particular product is to ensure that it is kept in a sound condition for its anticipated shelf-life (Brownsell et al, 1989). In order to study the shelf-life of the developed soya based instant mixes, each mix was packed separately in polythene bags.

A correctly selected food packaging material reduces microbial and insect attack as well as maintains the sensory and nutritive properties of the food by exclusion of oxygen, control of moisture-loss or gain, exclusion of dust and dirt. In order to judge the retention of the above qualities in the instant mixes, they were analysed before and after the storage period of three and six months using the methods of BIS (1970).

Sensory evaluation of recipes forms a crucial part of culinary art. Sensory indices are colour, flavour, texture and taste which form integral parts of the food as they stimulate the appetite, enhance consumption and leave a feeling of satiety aiding in better digestion. Unless these quality attributes are not satisfied the recipes or the food is said to be incomplete (Singh and Gupta, 1984). Recipes (Appendix II) were prepared with instant mixes and their acceptability in

terms of colour, flavour, texture and taste were evaluated by selected ten trained panel members using a five point score card developed for the purpose (Appendix III).

The recipes were prepared before and after storage of three months and sensory evaluation was done by the same ten trained panel members.

C. Conducting Acceptability Trials of the Instant Mixes in Selected Commercial and Non-commercial Food Service

Two non-commercial food service were selected using purposive sampling technique to incorporate soya based instant mixes. Saradalaya canteen situated at Avinashilingam Deemed University campus which caters to a large student body, the teaching and non-teaching members of the institute was non-commercial food service I and Saradalaya canteen situated in the Coimbatore Collectorate campus which caters to the public visiting the Collector's office as well as employees of the Collectorate was the non-commercial food service II were selected for the study.

Two commercial food service of the Coimbatore city namely Hotel Sree Annapoorna and Hotel Sree Lakshmi were selected to introduce the soya based instant mixes. These two commercial food service are located at vantage points where the turnover is high and clientele of all classes avail the facilities of these food service. The selection was based entirely on the discretion and judgement of the investigator.

Since fast food establishments are coming up in large numbers to cater to masses, it was decided to tryout the soya based instant mixes in fast food establishments also. Four fast food establishments located in market places, business areas, heavily populated areas and in cross roads were selected for the study. In the fast food establishments sweets are not preferred by the customers, hence only the savouries bajji and pakoda were tried out.

In the non-commercial, and commercial food service, one hundred heterogenous group of clientele evaluated the recipes each day in each food service. Among the one hundred, seventy five per cent were adults of both sexes, fifteen per cent adolescents and ten per cent children. Each recipe was prepared and given for the clientele for three consecutive days. In the fast food establishment fifty clientele evaluated the recipes for three consecutive days. Each day the products were presented to different clientele who visited the food service.

The recipes were evaluated by scoring. Each characteristic of the recipe was given five as the maximum and one as the minimum score. The clientele were asked to give five scores if they liked the recipe, three, if they considered the recipe as fairly acceptable and one for minimum acceptability. The mean of the three days scores was computed to assess the extent of acceptability of the prepared recipes.

The management and personnel in all non-commercial, commercial and fast food service rendered their full co-operation in the conduct of this study.

D. Formulating Suitable Soyaflour Incorporated Recipes for Pre-school Children and Assessing the Impact of Recipes on their Nutritional Status

The non-commercial food service includes "Group feeding programmes" as in pre-schools and secondary schools along with food service in educational institutions, industries and hospital dietary departments. Protein-energy malnutrition is the main nutritional problem in developing countries (Foster, 1992). It is the most prevalent and wide spread deficiency disease in India. In order to bridge the existing protein gap in the dietaries of pre-school children, protein rich soyaflour was incorporated in sweet biscuit, salt biscuit, diamond cuts and ribbon pakoda and fed to the pre-school children.

Twenty five children 3-5 years of age were selected with purposive sampling technique from Sri Avinashilingam Trust Balwadi to serve as experimental group and twenty five children from Coimbatore Corporation Balwadi to serve as control. The children in both the groups were comparable in their age, height and weight. Both the schools were under the Integrated Child Development Service (ICDS).

The selected four recipes were prepared with 15 per cent incorporation of defatted soya flour as a result of the better acceptability of recipes with 15 per cent soya flour by the children (Appendix V). Each child was fed with 150g of cooked recipe in equal amounts as mid morning and mid afternoon snacks. The children were fed for sixty days by alternating the preparations to avoid monotony and create interest among children.

Nutritional status of the selected children were assessed before and after the supplementation of soya incorporated recipes in terms of anthropometric measurements, estimation of haemoglobin (NIN, 1985) and plasma protein (NIN, 1985).

E. Assessing the Effect of Administration of Soyaflour on the Lipid Profile of Selected Hyperlipidemic Patients

Hospital dietary departments play an important role to speed up the convalesing process and to regain the health. According to Carroll (1991) in human beings substitution of soya protein for dietary animal protein or addition of soya protein to the diet lowers total and low density lipoprotein cholesterol levels in individuals with hypercholesterolemia. Hence this venture of assessing the effect of administration of soyaflour on the lipid profile of selected hyperlipidemic patients was carried out.

1. Selection of the patients

Patients getting treatment in Coimbatore Medical College hospital, and Kugan hospitals for hyperlipidemia were selected with the help of the physician for the study. Fourteen patients were selected on the basis of their willingness to participate in the study to see the effect of soyaflour on their serum lipid levels. Seven served as matching control and seven as experimental. The cholesterol levels of these patients were over 240 mg/dl and they were visiting the hospitals regularly. The selected 14 patients were in the age group of 35-55 years.

Recent guidelines given by National Cholesterol Education Programme (NCEP) indicate that the total cholesterol levels above 240 mg/dl is the high risk status of the patients (Goodman, 1991).

2. Incorporation of soyaflour in the selected recipes and introduction in the diets of selected seven patients

The recipes which were consumed by the patients like idiappam, puttu, iddli, pulkas, kozhukattai, sambar and greens masial were selected to incorporate soyaflour. The recipes were tried out with 10 per cent and 30 per cent soyaflour and presented to the patients.

As a result of the demonstration of recipes with soyaflour, the patients showed keen interest to incorporate soyaflour in their daily diet. Each patient was provided with 50g of soyaflour per day for incorporation in their commonly used recipes for a period of 45 days. Seven

patients (Group A) received the soyaflour and seven patients (Group B) served as control.

Each patient was given a diet sheet indicating the day's energy, carbohydrate, protein and fat level to maintain the desirable body weight.

3. Effect of soyaflour on the lipid profile

Pre and post feeding trial estimations of serum lipids were conducted by the methods given by Varley, et al, (1980).

The values of LDL cholesterol and VLDL - cholesterol were estimated from the following formula as given by Teitz (1985).

$$\text{LDL} = \text{Total cholesterol} - \frac{\text{TGL}}{5} - \text{HDL cholesterol}$$

$$\text{VLDL} = \text{Total cholesterol} - \text{HDL} - \text{LDL} - \frac{\text{TGL}}{5}$$

According to Vessby (1989) three weeks is sufficient to reach maximal lipid lowering effect, after a change of diet with soyabean protein. But this study was conducted for 45 days. It is twice the number of days indicating by Vessby for more reliable results.

RESULTS AND DISCUSSION

IV RESULTS AND DISCUSSION

The results obtained in the study "Acceptability of Soya Based Recipes in Food Service" are discussed under the following headings :

A. Nutrient Content of the Instant Mixes
B. Sensory Evaluation and the Shelf Life of the Instant Mixes
C. Acceptability of Instant Mixes in Food Service - Commercial and Non-commercial
D. Formulation of Suitable Soyaflour Incorporated Recipes for Pre-school Children and Impact of Administration of these Recipes on their Nutritional Status
E. Effect of Soyaflour on the Lipid Profile of Selected Hyperlipidemic Patients

A. Nutrient Content of the Instant Mixes

The computed and analysed nutritive values of the instant mixes developed are presented in Tables V to VIII.

Tables V and VI give the computed and analysed nutritive values of Bajji mix and Pakoda mix.

TABLE V

NUTRIENT CONTENT OF BAJJI MIX - COMPUTED AND ANALYSED VALUES

Nutrients	Standard			Percentage of soyaflour incorporation								
				10			15			20		
	C.V	A.V	% Diff	C.V	A.V	% Diff	C.V.	A.V	% Diff	C.V	A.V	% Diff
Energy (Kcal)	386	367	4.90	384	368	4.20	383	363	5.20	382	362	5.20
Protein (g)	18.50	16.20	0.02	20.90	18.40	0.12	22.10	20.10	9.00	23.40	21.10	0.10
Fat (g)	5.20	4.90	0.06	4.90	4.70	0.04	4.70	4.05	0.14	4.50	3.95	0.12
Carbohydrate (g) percentage by difference	66.60	63.00	3.60	64.50	62.20	3.57	63.30	60.86	3.85	62.20	59.25	4.75
Crude fibre (g) Percentage (w/w)	3.00	3.00	Nil	3.10	3.20	3.20	3.10	3.00	3.20	3.10	3.00	3.20
Moisture percentage (w/w)	11.54	7.08	38.65	11.36	5.54	51.23	11.36	5.59	50.79	11.18	7.20	35.60
Total ash percentage (w/w)	N.A	5.82	-	N.A	5.69	-	N.A	6.40	-	N.A	5.50	-

C.V. = Computed values

A.V. = Analysed values

N.A. = Data Not Available

TABLE VI

NUTRIENT CONTENT OF PAKODA MIX - COMPUTED AND ANALYSED VALUES

Nutrients	Standard			Percentage of soyaflour incorporation								
				10			15			20		
	C.V	A.V	% Diff	C.V	A.V	% Diff	C.V	A.V	% Diff	C.V	A.V	% Diff
Energy (Kcal)	423	401	5.20	421	392	6.90	419	390	6.90	418	380	9.00
Protein (g)	19.90	19.15	0.04	22.50	20.45	9.10	23.80	21.00	11.76	25.00	22.61	9.56
Fat (g)	5.50	4.50	18.00	5.10	4.31	0.15	5.00	4.35	0.27	4.80	4.20	0.13
Carbohydrate (g) Percentage difference	73.50	60.93	17.10	71.20	58.06	18.60	70.00	57.75	17.50	68.80	57.20	16.83
Crude fibre (g) Percentage w/w	3.10	2.53	18.38	3.10	3.20	3.20	3.20	3.20	Nil	3.20	2.29	0.10
Moisture percentage w/w	12.72	7.88	38.00	12.53	8.89	29.00	12.43	8.50	13.60	12.34	8.00	35.17
Total ash percentage w/w	N.A	5.00	-	N.A	5.09	-	N.A	5.20	-	N.A	5.10	-

C.V. = Computed values

A.V. = Analysed values

N.A. = Data not available

As given in Tables V and VI, increasing the quantity of defatted soyaflour has increased the protein content and decreased the carbohydrate content of bajji and pakoda mix in proportion to the percent of soyaflour incorporated when compared to the standard. The energy value also accordingly changed.

The computed and analysed values of the instant mixes corresponded well except for moisture content which probably may be attributed to the type of flour and extent of drying.

Tables VII and VIII present the nutrient content of Halwa mix and Gulabjamun mix.

TABLE VII

NUTRIENT CONTENT OF HALWA MIX - COMPUTED AND ANALYSED VALUES

Nutrients	Standard			Percentage of soyaflour incorporation								
				10			15			20		
	C.V	A.V	% Diff.	C.V	A.V	% Diff	C.V	A.V	% Diff	C.V	A.V	% Diff
Energy (Kcal)	355	350	1.40	348	341	2.00	356	350	1.70	357	355	0.56
Protein (g)	14.00	13.50	3.57	17.70	16.28	8.02	19.60	18.94	3.37	21.50	19.94	7.26
Fat (g)	0.86	0.80	6.98	0.92	0.87	5.43	0.93	0.90	0.23	0.95	0.95	1.05
Carbohydrate (g) Percentage by difference	71.60	70.60	1.40	67.70	69.40	2.51	65.70	68.00	3.50	63.70	69.56	9.20
Crude fibre (g) Percentage w/w	0.77	0.75	2.60	0.94	0.84	10.64	1.02	0.91	10.78	1.10	0.76	30.90
Moisture percentage w/w	12.38	11.96	13.9	11.86	11.08	15.00	11.61	9.85	15.00	11.35	6.89	39.00
Total ash percentage w/w	N.A	1.59	-	N.A	1.49	-	N.A	1.40	-	N.A	1.91	-

C.V. = Computed values

A.V. = Analysed values

N.A. = Data not available

TABLE VIII

NUTRIENT CONTENT OF GULABJAMUN MIX-COMPUTED AND ANALYSED VALUES

Nutrients	Standard			Percentage of soyaflour incorporation								
				10			15			20		
	C.V.	A.V.	% Diff	C.V.	A.V.	% Diff	C.V.	A.V.	% Diff	C.V.	A.V.	% Diff
Energy (Kcal)	350	343	2	350	350	Nil	350	348	0.57	350	350	Nil
Protein (g)	17.75	17.04	0.04	20.9	20.1	0.23	22.6	20.65	8.63	24.0	21.5	10.42
Fat (g)	0.71	0.70	1.41	0.74	0.72	2.70	0.75	0.70	0.99	0.99	0.89	10.10
Carbohydrate (g) percentage by difference	68.20	68.50	0.44	65.0	66.0	1.54	63.10	65.01	0.03	61.60	64.00	3.90
Crude fibre (g) percentage w/w	0.23	0.14	39.00	0.36	0.21	41.67	0.43	0.32	25.50	0.50	0.44	12.00
Moisture percentage w/w	11.00	10.84	1.45	10.57	9.83	7.00	10.35	9.80	5.3	10.14	9.95	1.78
Total ash percentage w/w	N.A	2.78		N.A	3.14		N.A	3.52		N.A	3.21	

C.V. = Computed values

A.V. = Analysed values

N.A. = Data not available

Incorporation of soyaflour enhanced the protein and fibre content of the instant mixes. The computed values corresponded very well with the analysed values with maximum percentage difference of 39 per cent in moisture content of halwa mix with 20 per cent incorporation of soyaflour and 41.67 per cent in crude fibre content of gulabjamun mix with 10 per cent incorporation of soyaflour. The difference in moisture content may be attributed to the type of flour and extent of drying and crude fibre content to the type of flours used.

Table IX gives the food cost of the instant mixes.

TABLE IX

FOOD COST OF THE INSTANT MIXES

Instant mixes	Amount in g	No.of portions	Standard	Percentage of soyaflour incorporation		
				10	15	20
			Rs.P	Rs.P	Rs.P	Rs.P
Bajji	100	5	2.30	2.25	2.20	2.15
Pakoda	110	5	2.50	2.40	2.36	2.32
Halwa	100	10	1.90	1.95	1.98	2.00
Gulabjamun	100	10	3.17	3.22	3.24	3.25

The food cost of bajji mix packed in the polythene bag was Rs.2.30 for standard and only Rs.2.15 with incorporation of 20 per cent soyaflour. The food cost of

pakoda mix with incorporation of 10, 15 and 20 per cent soyaflour was Rs.2.40, 2.36 and Rs.2.32 respectively as against Rs.2.50 for standard. The decrease in the food cost is due to reduction of Bengalgram flour and addition of soyaflour which is less costly than Bengal gram flour.

With regard to food cost of halwa mix, the food cost increases as the amount of refined wheat flour decreases, the cost of which is less than the cost of defatted soyaflour. In the case of gulabjamun mix, the food cost is comparatively higher due to the increase in the amount of milk powder.

Table X gives the mean organoleptic scores obtained for the four recipes prepared with instant mixes before and after 3 months of storage. Individual values are given in Appendix IV. A panel of ten judges evaluated the products.

TABLE X

MEAN ORGANOLEPTIC SCORES OF THE SELECTED FOUR RECIPES BEFORE AND AFTER STORAGE OF THE MIXES

Recipes		Percentage of soyaflour incorporation					
		10		15		20	
		Before storage	After storage	Before storage	After storage	Before storage	After storage
Bajji	Mean±	4.23±	4.65±	4.15±	4.51±	3.72±	4.315±
	S.D	0.065	0.146	0.220	0.386	0.166	0.275
't' value		3.37**		2.56*		5.86**	
Pakoda		4.48±	3.67±	4.28±	4.27±	4.148±	4.30 ±
		0.250	0.118	0.322	0.079	0.368	0.105
't' value		9.288**		2.290NS		0.488NS	
Halwa		4.425±	4.50±	4.30±	4.72±	4.62±	4.52 ±
		0.20	0.408	0.158	0.142	0.310	0.142
't' value		0.232NS		6.335**		0.880NS	
Gulabjamun		3.17±	3.30±	3.25±	3.35±	3.33±	2.52 ±
		0.237	0.307	0.204	0.269	0.266	0.558
't' value		0.533NS		0.367NS		4.121**	

* = significant at 5 per cent level

** = Significant at 1 per cent level

NS = Not significant

The perusal of the above Table X depicts that the organoleptic scores for the recipes prepared from stored instant mixes were higher compared to fresh instant mixes. Statistical appraisal indicated significant difference at one per cent level at 10 per cent incorporation for bajji and pakoda and also for 20 per cent incorporation for bajji alone. The probable reason could be that storage could have subdued the characteristic flavour of soya. No significant difference was seen for incorporation of 15 and 20 per cent for pakoda. With regard to sweets the difference was not significant for organoleptic scores before and after storage.

In order to estimate the shelf- life of the instant mixes analysis on selected microbiological parameter was carried out for the four instant mixes.

Table XI presents the results of the microbiological analysis on bajji mix and pakoda mix before and after storage of 3 and 6 months along with the standard.

TABLE XI

MICROBIOLOGICAL ANALYSIS OF BAJJI MIX AND PAKODA MIX BEFORE AND AFTER STORAGE OF 3 AND 6 MONTHS

Analysis	Standard storage			Percentage of soyaflour incorporation								
				10			15			20		
				Storage			Storage			Storage		
	Fresh	3 months	6 months	Fresh	3 months	6 months	Fresh	3 months	6 months	Fresh	3 months	6 months
Bajji mix												
Standard Plate count/g	10,700	16,500	18,700	27,500	47,750	65,000	34,000	48,500	86,000	30,000	49,500	97,000
Insect filth and fragments	Nil	Nil	Nil	Nil	Nil	Present	Nil	Nil	Present	Nil	Nil	Present
Salmonella/25g	——————————> Negative <——————————											
Pakoda mix												
Standard Plate count/g	20,000	28,000	32,000	31,000	38,000	60,000	31,200	42,100	66,500	33,000	47,000	84,000
Insect filth and fragments	Nil	Nil	Nil	Nil	Nil	Present	Nil	Nil	Nil	Nil	Nil	Present
Salmonella/25g	——————————> Negative <——————————											

It was encouraging to note that there was absence of insect filth and fragments upto three months of storage. The other parameter namely plate count/g was within the prescribed limits of edible flour (IS 7836-1975). while salmonella was totally absent as per the BIS prescriptions.

Hence the developed mixes could be stored safely for a period of three months.

Table XII gives the microbiological analysis of halwa mix and gulabjamun mix.

TABLE XII

MICROBIOLOGICAL ANALYSIS OF HALWA MIX AND GULABJAMUN MIX BEFORE AND AFTER STORAGE OF 3 AND 6 MONTHS

Analysis	Standard			Percentage of soyaflour incorporation								
				10			15			20		
		Storage			Storage			Storage			Storage	
	Fresh	3 months	6 months	Fresh	3 months	6 months	Fresh	3 months	6 months	Fresh	3 months	6 months
Halwa mix												
Standard plate count/g	5,400	5,600	6,000	<3,000	3,500	4,500	6,200	6,500	8,500	6,800	11,000	13,500
Insect filth and fragments	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Salmonella/25g	⟶ Negative ⟵											
Gulabjamun mix												
Standard plate count/g	8,500	8,900	9,500	<3,000	8,000	15,000	<3,000	7,200	8,500	<3,000	15,300	22,300
Insect filth and fragments	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Salmonella/25g	⟶ Negative ⟵											

In the case of Halwa and Gulabjamun mix the standard plate count after storage of six months was only 22,300 which was less than the standard limits prescribed for edible flour by ISI 7836-1975. No insect filth and fragments even after storage of six months were found in both the mixes. Test for the presence of Salmonella was found negative. Hence the developed mixes could be stored safely for a period of six months.

C. Acceptability of Instant Mixes in Food Service

1. Commercial food service

One hundred clientele of heterogenous nature consumed Bajji in two commercial food service institutions. Table XIII indicates the mean acceptability scores given for Bajji (Figure 1)

TABLE XIII

MEAN ACCEPTABILITY SCORES OBTAINED FOR BAJJI IN SELECTED TWO COMMERCIAL FOOD SERVICE

N = 100

Quality attributes	Percentage of soyaflour incorporation					
	Commercial food service					
	10		15		20	
	I	II	I	II	I	II
Appearance	3.6	3.8	3.1	3.8	2.8	3.2
Colour	3.4	3.8	4.0	3.6	3.4	3.1
Flavour	3.6	3.6	3.2	3.7	2.3	3.1
Texture	3.6	3.6	3.0	3.0	2.7	3.0
Taste	3.6	3.8	3.2	4.0	2.8	3.3
Overall acceptability	3.6	3.7	3.3	3.6	2.8	3.1

Between attributes 'F' value = 0.09 NS

Between percentage 'F' value = 0.183 NS

MEAN ACCEPTABILITY SCORES - BAJJI

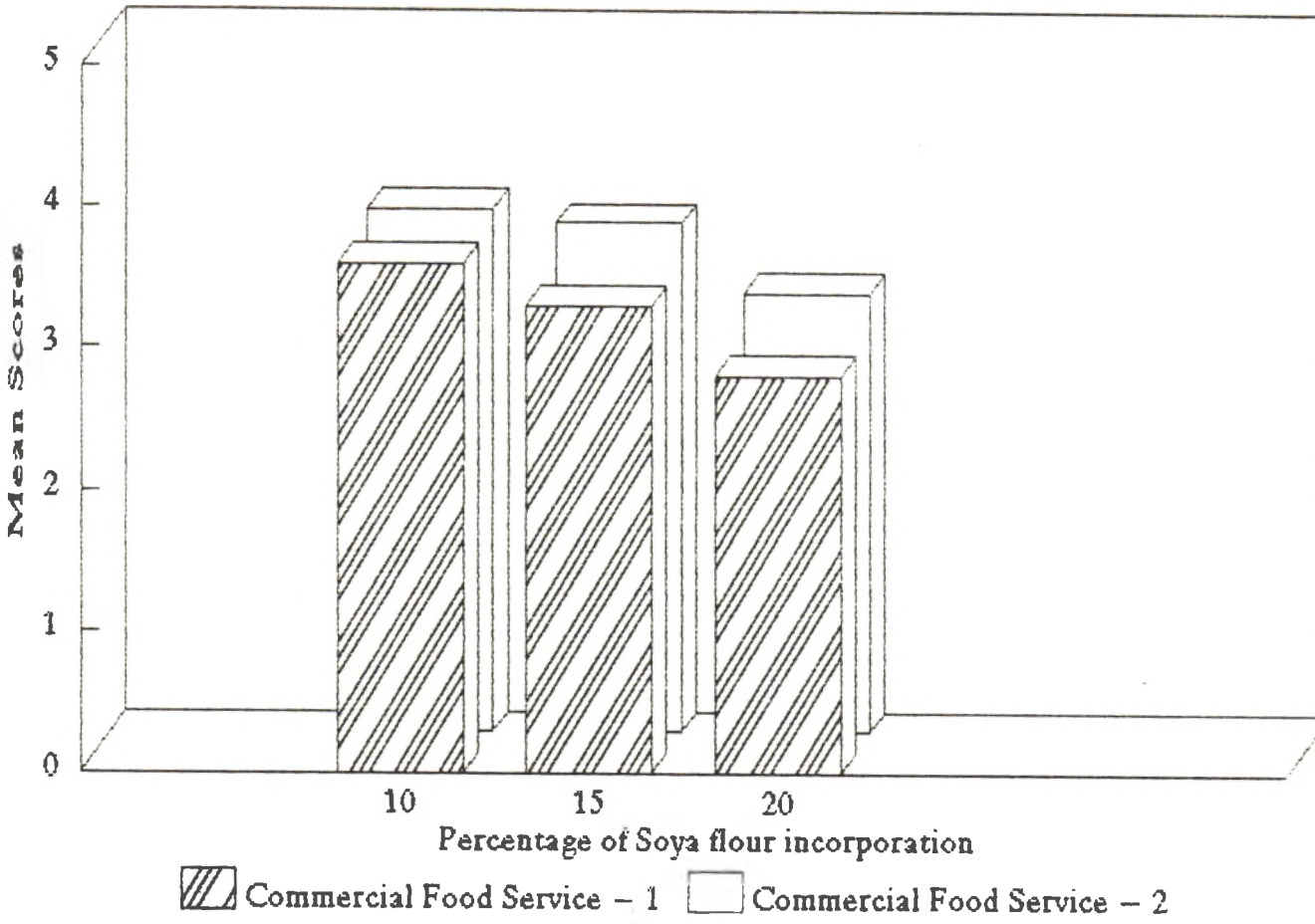


Fig. 1

The Bajji prepared with 10, 15 and 20 per cent incorporation of soyaflour was acceptable and did not vary significantly - as per the ANOVA test. There was no significant difference in the quality attributes of bajji prepared with different percentage of soyaflour.

Table XIV presents the mean acceptability scores obtained for pakoda in selected two commercial food service (Figure 2).

TABLE XIV

MEAN ACCEPTABILITY SCORES OBTAINED FOR PAKODA IN SELECTED TWO COMMERCIAL FOOD SERVICE

N = 100

Quality attributes	Percentage of soyaflour incorporation					
	Commercial food service					
	10		15		20	
	I	II	I	II	I	II
Appearance	3.6	3.6	3.8	3.2	3.1	2.4
Colour	3.6	3.6	3.8	3.2	3.4	2.4
Flavour	3.6	3.6	3.9	3.2	2.5	2.4
Texture	3.7	4.0	3.8	3.2	2.5	2.3
Taste	3.8	3.6	3.8	3.3	2.4	2.3
Overall acceptability	3.7	3.7	3.8	3.2	2.8	2.4

Between attributes 'F' value = 7.24^{**}
Significant at 1 per cent level

Between percentage 'F' value = 27.55^{**}
Significant at 1 per cent level

MEAN ACCEPTABILITY SCORES - PAKODA

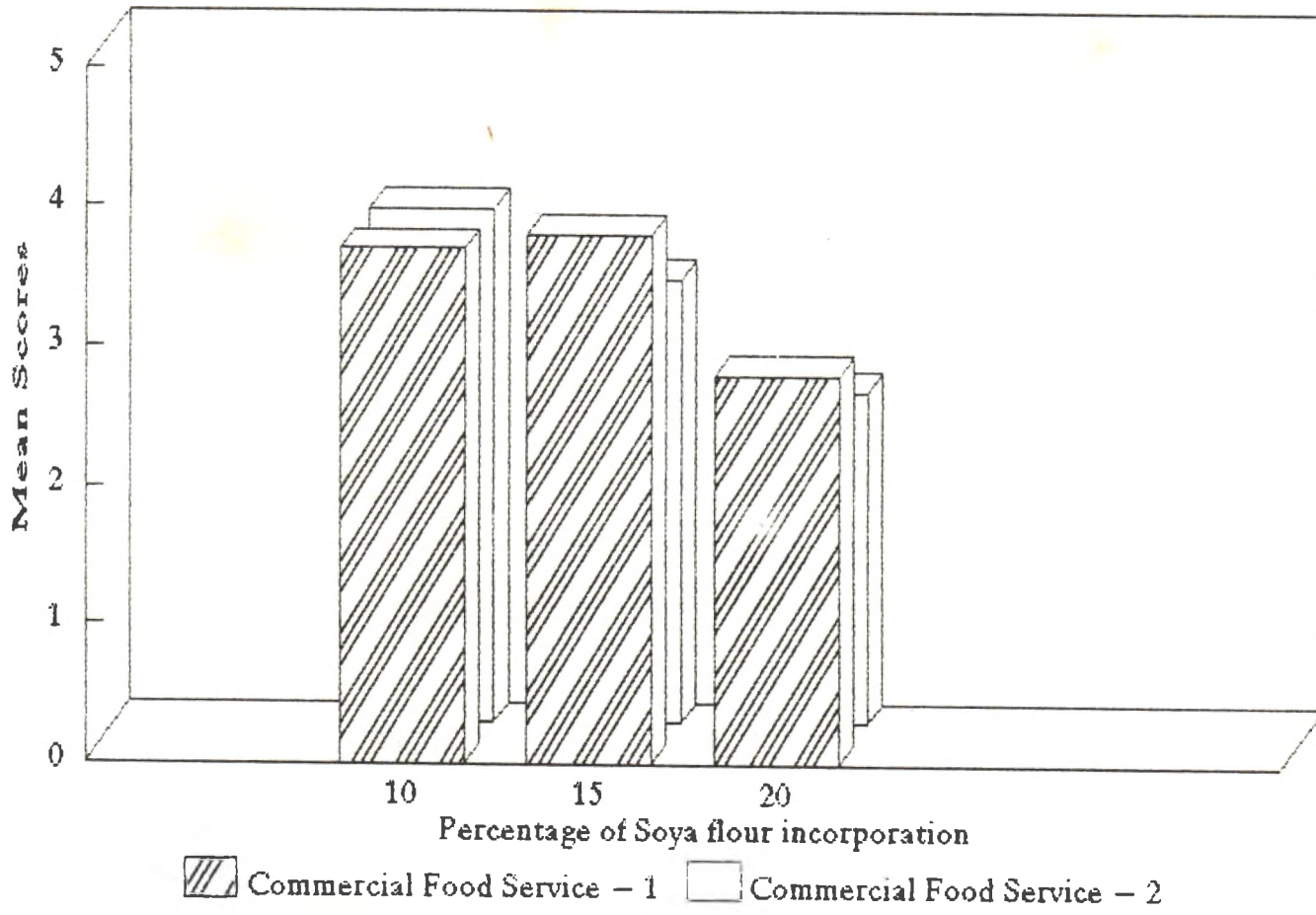


Fig. 2

With regard to the acceptability of pakoda, statistical appraisal indicated significant difference at one per cent level as per ANOVA test for quality attributes and 10, 15 and 20 per cent incorporation of soyaflour.

Table XV gives the mean acceptability scores obtained for Halwa in selected two commercial food service (Figure 3).

TABLE XV

MEAN ACCEPTABILITY SCORES OBTAINED FOR HALWA IN SELECTED TWO COMMERCIAL FOOD SERVICE

N = 100

Quality attributes	Percentage of soyaflour incorporation					
	10		15		20	
	Commercial food service					
	I	II	I	II	I	II
Appearance	3.9	3.6	3.6	3.6	3.2	2.9
Colour	4.0	3.6	3.8	3.4	3.0	3.4
Flavour	3.8	3.6	3.5	3.6	3.3	2.6
Texture	4.2	3.7	3.4	3.7	3.1	3.0
Taste	4.0	3.7	3.5	3.7	3.2	3.0
Overall Acceptablity	4.0	3.6	3.6	3.6	3.2	3.0

Between attributes 'F' value = 0.029 NS

Between percentage 'F' value = 0.555 NS

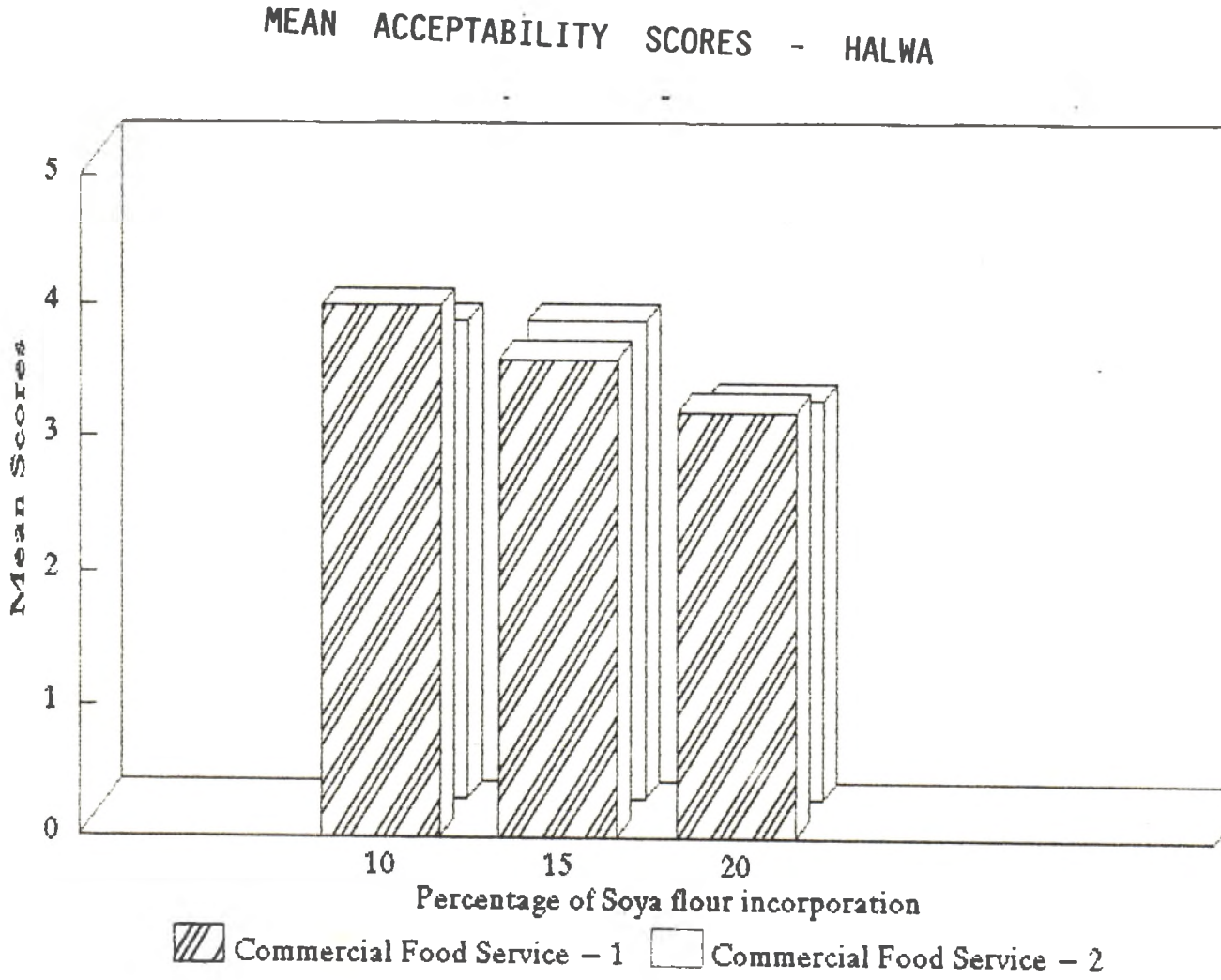

MEAN ACCEPTABILITY SCORES - HALWA
Mean Scores
5
4
3
2
1
0
10
15
20
Percentage of Soya flour incorporation
Commercial Food Service – 1
Commercial Food Service – 2

Fig 3

As per Table XV Halwa prepared with 10, 15 and 20 per cent soyaflour was acceptable and there was no significant difference between attributes nor due to the percentage of incorporation.

Table XVI indicates the mean acceptablity scores obtained for Gulabjamun in selected two commercial food service (Figure 4).

TABLE XVI

MEAN ACCEPTABILITY SCORES OBTAINED FOR GULABJAMUN IN SELECTED TWO COMMERCIAL FOOD SERVICE

N = 100

	Percentage of soyaflour incorporation					
	10		15		20	
	Commercial food service					
	I	II	I	II	I	II
Appearance	3.5	3.6	3.4	3.6	2.3	3.2
Colour	3.7	3.6	3.4	3.4	2.8	2.1
Flavour	3.6	3.8	3.4	3.6	2.8	2.9
Texture	3.5	3.3	3.4	3.6	2.8	3.2
Taste	3.4	3.8	3.3	3.7	2.8	3.0
Overall Acceptability	3.5	3.6	3.4	3.6	2.7	2.9

Between attributes 'F' value = 1.636 NS

Between percentage 'F' value = 8.4945^{**}

Significant at 1 per cent level

MEAN ACCEPTABILITY SCORES - GULABJAMUN

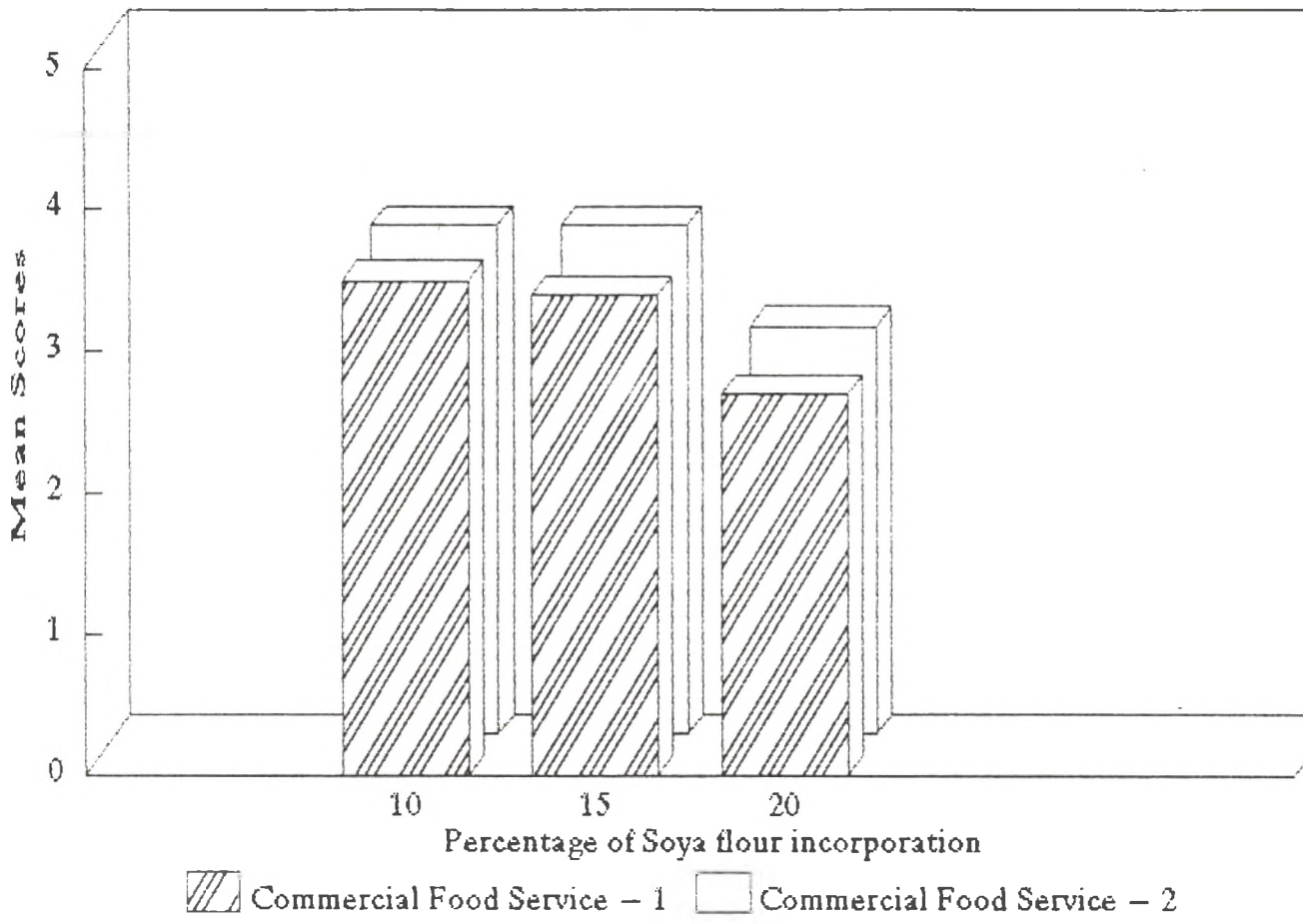


Fig. 4

There was no significant difference between quality attributes as per ANOVA test but there was significant difference at one per cent level in the acceptability of Gulabjamun prepared with different levels of incorporation of soyaflour.

2. Non-commercial food service

Table XVII presents the mean scores obtained for Bajji in two selected non-commercial food service (Figure 5).

TABLE XVII

MEAN ACCEPTABILITY SCORES OBTAINED FOR BAJJI IN TWO SELECTED NON-COMMERCIAL FOOD SERVICE

N = 100

Quality attributes	Percentage of soyaflour incorporation					
	10		15		20	
	Non-commercial food service					
	I	II	I	II	I	II
Appearance	3.47	3.47	3.47	3.22	3.23	3.20
Colour	3.47	3.48	3.22	3.22	3.08	3.20
Flavour	3.46	3.51	3.30	3.57	3.10	3.21
Texture	3.44	3.51	3.30	3.50	3.10	3.22
Taste	3.47	3.48	3.47	3.22	3.23	3.20
Overall acceptability	3.46	3.49	3.55	3.35	3.15	3.21

Between percentage 'F' value = 0.16 NS

Between attributes 'F' value = 5.00*

* Significant at five per cent level

MEAN ACCEPTABILITY SCORES - BAJJI

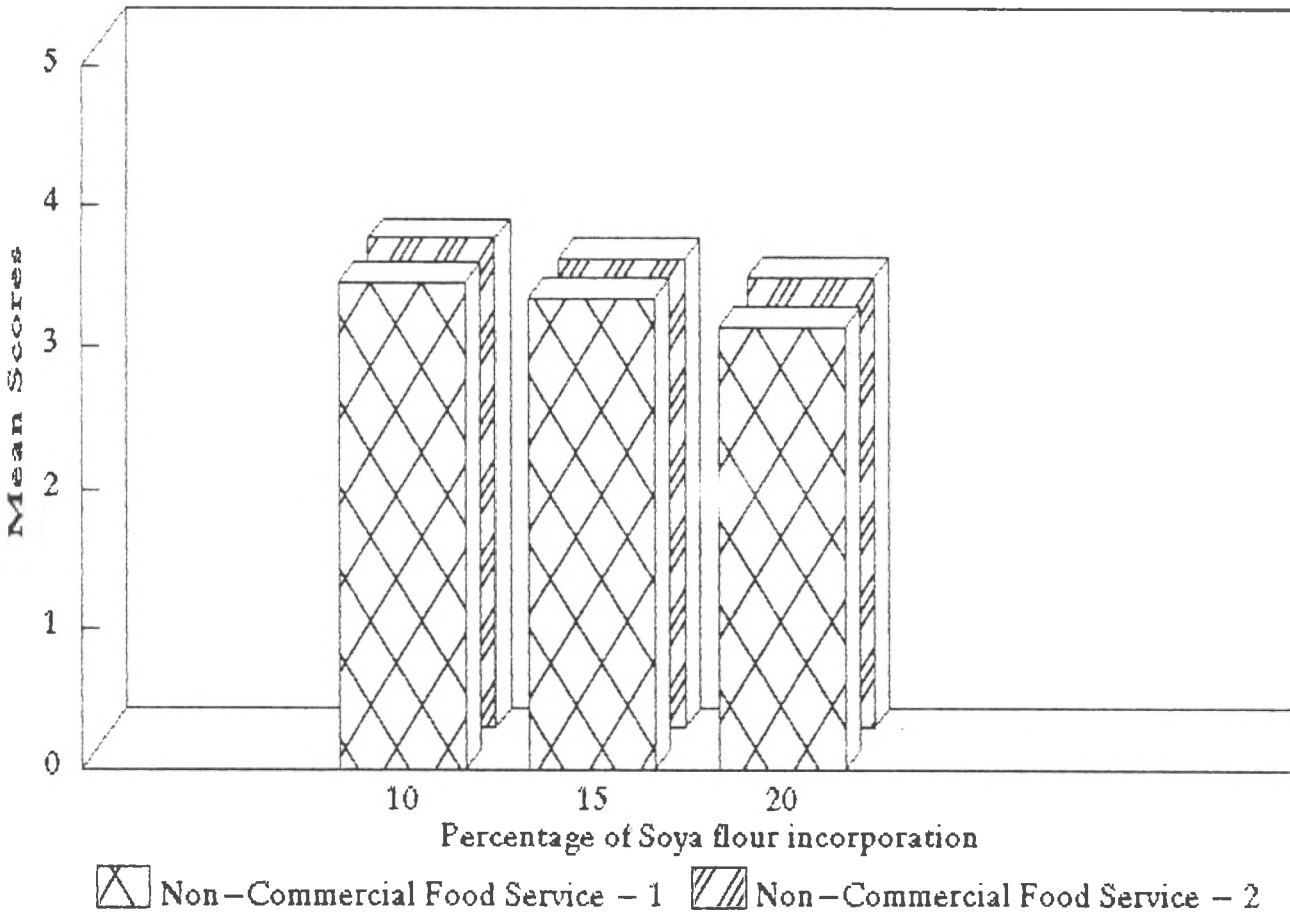


Fig. 5

Bajji prepared with 10, 15 and 20 per cent addition of soyaflour was accepted by the clientele of two selected non-commercial food service without any significant difference in the acceptability. There was significant difference at five per cent level between the quality attributes of Bajji.

Table XVIII gives the mean acceptability scores obtained for pakoda in selected two non-commercial food service (Figure 6).

TABLE XVIII

MEAN ACCEPTABILITY SCORES OBTAINED FOR PAKODA IN SELECTED TWO NON-COMMERCIAL FOOD SERVICE

Quality attributes	Percentage of soyaflour incorporation					
	10		15		20	
	Non-commercial food service					
	I	II	I	II	I	II
Appearance	3.81	3.16	3.41	3.76	3.56	3.72
Colour	3.36	3.56	3.96	3.80	3.56	3.44
Flavour	3.68	3.56	3.52	3.84	3.56	3.52
Texture	3.56	3.76	3.56	2.68	3.72	4.12
Taste	3.60	3.64	3.04	3.76	3.84	3.14
Overall acceptability	3.60	3.54	3.49	3.57	3.65	3.59

Between attributes 'F' value = 16.58**

Between percentage 'F' value = 11.69**

** Significant at 1 per cent level

MEAN ACCEPTABILITY SCORES - PAKODA

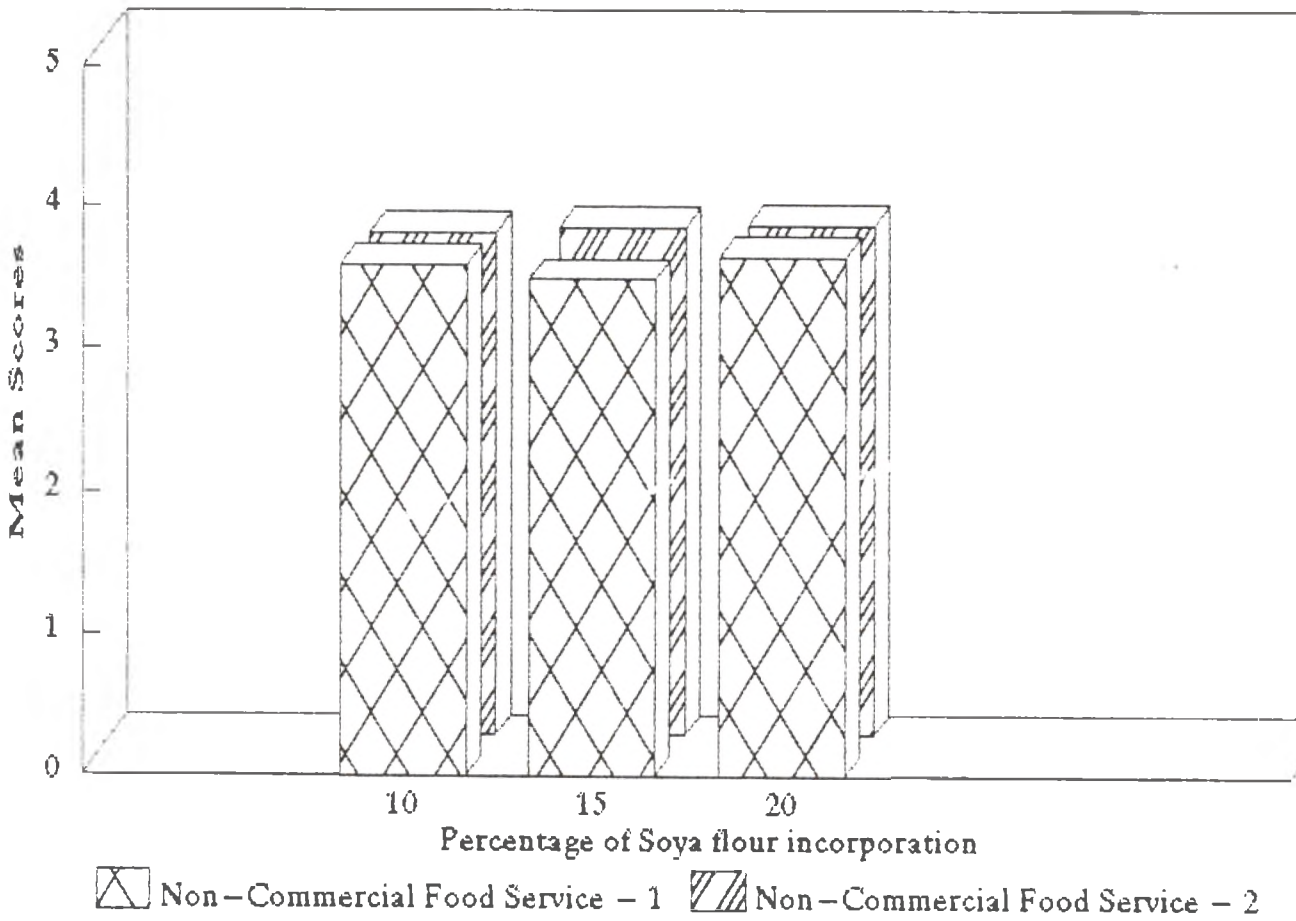


Fig. 6

In the case of Pakoda there was a significant difference at one per cent level between quality attributes and the percentage incorporation of soyaflour.

Table XIX gives the mean acceptability scores obtained for Halwa in selected two non-commercial food service (Figure 7)

TABLE XIX

MEAN ACCEPTABILITY SCORES OBTAINED FOR HALWA IN SELECTED TWO NON-COMMERCIAL FOOD SERVICE

N = 100

Quality attributes	Percentage of soyaflour incorporation					
	10		15		20	
	Non-commercial food service					
	I	II	I	II	I	II
Appearance	3.36	3.52	3.80	3.28	2.64	3.24
Colour	2.80	3.00	3.12	3.28	2.76	2.12
Flavour	3.60	3.44	4.20	3.00	2.92	2.92
Texture	3.52	3.48	3.76	3.16	2.92	2.40
Taste	3.40	3.48	3.84	3.32	2.76	2.80
Overall acceptability	3.34	3.38	3.74	3.20	2.80	2.69

Between attributes 'F' value = 12.95**

Between percentage 'F' value = 12.97**

** Significant at 1 per cent level

MEAN ACCEPTABILITY SCORES - HALWA

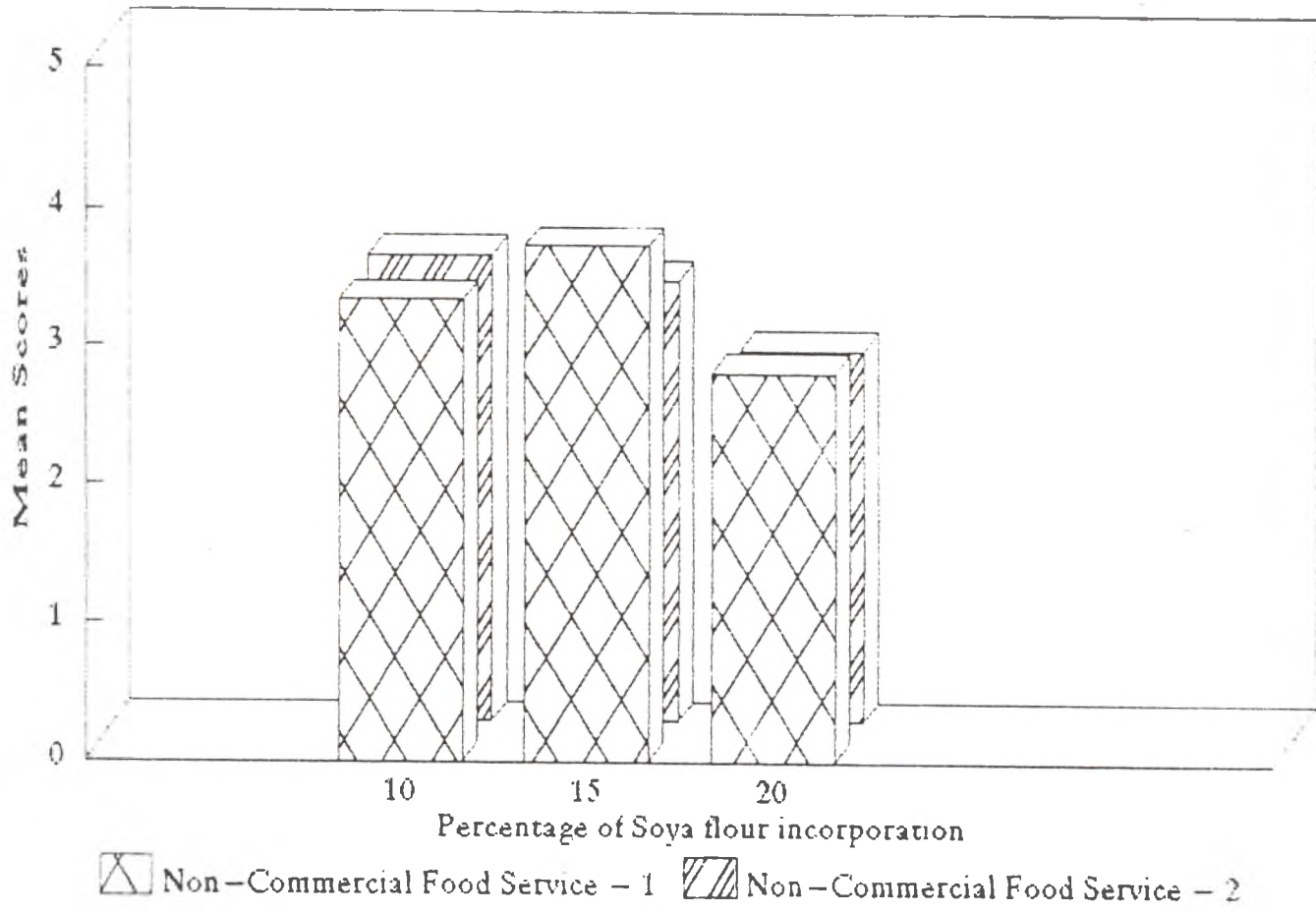


Fig. 7

Similar to Pakoda, there was also a significant difference at one per cent level in the acceptability of Halwa prepared with 10, 15, and 20 per cent soyaflour and between the quality attributers as per the Table XIX.

Table XX reveals the mean acceptability scores obtained for Gulabjamun in selected two non-commercial food service (Figure 8).

TABLE XX

MEAN ACCEPTABILITY SCORES OBTAINED FOR GULABJAMUN IN SELECTED TWO NON-COMMERCIAL FOOD SERVICE

Quality attributes	Percentage of soyaflour incorporation					
	10		15		20	
	Non-commercial food service					
	I	II	I	II	I	II
Appearance	4.32	4.08	4.00	4.12	3.76	3.0
Colour	4.40	3.48	4.00	4.24	4.52	3.8
Flavour	3.88	4.00	3.76	3.16	4.10	3.0
Texture	4.00	4.00	4.24	3.52	3.80	2.5
Taste	3.80	4.36	3.88	3.80	2.84	3.4
Overall acceptability	4.08	3.98	3.98	3.76	3.80	3.1

Between attributes 'F' value = 0.37 NS

Between percentage 'F' value = 0.268 NS

Similar to Pakoda, there was also a significant difference at one per cent level in the acceptability of Halwa prepared with 10, 15, and 20 per cent soyaflour and between the quality attributers as per the Table XIX.

Table XX reveals the mean acceptability scores obtained for Gulabjamun in selected two non-commercial food service (Figure 8).

TABLE XX

MEAN ACCEPTABILITY SCORES OBTAINED FOR GULABJAMUN IN SELECTED TWO NON-COMMERCIAL FOOD SERVICE

Quality attributes	Percentage of soyaflour incorporation					
	10		15		20	
	Non-commercial food service					
	I	II	I	II	I	II
Appearance	4.32	4.08	4.00	4.12	3.76	3.08
Colour	4.40	3.48	4.04	4.24	4.52	3.82
Flavour	3.88	4.00	3.76	3.16	4.10	3.06
Texture	4.00	4.00	4.24	3.52	3.80	2.56
Taste	3.80	4.36	3.88	3.80	2.84	3.44
Overall acceptability	4.08	3.98	3.98	3.76	3.80	3.19

Between attributes 'F' value = 0.37 NS

Between percentage 'F' value = 0.268 NS

MEAN ACCEPTABILITY SCORES - GULABJAMUN

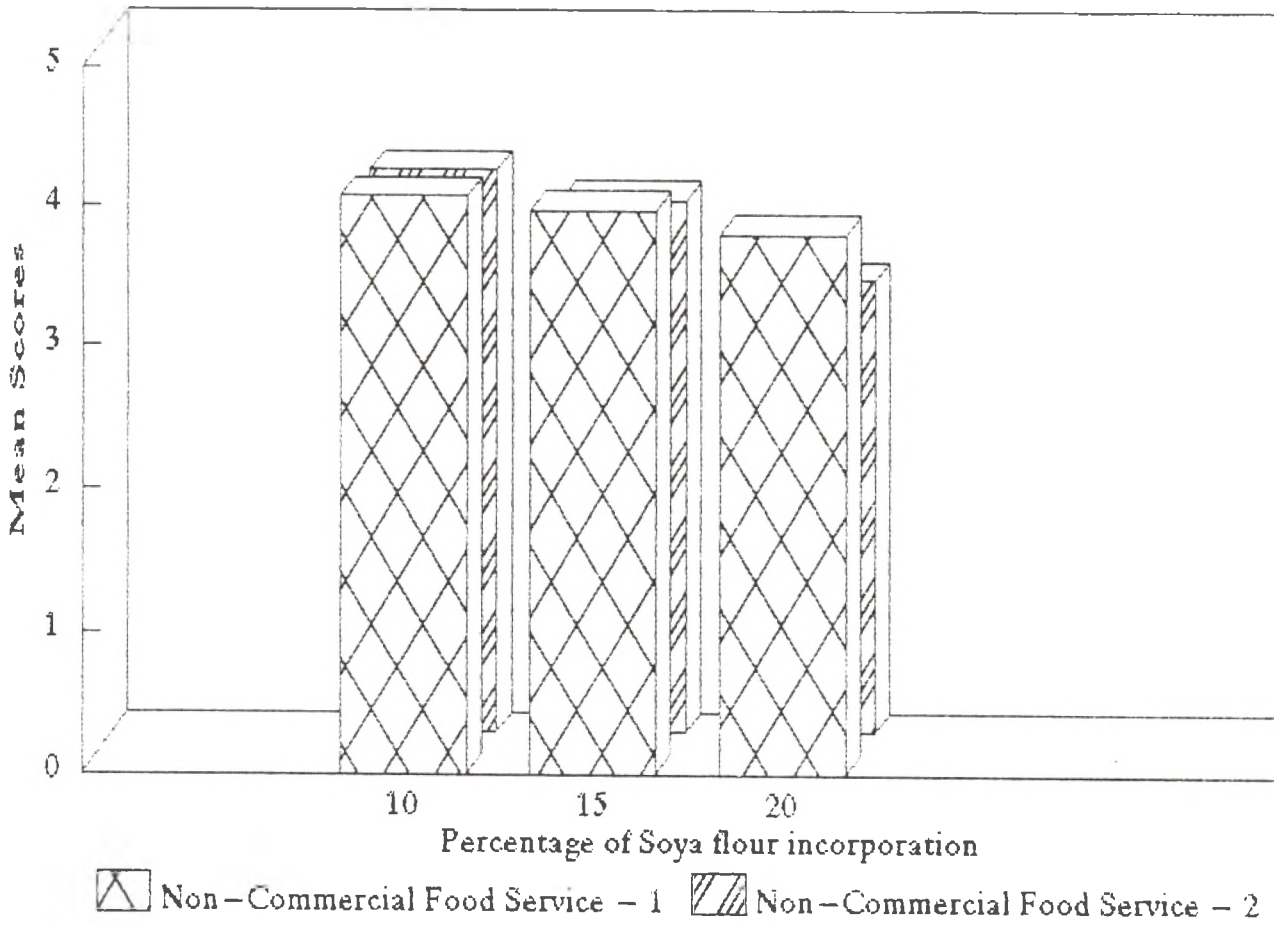


Fig. 8

The acceptability of Gulabjamun in selected non-commercial food service institutions at different levels of incorporation was not statistically significant and this stands the same for the quality attributes.

3. Selected four fast food outlets

The mean acceptability scores obtained for Bajji and Pakoda in selected four fast food outlets are presented in Tables XXI and XXII (Figure 8-A and 8-B).

A heterogenous group of fifty clientele in the selected four fast food outlets evaluated the recipes with 10, 15 and 20 per cent of soyaflour.

TABLE XXI

MEAN ACCEPTABILITY SCORES OBTAINED FOR BAJJI IN SELECTED FOUR FAST FOOD OUTLETS

N = 50

Quality attributes	Percentage of soyaflour incorporation											
	10				15				20			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Appearance	4.24	4.08	4.16	4.12	4.40	3.76	4.12	3.76	3.76	3.16	3.76	4.16
Colour	4.04	3.48	3.72	4.12	4.80	3.80	4.40	4.16	3.92	3.72	4.04	4.16
Flavour	4.36	4.04	3.72	4.40	3.76	3.88	3.16	4.40	3.60	3.60	3.44	4.40
Texture	4.36	4.00	4.20	4.24	3.68	3.80	4.32	4.24	3.00	3.00	3.32	4.24
Taste	4.36	4.40	4.40	3.40	4.16	3.76	4.08	3.40	3.16	3.16	3.76	3.40
Overall acceptability	4.27	4.00	4.04	4.05	4.01	3.80	4.01	3.99	3.49	3.32	3.66	4.07

Between attributes 'F' value = 3.0066 NS

Between percentage 'F' value = 7.89^{**}

** Significant at 1 per cent level

TABLE XXII

MEAN ACCEPTABILITY SCORES OBTAINED FOR PAKODA IN SELECTED FOUR FAST FOOD OUTLETS

N = 50

Quality attributes	Percentage of soyaflour incorporation											
	10				15				20			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Appearance	4.32	3.64	4.08	3.76	4.00	2.90	4.16	3.60	4.12	2.64	3.04	3.00
Colour	4.40	3.36	4.04	3.68	4.04	3.44	4.16	3.52	3.44	2.32	3.40	2.84
Flavour	3.38	3.64	4.08	3.72	3.76	3.36	4.52	4.00	3.56	2.88	2.76	2.88
Texture	4.00	3.56	4.16	3.76	4.32	3.36	4.24	4.00	3.40	2.64	2.76	3.00
Taste	3.80	3.60	4.08	3.76	3.84	3.64	4.24	3.88	3.00	2.96	3.44	2.92
Overall acceptability	4.08	3.56	4.08	3.73	3.99	3.34	4.26	3.80	3.50	2.68	3.08	2.93

Between attributes 'F' value = 2.268 NS

Between percentage 'F' value = 8.0522**

** significant at 1 per cent level

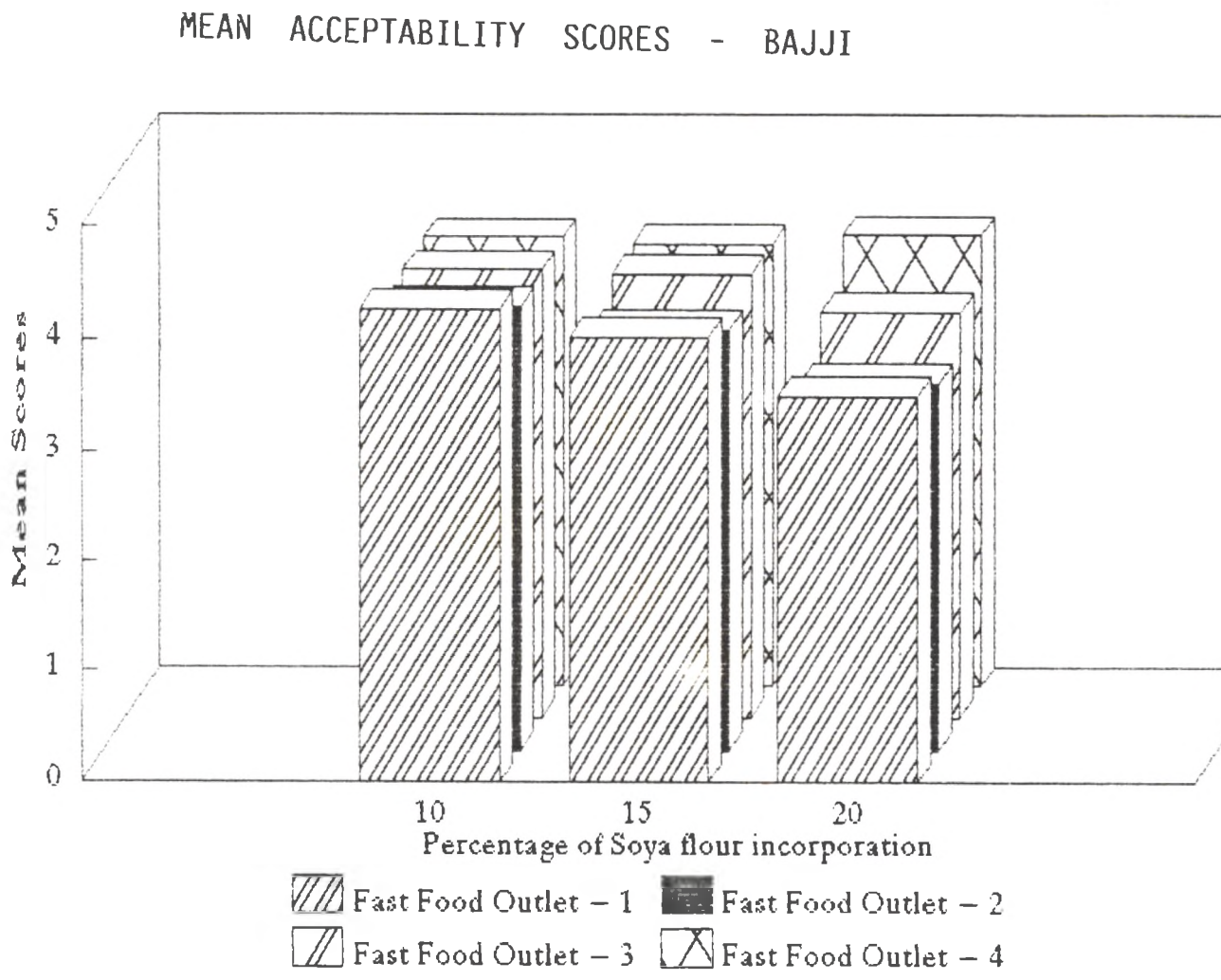

MEAN ACCEPTABILITY SCORES - BAJJI
Mean Scores
5
4
3
2
1
0
10
15
20
Percentage of Soya flour incorporation
Fast Food Outlet – 1
Fast Food Outlet – 2
Fast Food Outlet – 3
Fast Food Outlet – 4

Fig. 8-A

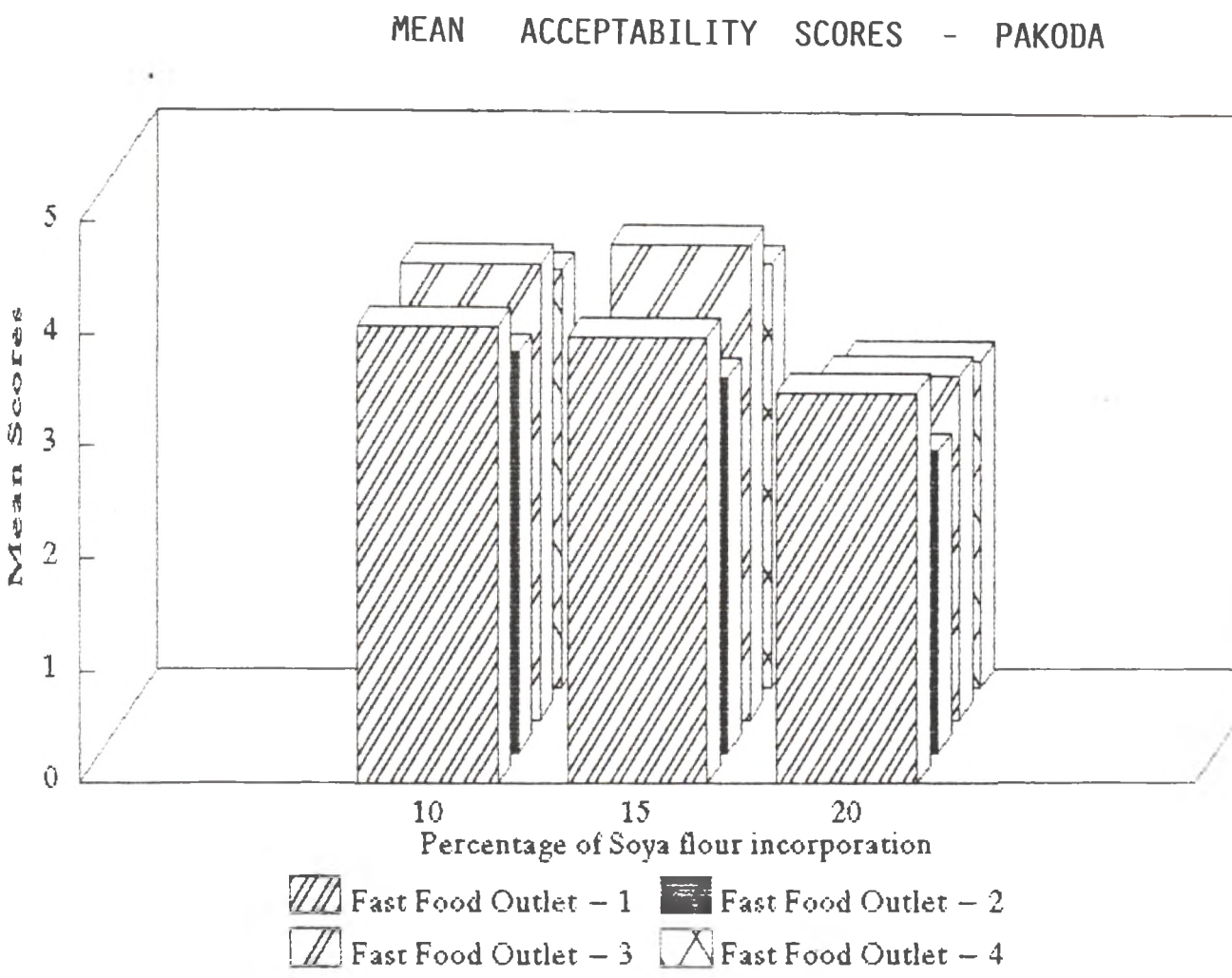

MEAN ACCEPTABILITY SCORES - PAKODA
Mean Scores
5
4
3
2
1
0
10
15
20
Percentage of Soya flour incorporation
Fast Food Outlet – 1
Fast Food Outlet – 2
Fast Food Outlet – 3
Fast Food Outlet – 4

Fig. 8-B

With regard to the acceptability of Bajji and Pakoda, different quality attributes were accepted without any significant difference. The acceptability of Bajji and Pakoda with different levels of incorporation of soya flour was significant at one per cent level.

D. Formulation of Suitable Soyaflour Incorporated Recipes for Pre-school Children and Impact of Administration of these Recipes on their Nutritional Status

Consumption of sweet biscuits, salt biscuits diamond cuts and ribbon pakoda with 15 per cent soyaflour by the selected pre-school children for a period of sixty days revealed changes in their height, weight, plasma proteins and haemoglobin.

The weight increment of the selected 25 pre-school children before and after supplementation are presented in Table XXIII.

TABLE XXIII

MEAN WEIGHT INCREMENT (SIX MONTHS) OF THE PRE-SCHOOL CHILDREN IN EXPERIMENTAL AND CONTROL GROUP

Age Years	Weight -(kg)- Boys								Weight -(kg)- Girls							
	Experimental				Control				Experimental				Control			
	N	Initial	Final	Increment	N	Initial	Final	Increment	N	Initial	Final	Increment	N	Initial	Final	Increment
3	3	11.30	12.60	1.30	3	11.83	12.63	0.8	3	11.33	12.36	1.03	3	11.73	12.33	0.6
4	3	11.80	13.00	1.20	3	12.33	13.03	0.7	3	12.16	13.46	1.30	3	13.30	14.10	0.8
5	6	13.50	14.50	1.00	7	13.85	14.45	0.6	7	12.86	13.90	1.04	6	12.61	13.31	0.7

The children in the experimental group registered higher increment in weight over the six months period compared to those in the control group. The mean six monthly increment ranged between 1.0 - 1.3 kg as against a range 0.6 to 0.8 kg in the control group.

The mean height increments of the selected pre-school children are given in Table XXIV.

TABLE XXIV

MEAN HEIGHT INCREMENT (SIX MONTHS) OF THE PRE-SCHOOL CHILDREN IN EXPERIMENTAL AND CONTROL GROUP

N = 25

Age Years	Height -(cm)- Boys								Height -(cm)- Girls							
	Experimental				Control				Experimental				Control			
	N	Initial	Final	Increment	N	Initial	Final	Increment	N	Initial	Final	Increment	N	Initial	Final	Increment
3	3	85.50	88.00	2.5	3	85.50	86.50	1.0	3	87.33	89.73	2.4	3	90.30	91.20	0.9
4	3	95.33	97.43	2.1	3	94.60	95.70	1.1	3	95.66	97.66	2.0	3	96.33	97.33	1.0
5	6	99.33	101.23	1.9	7	97.42	98.82	1.4	7	96.85	99.05	2.2	6	94.83	95.83	1.0

As per Table XXIV the height increment of the pre-school children was 1.9 to 2.5 cm for experimental group and 0.9 to 1.4 cm for control group. The increment in weight and height of the children are in line with the pattern of growth observed among healthy children by Easwaran and Devadas (1981).

Table XXV presents the plasma protein levels of selected 10 pre-school children before and after supplementation for a period of six months(Figure 9-11).

TABLE XXV

PLASMA PROTEIN LEVELS OF SELECTED PRE-SCHOOL CHILDREN BEFORE AND AFTER SUPPLEMENTATION

N = 10

	Total serum protein g%			Seum albumin g%			Serum globulin g%		
	Before	After	Diff.	Before	After	Diff	Before	After	Diff.
1	4.3	6.1	1.8	2.4	3.4	1.0	2.0	2.9	0.9
2	5.2	5.8	0.6	2.4	2.8	0.4	2.8	3.0	0.2
3	5.4	6.2	0.8	2.5	3.2	0.7	2.8	3.1	0.3
4	5.5	6.8	1.3	2.7	3.5	0.8	3.0	3.3	0.3
5	4.3	5.6	1.3	2.3	3.0	0.7	2.0	2.7	0.7
6	4.6	5.4	0.8	2.0	3.2	1.2	2.3	2.5	0.2
7	4.6	5.8	1.2	2.2	3.2	1.0	2.6	2.7	0.1
8	5.1	6.5	1.4	2.4	3.3	0.9	2.7	3.2	0.5
9	5.3	6.1	0.8	2.5	3.4	0.9	2.8	3.2	0.4
10	5.2	6.0	0.8	2.2	3.1	0.9	3.0	3.2	0.2

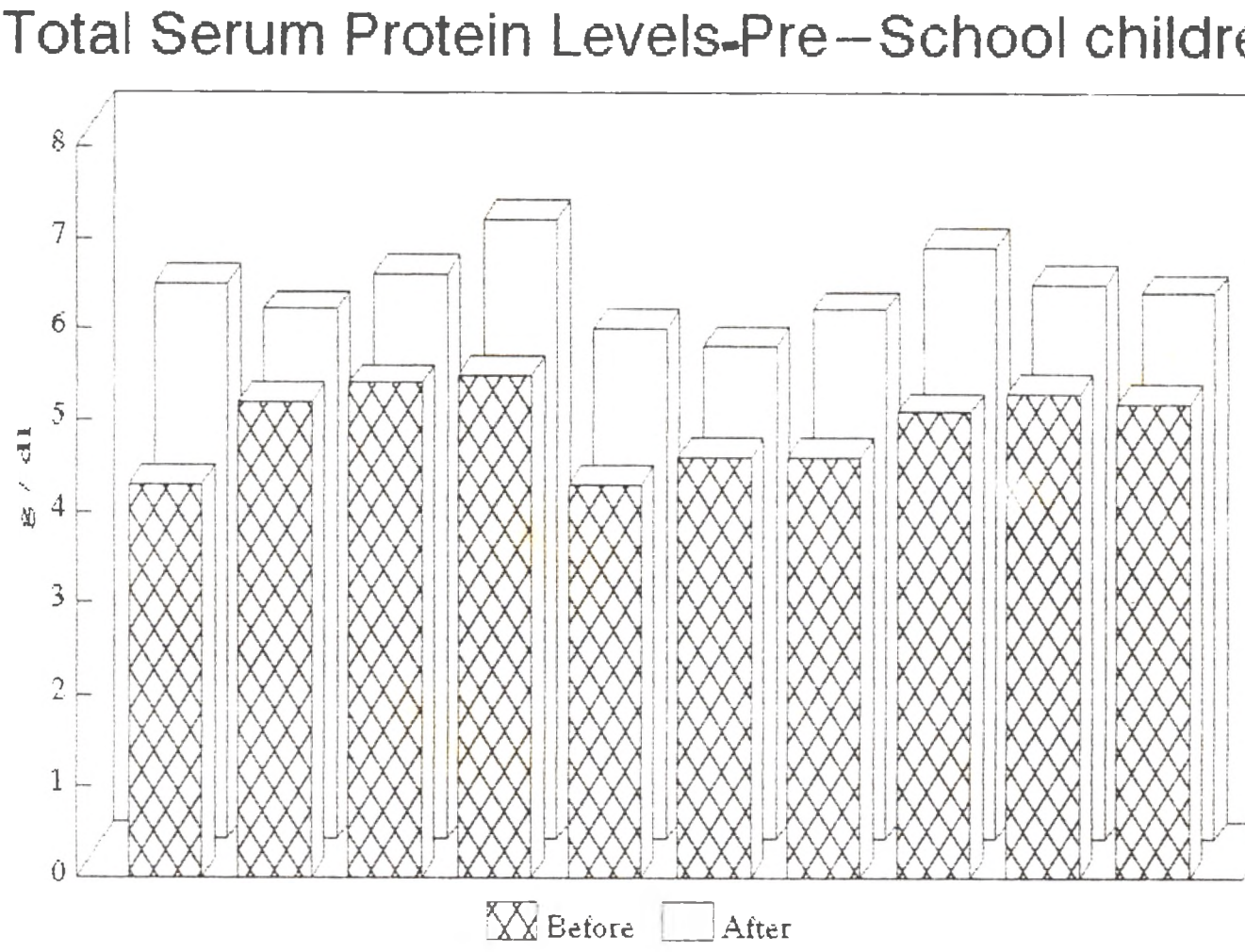

Total Serum Protein Levels-Pre-School childre
8
7
6
5
4
3
2
1
0
Before
After

Fig. 9

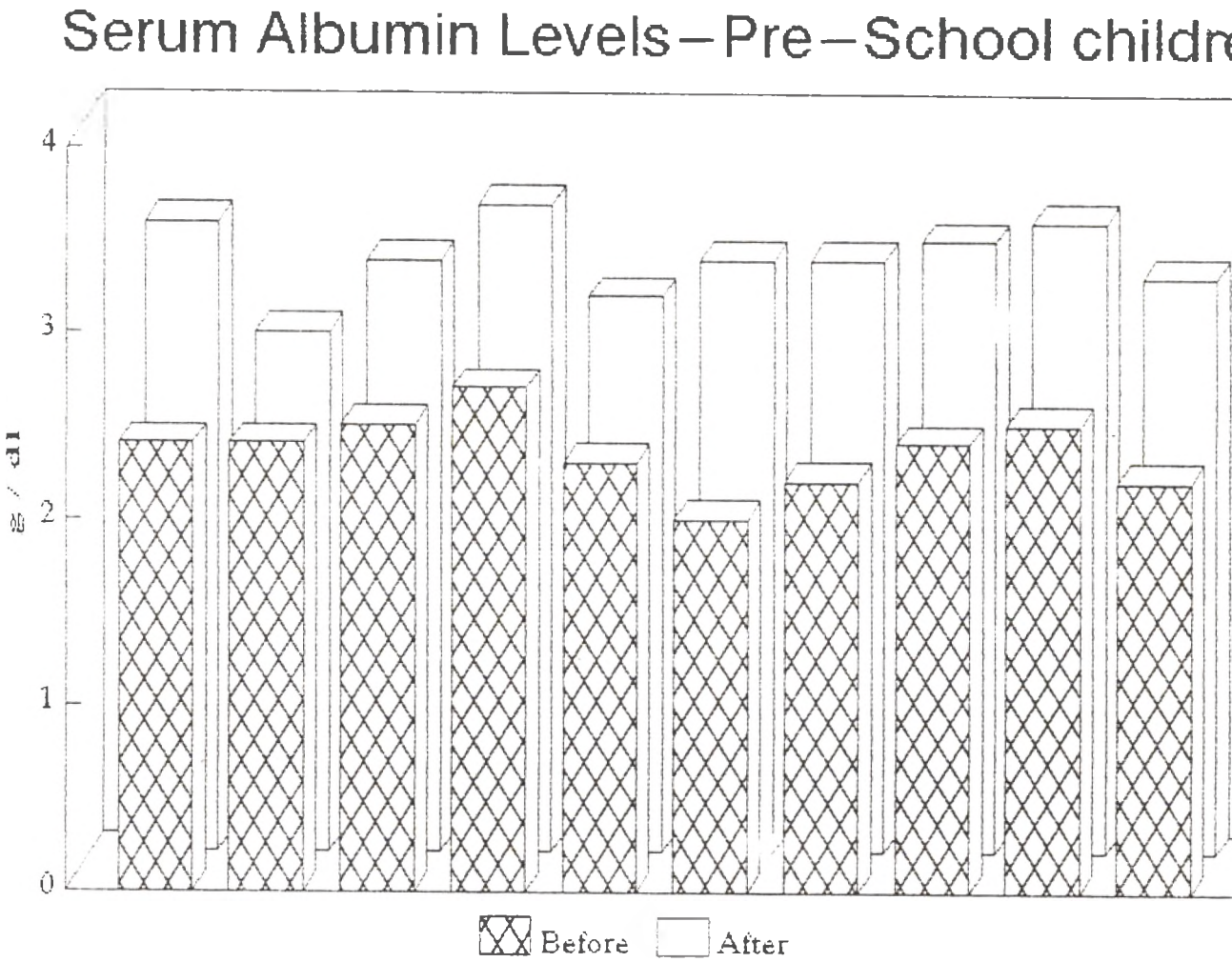


Fig. 10

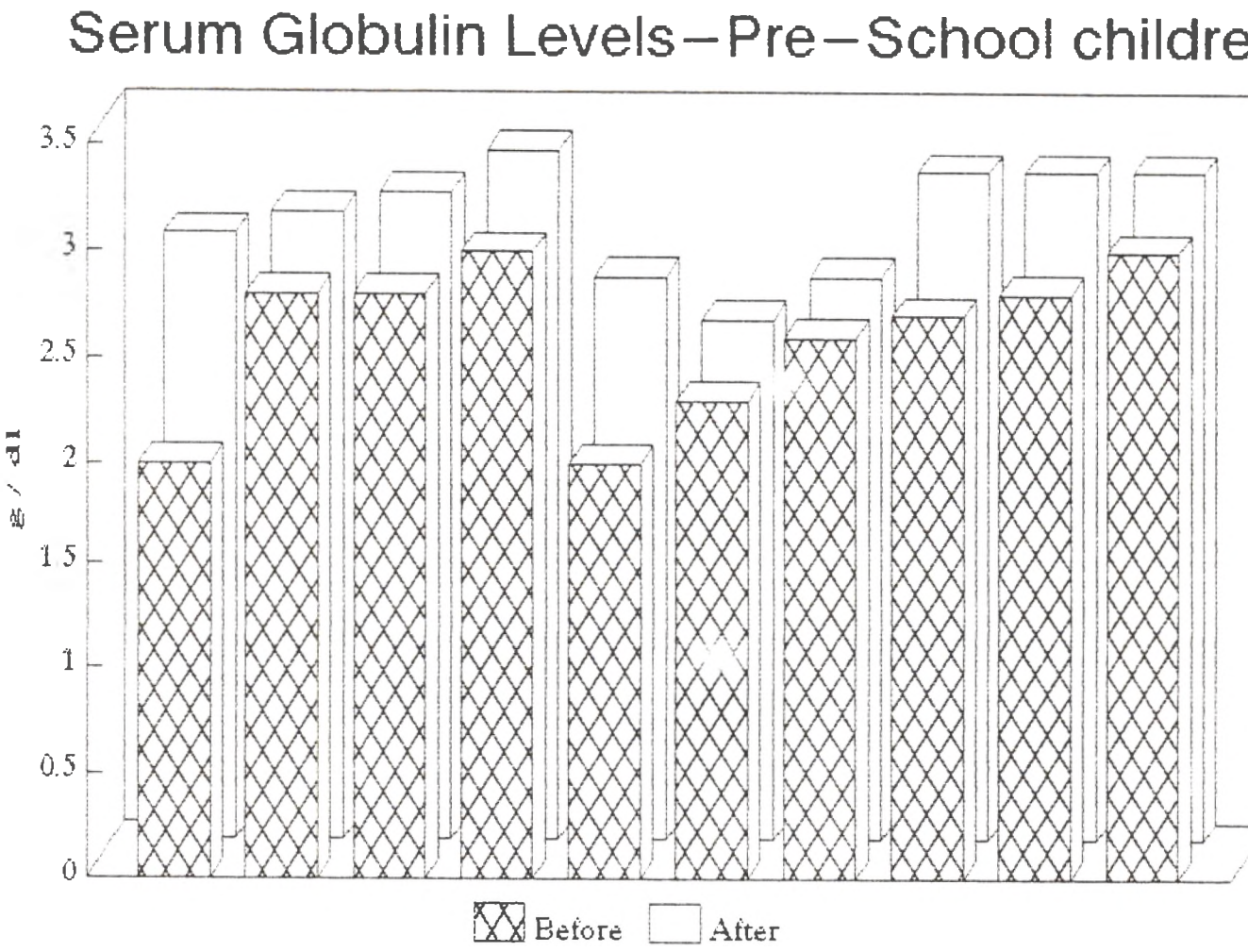

Serum Globulin Levels–Pre–School childre
3.5
3
2.5
2
1.5
1
0.5
0
Before
After

Fig. 11

As per Table XXV the total serum protein in the selected 10 pre-school children increased from 0.6 to 1.8g per cent after supplementation with soyaflour snacks. There was 0.4 to 1.2g per cent increase in serum albumin levels of the pre-school children after supplementation. Serum globulin increment level was from 0.1 to 0.9g per cent. The improvement in the plasma proteins of the present study are similar to the observations made by Devadas et al, (1984) in her studies with pre-school children who were supplemented with cereal pulse mixtures. Kothari et al, (1985) observed improvement in plasma-proteins in marasmic and marasmic kwashiorkor children fed with soya milk.

Table XXVI presents the mean heamoglobin levels of selected pre-school children before and after supplementation (Figure 12).

TABLE XXVI

MEAN HAEMOGLOBIN LEVELS OF SELECTED PRE-SCHOOL CHILDREN BEFORE AND AFTER SUPPLEMENTATION

N = 10

	Haemoglobin g%		Difference
	Before	After	
1	6.7	7.3	0.6
2	6.8	7.2	0.4
3	7.0	7.6	0.6
4	7.3	8.0	0.7
5	7.4	8.1	0.7
6	6.9	7.0	0.1
7	7.1	7.5	0.4
8	7.2	7.7	0.5
9	6.9	7.2	0.3
10	7.0	7.6	0.6

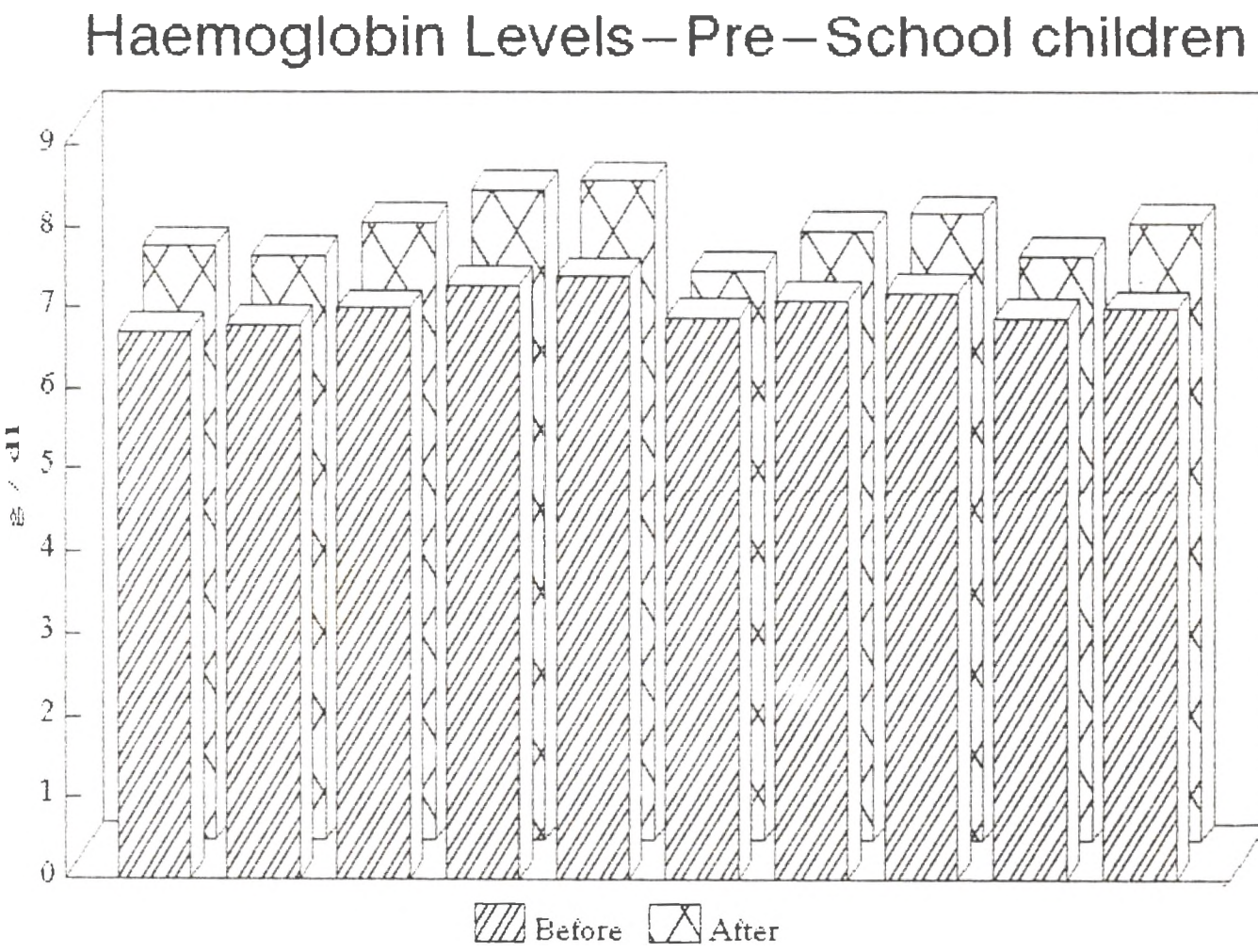

Haemoglobin Levels – Pre – School children
9
8
7
6
5
4
3
2
1
0
Before
After

Fig.12

The haemoglobin picture also improved in the pre-school children after the six months supplementation with soyaflour snacks. The increase ranged between 0.1 to 0.7g per cent.

E. Effect of Soyaflour on the Lipid Profile of Selected Hyperlipidemic Patients

1. Serum cholesterol level

The serum cholesterol levels of the selected 14 patients were estimated before and after feeding with soyaflour incorporated recipes for forty five days. The results are presented in Table XXVII (Figure 13).

TABLE XXVII

SERUM CHOLESTEROL LEVELS (mg/dl) OF SELECTED PATIENTS BEFORE AND AFTER SOYAFLOUR INCORPORATION

N = 14

Group A Control			Group B Experimental		
Initial	Final	Difference	Initial	Final	Difference
259	250	- 9	259	239	- 20
257	256	- 1	264	243	- 21
256	250	- 6	276	249	- 27
296	289	- 7	266	246	- 20
243	243	- 0	298	272	- 26
303	300	- 3	275	260	- 15
283	280	- 2	260	248	- 12
Mean± 270.9±	266.9±	4±	271±	250±	20.14±
SD 21.1	20.8	3.11	12.6	10.9	4.99
't' value	1.93NS			9.873**	

Groups compared A Vs B 't' value - 7.237**

** Significant at 1 per cent level

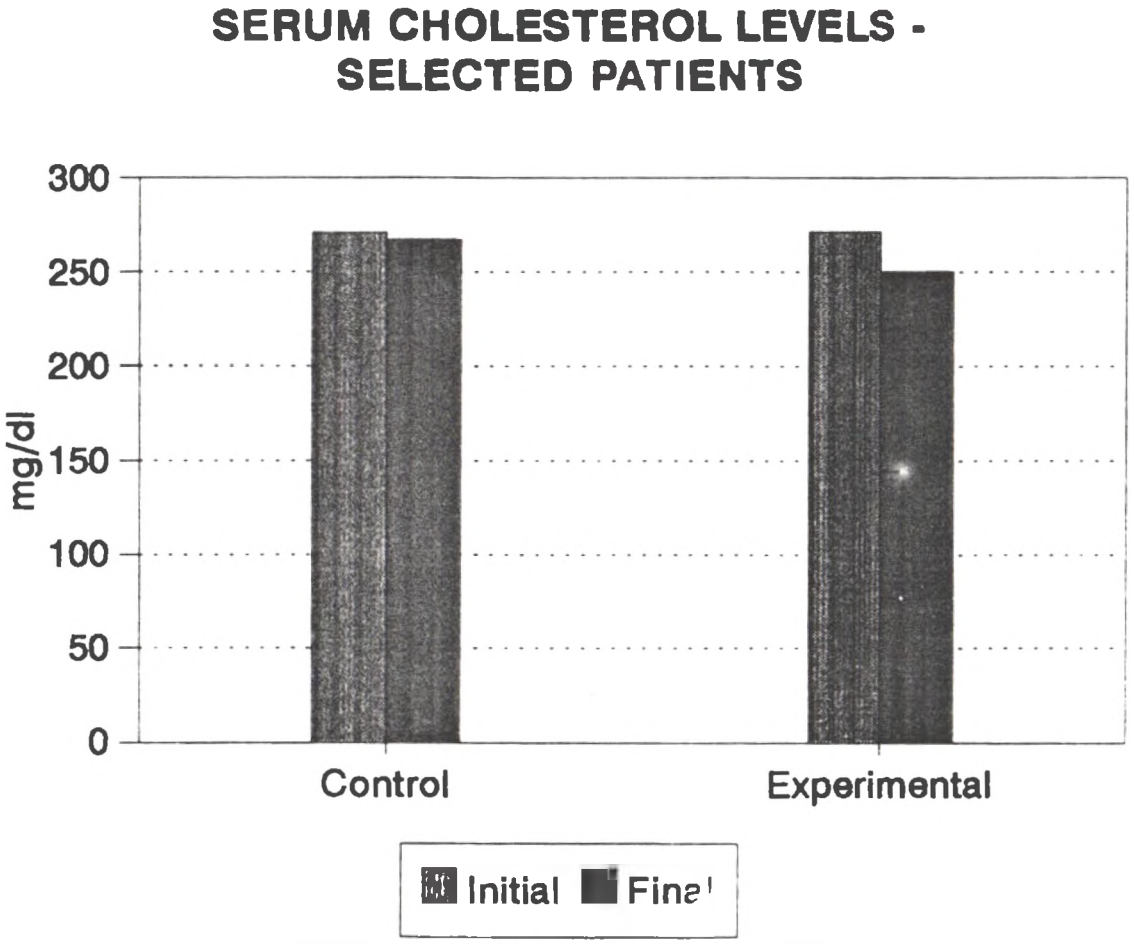

SERUM CHOLESTEROL LEVELS -
SELECTED PATIENTS
300
250
200
150
100
50
0
mg/dl
Control
Experimental
Initial
Final

Fig. 13

As presented in Table XXVII the serum cholesterol levels of the selected patients showed significant reduction after a period of 45 days of consumption of defatted soyaflour when compared to control. The reduction was significant at one per cent level. In the present study there was 8 per cent reduction in serum cholesterol levels of patients who consumed recipes with soyaflour incorporation as against 1.4 per cent reduction in control group. Carroll (1991) observed 13 per cent reduction in serum cholesterol in hypercholesterolemic subjects when their low lipid diet was supplemented with soya protein isolate for casein.

2. Serum triglyceride level

Table XXVIII gives the serum triglyceride levels of selected patients before and after soyaflour supplementation (Figure 14).

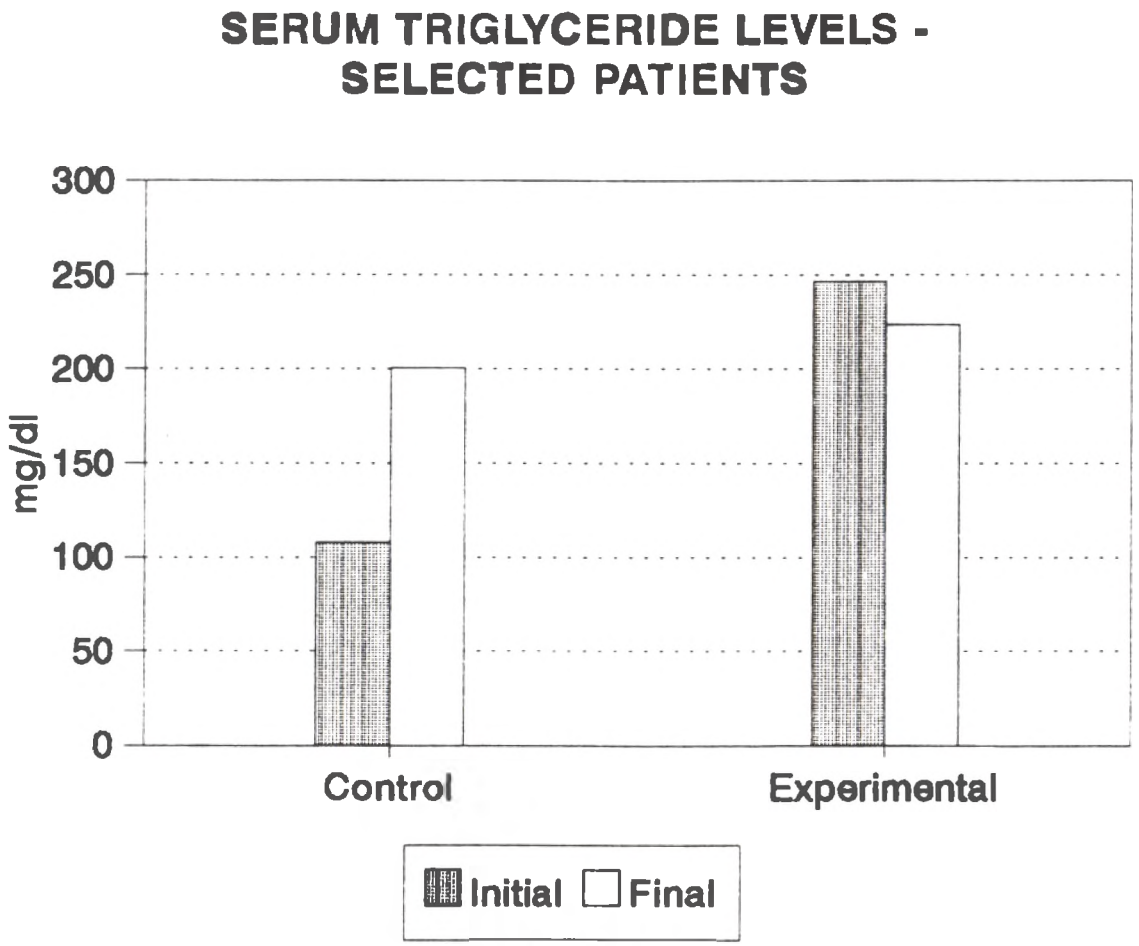

SERUM TRIGLYCERIDE LEVELS -
SELECTED PATIENTS
300
250
200
150
100
50
0
mg/dl
Control
Experimental
Initial
Final

Fig. 14

TABLE XXVIII

SERUM TRIGLYCERIDE LEVELS (mg/dl) OF SELECTED PATIENTS BEFORE AND AFTER SOYAFLOUR INCORPORATION

N = 14

Group A Control			Group B Experimental		
Initial	Final	Difference	Initial	Final	Difference
190	187	- 3	180	160	- 20
215	213	- 2	192	175	- 17
212	207	- 5	220	195	- 25
260	240	- 20	263	240	- 23
187	185	- 2	240	210	- 30
211	205	- 6	280	254	- 26
180	168	- 12	252	230	- 22
Mean± 107.9±	200.7±	7±	246.7±	223.4±	- 23.28±
SD 24.86	24.86	6.15	57.15	55.96	3.392
't' value	2.84*		14.76**		

Groups compared A Vs B 't' value = 5.86**

* Significant at 5 per cent level

** Significant at 1 per cent level

With regard to serum triglyceride levels of the selected patients, reduction was noticed after 45 days of the experimental period. The reduction was significant at one per cent level. The reduction was 9 per cent for patients who consumed recipes with soyaflour as against 4

per cent reduction in control group. Carroll (1991) observed 23 per cent decrease in serum triglyceride level in hypercholesterolemic subjects when their low lipid diet was supplemented with soya protein isolate instead of casein.

3. High Density Lipoprotein levels

Table XXIX gives the HDL values of selected patients before and after soyaflour incorporation (Figure 15).

TABLE XXIX

HDL VALUES (mg/dl) OF SELECTED PATIENTS BEFORE AND AFTER SOYAFLOUR INCORPORATION

N = 14

No	Group A Control			Group B Experimental		
	Initial	Final	Difference	Initial	Final	Difference
1	58	59	+ 1	35	35	0
2	55	55	0	28	32	+ 4
3	42	42	0	28	29	+ 1
4	34	34	0	30	32	+ 2
5	53	54	+ 1	35	38	+ 3
6	51	51	0	29	32	+ 3
7	32	33	+ 1	34	35	+ 1
Mean±	46.4±	46.9±	0.28±	31.3±	33.3±	2±
SD	9.66	9.73	0.45	3.02	2.71	1.31
't' value			2.11 NS			3.76**

Groups compared A Vs B 't' value = 3.285 **

NS Not significant

** Significant at 1 per cent level

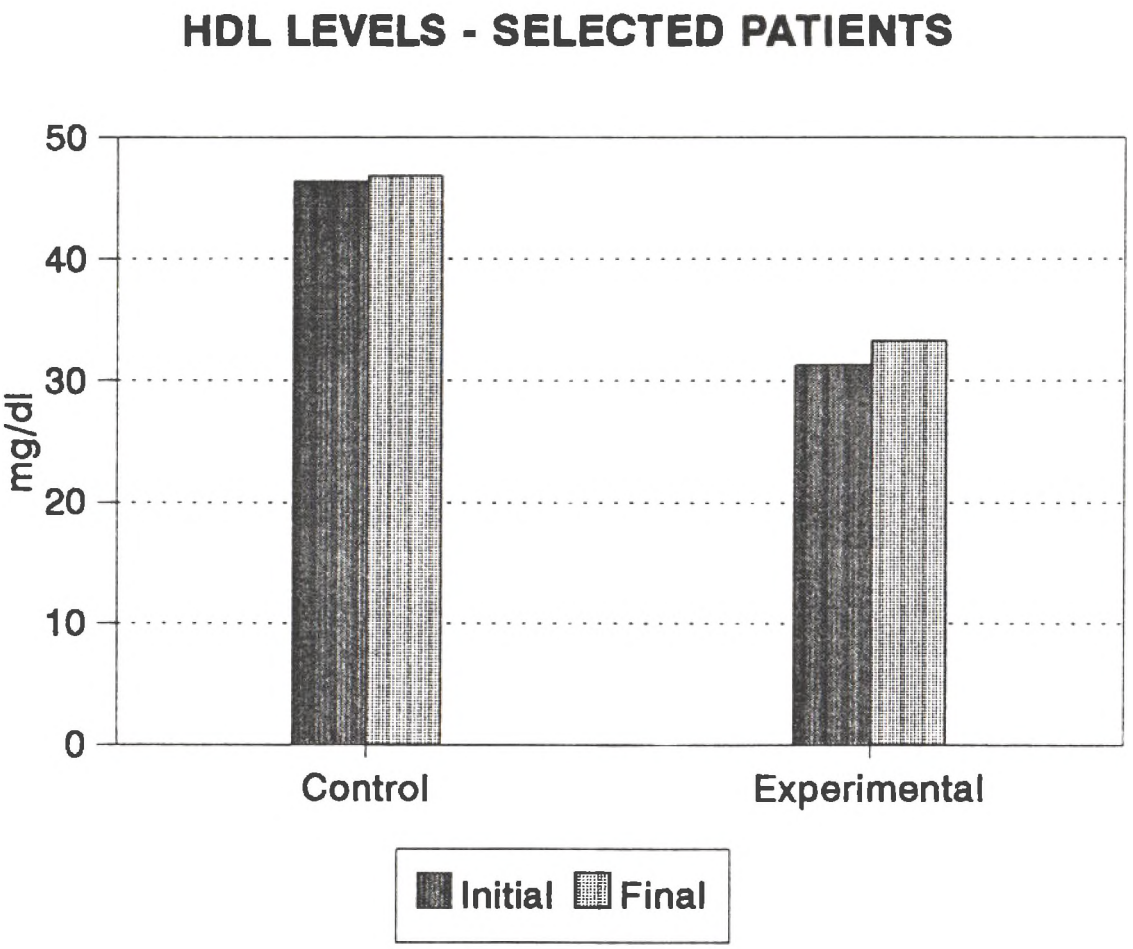

HDL LEVELS - SELECTED PATIENTS
50
40
30
20
10
0
mg/dl
Control
Experimental
Initial
Final

Fig. 15

The increase in HDL level of the experimental group was significant at one per cent level as given in Table XXIX. There was 6.38 per cent increase in experimental group against 0.6 per cent increase in the control group.

4. LDL levels

Table XXX gives the the serum LDL levels of the selected patients (Figure 16).

TABLE XXX

LDL LEVELS (mg/dl) OF SELECTED PATIENTS BEFORE AND AFTER SOYAFLOUR INCORPORATION

N = 14

	Group A - Control			Group B Experimental		
	Initial	Final	Difference	Initial	Final	Difference
	163	154	- 9	188	172	- 16
	159	158	- 1	198	176	- 22
	172	167	- 5	204	181	- 23
	210	207	- 3	163	146	- 17
	153	153	- 1	215	192	- 23
	210	208	- 2	190	177	- 13
	214	213	- 1	176	167	- 9
Mean±	183.00±	179.90±	3.14±	190.60±	173.00±	17.57±
SD	25.12	25.90	2.74	16.09	13.18	5.01
't' value		2.77*			8.59**	

Groups compared to A Vs B 't' value = 6.695**

* Significant at 5 per cent level

** Significant at 1 per cent level

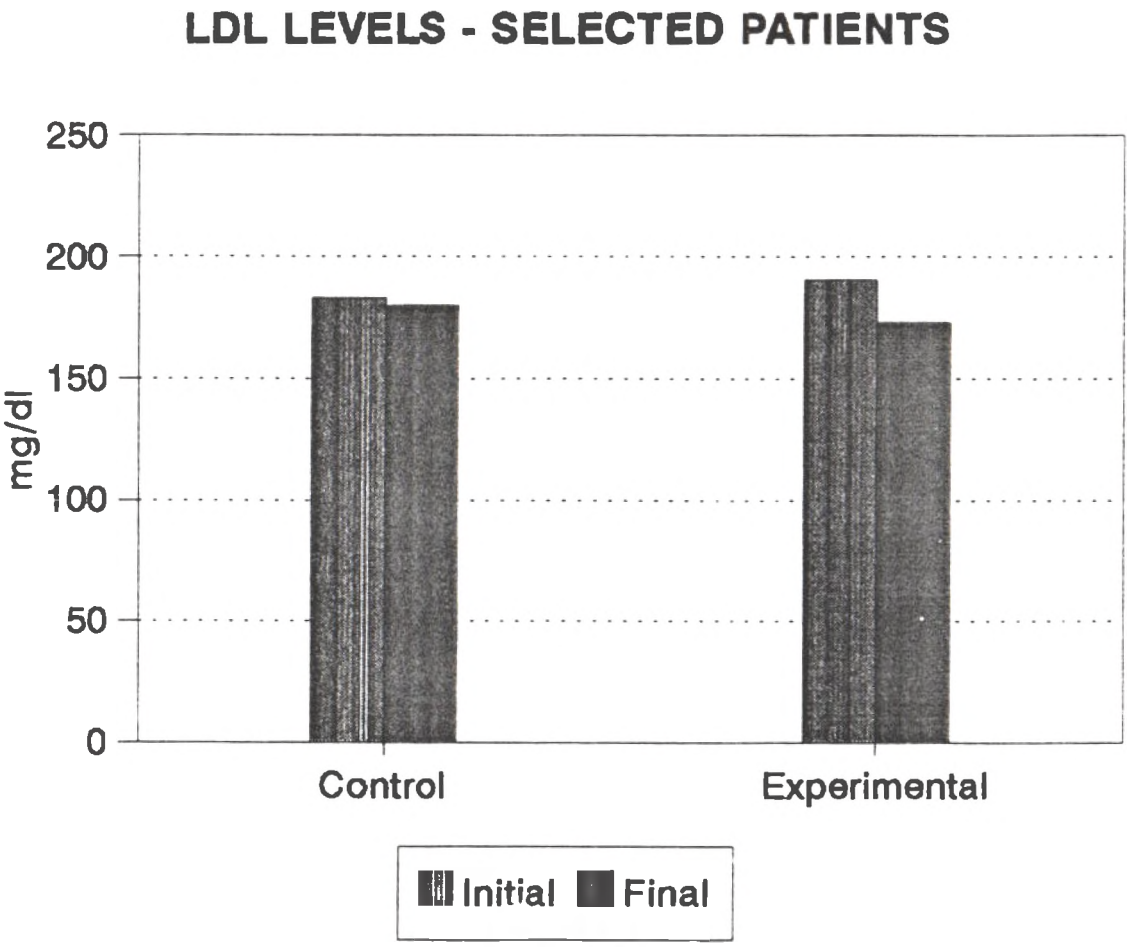

LDL LEVELS - SELECTED PATIENTS
250
200
150
100
50
0
mg/dl
Control
Experimental
Initial
Final

Fig. 16

The LDL levels of the selected patients reduced after 45 days of incorporation of soyaflour and the reduction was significant at one per cent level when compared to control.

As per Vessby (1989), Ulbright (1991) and Ghafoorunisa (1992) soyabean contains both the linoleic (n-6) and linolenic (n-3) acids which are antiatherogenic and antithrombogenic respectively as they reduce the total and LDL cholesterol. In the present study also reduction in the LDL level was noticed and the reduction was significant at one per cent level when compared to the control as shown in Table XXX.

SUMMARY AND CONCLUSION

V SUMMARY AND CONCLUSION

The increase in urbanisation has created a dramatic change in our life styles while there is also a considerable increase in the spending power due to more women in employment. This has led to a tendency in our present population to go in for convenience food. If nutritionally adequate food is made available, it will improve the nutritional status of the masses.

With this view, the present study on "Acceptability of Soya based Recipes in Food Service" was conducted to develop instant mixes for common traditional recipes using defatted soyaflour. Common four traditional recipes namely Bajji, Pakoda, Halwa and Gulabjamun were selected and soyaflour was incorporated at 10, 15 and 20 per cent replacing the main ingredient namely Bengal gram flour or refined wheat flour of the four recipes. The instant mixes were formulated in a hygienic condition and packaged using dry polythene bags to be cost effective and their shelf-life was studied after 3 months and 6 months. The recipes were prepared with fresh instant mixes and after a storage period of three months and evaluated by 10 trained panelists. The acceptability was also studied in two commercial, two non-commercial food service institutions and four fast food outlets as these were the hot spots where turnover was high.

In the food service of a group feeding programme, the impact of the soya based recipes was assessed on the nutritional status of pre-school children. Twenty five children 3-5 years of age were selected from Sri Avinashilingam Trust Balwadi to serve as experimental group and 25 children from Coimbatore Corporation Balwadi to serve as control. The children were fed with soya incorporated recipes such as sweet biscuit, salt biscuit, diamond cuts and ribbon pakoda for sixty days by alternating the four recipes to avoid monotony and create interest among children.

To assess the therapeutic values of soyaflour, 14 hyperlipidemic patients were selected to form two groups, experimental and control. Seven patients of experimental group were counselled to incorporate 50g of soyaflour in their daily diet for a period of 45 days and their serum liped profile examined before and after supplementation.

The salient findings of the present study are :

- Soyaflour enhanced protein and fibre content while carbohydrate content was low in soya based instant mixes compared to the standard
- Food cost of the instant mixes of two savoury items developed Bajji and Pakoda was less by 15 and 18 paise compared to standard while for "Halwa" and "Gulabjamun" mix increased by 10 and

eight paise, the reason being that refined wheat flour is cheaper than defatted soyaflour.

- Organoleptic scores of soya based recipes before and after storage of 3 months did not have any appreciable change indicating the wholesomeness of the product.

- The selected parameters of microbiological analysis, namely standard plate count, insect filth and fragments and Salmonella of Bajji and Pakoda mix revealed that the samples satisfied the bacteriological requirements for edible low fat soyaflour prescribed by IS-7836 - 1975. As for Halwa and Gulabjamun mixes, the counts were far less than the standards prescribed by IS-7836 1975. Test for the presence of Salmonella proved negative for all the instant mixes. There was no insect filth or fragments in the instant mixes even upto three months indicating that the developed instant mixes can be stored upto three months in polythene bags without spoilage.

- The soyaflour incorporated recipes were best acceptable at 10 and 15 per cent levels in the selected commercial, non-commercial and fast foods outlets.

- Children, fed with soya based recipes registered an increment of 1.0 to 1.30 kg and 1.03 to 1.30 kg boys and girls respectively over a period of six months as against the control group where increment was between 0.6 to 0.8 kg. Height increments were higher among the children in the experimental group ranging between 1.9 - 2.0 as against increment of 0.9 to 1.4 cm among the children in the control group.

- The increase in serum total protein was 0.6 to 1.8g per cent after supplementation over a period of six months, with increase of 0.4 to 1.2g per cent in serum albumin and 0.1 to 0.9g per cent increase in serum globulin respectively. Soyaflour supplementation also improved the haemoglobin picture with an increment from 0.1 to 0.9g per cent after six months.

- Hypolipidemic effect of soyaflour was statistically proved by the reduction in lipid components namely triglycerides, LDL, total cholesterol with an increse in HDL. Defatted soyaflour not only lends itself as a high protein supplement, but can also be fabricated into various recipes for a prudent diet to a healthy heart.

RECOMMENDATIONS

1. Soyaflour as a cost effective nutrition supplement should be exploited in the best possible manner by incorporating it in food items served in commercial and non-commercial food service. This would go a longway to help improve the nutritional status of population groups.

2. Incorporation of soyaflour at 15 per cent level in instant mixes have been found to be well acceptble in food service - commercial and non-commercial and hence the instant mixes should be made available commercially. Along with this consumer education is essential.

3. The shelf-life of these instant mixes though has been found to be satisfactory upto three months, when commercial market is the target, research can be directed towards effect of inclusion of Class II preservatives and also better packaging including tetrapack.

4. The benefits of incorporating soyaflour in the recipes should be explained widely to the personnel incharge of both commercial and non-commercial food service.

5. Therapeutic uses of soyaflour can be studied indepth and the positive results of such studies should be put to use in various dietary management approaches of various systems of medicine.

BIBLIOGRAPHY

BIBLIOGRAPHY

Ali, N. : Soy based nutritious and economical food products, Guide on Food Products, 1992, II.

Areas, A.g.J. : Extrusion of food proteins. Critical Reviews in Food Science and Nutrition, 1992, 32, 4, 365-392.

Awasthi, P. : Soyabean - A wholesome food, Indian Farmers Digest, April, 1990, 28, 4,33.

Barnes, S.
Messina, M. : Soyfoods and cancer risks, The Journal of American Dietetic Association, 1991, Dec, 17, 12.

Beddows, C. : The old fashioned way with soya. Food Science and Technology Today, 1991, 2, 1, 12-15.

Beyen, A.C. : Dietary protein and serum cholesterol, Nutrition News, Jan-March, 1993, Issue VI, 3.

Boonyee, Y. : An update on Nutritional and Health aspects of Soyabean protein, ASA Technical Bulletin, Sep, 1991, HN15, 1-4.

Bhutta, Z.A., Molla, A.M. and Issani, Z. Dietary Management of persistent Diarrhoea, Nutrition Abstract and Reviews, 1992 July, 62, 7, 625.

Bronsell, V.L., Griffith, C.J., and Jones, E.	:	Applied science for food studies, 1989, Longman Scientific and Technical, England, 196.
Bureau of Indian Standards	:	Method for plate count of Bacteria in food stuffs, IS5402-1969,1970, BIS, New Delhi, 3-13.
Bureau of Indian Standards	:	Specifications for edible Lowfat soyaflour, IS 7836-1975,1975 BIS,New Delhi, 5-7.
Campbell, P.G.	:	Shelf life - Who needs it. Food Science and Technology Today, 1992, 3, 4, 244-246.
Carroll, K.	:	Review of clinical studies on cholesterol - lowering response to soy protein. Journal of American Dietetic Association, 1991, 91, 7, 820-826.
Cheman Yaakob, B., Mohamad, N.B., Abdulkarim and Tan,T.	:	Evaluation of four high-protein rice-soy snack formulation International Journal of Food Science and Technology, 1992, 27, 715-719.
Cheng, Y.J., Thompson, L.D and Brittin, H.C.	:	Sogurt, a yogurt - like soybean product : Development and properties, Journal of Food Science, 1990, 55, 4, 1178-1179.

Chhabra, N.N. : The protein rich wonder soyabean. Oils and Oil Seeds Journal, 1992, 45, 12, 11-15.

Chopra, C.S., Mital, B.K. and Singh, S. : Preparation of yoghurt like product from Soybean, Journal of Food Science and Technology, 1984, 21, 8.

Danielle, S., Sampath, P., George, F., Cawash, J. and Sabray, H. : Beyond cholesterol - Modification of LDL that increase its athrogenity. The New England Journal of Medicine, 1990, 320, 915-916.

Deepa, C.R., Urooj, A. and Puttaraj, S. : Effect of addition of soyflour on the quality characteristics of Black gram papdads. Journal of Food Science and Technology, 1992, 29, 6, 385-387.

Dermott, M.I., Trilling, B.M. and Florence, W.N. : Food for better living, 1987, II Edition, J.B. Lipincott Company, Philadelphia.

Devadas, R.P., Usha, C. and Bhooma, N. : Nutritional outcomes of a rural diet supplemented with low lost cost locally available foods - V - Impact on pre-schoolers followed over a period of four and a half years, Indian Journal of Nutrition and Dietetics, 1984, 21, 5, 153-164.

Dhawan, S. and Singh, G. : Studies on sev preparation from blends Bengal gram flour, defatted soy flour and rice flour. Beverage and Food World, 1991, Oct/Dec, 18-20.

Easwaran, P.P. and Devadas, R.P. : Trends in growth pattern of children and development of norms for children, Indian Journal of Nutrition and Dietetics, 1981, 18, 5, 155-160.

FAO : Utilisation of tropical foods : Tropical Oil Seeds, 1989, FAO, 1-35.

Foster, P. : The world food problem, 1992, Lynne Publishers, 13.

Fukushima, D. : Recent progress of soybean protein foods : Chemistry, Technology and Nutrition, Food Reviews International, 1991, 7, 3, 323-351.

Gaddi, A. : Dietary treatment for familial hypercholesterolemia - Different effects of Dietary soyprotein on the Apo lipoprotein -e- Phenotypes, Journal of Nutrition, 1991, 53, 5, 1191.

Gaddi, A., Descovitch, C.G., Noreda, G., Vaneti, G., Sirtori, G., Galli, E.and Sirtori, C.R. : Hypercholesterolemia treated by soyabean protein diet, Nutrition Abstracts and Reviews, 1987, 57, 6, 692.

Galan,G.A., Wang, S.H., Sgarbieri, V.C. and Moraes, M.A.C. : Sensory and nutritional properties of cookies based on wheat - rice - soy-bean flours baked in micro wave oven, Journal of Food Science, 1991, 56, 6, 1699-1701.

Gandhi, A.P. : Soy fortified biscuits, Food digest, 1992, April-June, 15, 2, 120.

Gandhi, A.P. and Ali, N. : Studies on Soydhal blends and the shelf life soydhal, The Indian Journal of Nutrition and Dietetics, 1986, 23, 12, 356.

Gandhi, A.P., Mishra, V.K. and Ali, N. : Organoleptic assessment of full fat soy flour in vrious indigenous products, Journal of Food Technology, 1983, 18, 6, 771-775.

Ghafoorunissa, : Fish for a Healthy Heart, Nutrition News, 1992, 13, 2, 1-4.

Goodman, D. : The National Cholesterol Education ProgrammeGuidelines, Status and issues, The American Journal of Medicine, 1991, 90, (Supp.2A) 2A.

Gopalan, C., Ramasastri, B.V. and Balasubramanian, S.C. : Nutritive value of Indian foods, 1994, NIN, Hyderabad.

Gopalan, C. : Variations in food consumption patterns of populations, towards better nutrition - problems and policies, 1993, Nutrition Foundation of India, Special Publication Series, 9, 131.

Gupta,C. and Sehgal, S. : Development, acceptability and nutritional value of weaning mixtures, Plant Foods for Human Nutrition, 1991, 41, 107-116.

Hofman, C.J. and Marhsal. : Lacti fermentation of ground soybeans for use in imitation cream cheese products, Journal of Food Science, 1985, 50, 325.

Hollingsworth P. : "Global opportunities for processed foods", Process foods have moved to centre stge in the competition to feed the world, Food Technology, 1994, 65.

Javalagi, A.M. and Vaidehi, M.P. : Protein and energy content of acceptable beverages prepared with blends of soya (D.F.) skim milk, sesame, coconut and malts from wheat, ragi and green gram, Beverage and Food world, 1986, 35-38.

Jenkins, J., Awolwel, T.N.S., and Josse, R.G. : Hypercholestrolemic effect of vegetable protein in a hypocaloric diet, Soyabean abstract, 1990, 13, 5, 250.

Judy Ria, : Food processing, The Magazine of the Food Industry, 1989, Sep, 1, 19.

Kale, T.S. : Soyabean, its value in dietetics, cultivation and uses, International Books and Periodicals Supply Services, 1985, 30, 36, 163.

Kanchana, S. and Neelakantan, S. : Acceptability and Nutritive value of puffed soya as a snack food, Journal of Food Science and Technology, 31, 5, 377-379.

Ranjanj, K. and Vaidehi, M.P. Nutritive composition of traditional Indian Tandoon naans and rotis prepared with blends of wheat with selected oil seed and pulse flours, Beverage and Food World, 1988, 15-16.

Kothari, S.L., Ranjana, P., Razia, A., Shingeware, K.S. and Radha, A.N. : Effect of feeding soya milk to the children suffering from protein-calorie malnutrition, 1985. The Indian Journal of Nutrition and Dietetics, 22, 9, 263-271.

Khare, S.K. : Soy bean : A Remedial and Nutritive Diet, Soy bean processing and utilisation project, 1972. Central Institute of Agricultural Engineering , Bhopal, Unpublished data.

Komatsu, T., Yamagishi, M. : Studies on clinical applications of soy peptide, Soyabean Abstract, 1991, Oct, 14, 5, 255.

Lavin, D., Jacque, H., Moorjani,S. and Lupin, P.J. : Effect of soy protein beverage on plasma lipoproteins in children with familial hypercholestrolemia, Nutrition Abstracts and Reviews, 1992, March, 62, 3.

Lee, H.P., Gourleg, L., Duffy, S.W. and Esterve, J. : Dietary Effects on breast cancer in singapore, Soyabean Abstract, Oct,14, 5, 26.

Lowell Ponte : Foods that help you live long, Readers Digest, 1993, Aug, 82-87.

Meena, G. and Usha, B. : Scope and trends of soy protein utilization for Beverge production, Beverage and Food World, 1990, 22-23.

Meena, G. and Usha, B. : Soyprotein isolate : Production technology, functional properties, Nutritive value and applications, A Review, Indian Food Packer, 1990, 5-22.

Naganwa, S., Itoh, Y., Yamatoh, M., Muto, : Effect of soy protein diet on patients with liver cirrhosis, Soyabean abstract, 1991, Oct, 14, 5, 256.

Nasim, M., Mital, B.K. and Tyagi, S.M. : Development of a process for preparation of soy paneer, Journal of Food Science and Technology, 1986, 23, 69.

Nyotu, H.G., Alli, I. and Paquette, G. : Soy supplementation of maize based Keyan food (UGALI). Journal of Food Science, 1986, 51, 5, 1204-1207.

NIN, A manual of laboratory techniques, 1983, ICMR, Hyderabad, 35-42.

Okita, J., and Sugand, M. : Effects of the type and level of dietary protein on plasma lipids, fatty acid profiles and faecal steroid excretion in rats, Nutrition Abstracts and Reviews, 1990, 60, 7, 596.

Pariza, M. : Soy and cancer, New Scientists, 1992, Nov, 21, 14.

Pomeranz, Y. : Functional properties of food components - Second edition, Academic Press, Inc, Newyork, 1991, 451-469.

Pushpendra, Hari Ram, and Kamendra Singh, : Soyabean - A wonder crop of multiple uses, Indian Farmers Digest, 1992, May/June, 25, 5-6, 9-10.

Raghuram, T.C., Swaran Pasricha, and Sharma, R.D. : Diet and Diabetes, NIN, Hyderabad, 1993, 3.

Rakosky, J.R. : Protein additives in food service preparations, 1989, Van Nostrand - Reinhold, Newyork, 1-3.

Ramakrishna, H.B.V., Mital, B.K., Gupta K.C., and Sand, N.K. : Fatty acid composition of different soyabean varieties, The Indian Journal of Nutrition and Dietetics, 1990, Jan, 27, 1, 24-27.

Rawat, A., Gurmukh Singh, Mital, B.K., and Mittal, S.K. : Effect of soy-fortification on quality characteristics of chapatis, Journal of Food Science and Technology, 1984, 31, 2, 114-116.

Santosh Kumari, G.S., Chauhan and Dheer Singh, : Effect of soy flour supplementation on the sensory characteristics of some traditional foods, Beverage and Food World, 1992, June/July, 29-31.

Saraswat, : Making sense of soyabean, Indian Express, Dec, 9, 1993.

Sharma, P., Usha, M.S., Awasthi, P. and Chauhan, G.S. : Defatted soyaflour substitution in some traditional foods : Effect on sensory characteristics, Beverage and Food World, 1993, 20, 3, 7-10.

Singh, B. and Shurpalekar, S.R. : Studies on ready-mix for kheer, Journal of Food Science and Technology, 1989, 26, 1, 12-15.

Singh, N. and Chauhan, G.S. : Some physico-chemical characteristics of defatted soy flour fortified noodles, Journal of Food Science and Technology, 1989, 26, 1, 210-212.

Singh, Awasthi, P., Usha, M.S. and Chauhan, G.S. : Effect of defatted soy flour addition on the quality characteristics of black gram papad, Beverage and Food World, March, 1993, 35-36.

Singh, L.K. and Ali, N. : Preparation of medium fat soy flour at small scale, Journal of food science and technology, 1993, 30, 1, 14-16.

Singh, R.P. and Singh, G. : Use of defatted soy flour in Sev preparation, Beverage and Food World, 1989 April/June, 1992, 22-24.

Singh, T.R. and Gupta, A. : Comparative organoleptic evaluation of food stuffs cooked in different modes of cooking, Indian Journal of Nutrition and Dietetics, 1984,5,199-204.

Slavin, J. : Nutrition benefits of soy protein and soy fiber, The Journal of American Dietetic Association, 1991, 91, 7, 816-819.

Sloan, A.E. : Tastier, Healthier and Down right more fun to eat, Food Technology, 1993, 138-140.

Tandon, M. and Singh, G. : Effect of addition of defatted soy flour on physico-chemical characteristics and acceptability of Green gram barian, Journal of Food Science and Technology, 1987, 24, 283.

Tyagi, A.K. and Mital, B.K. : Preparation of soy-ice cream Beverage and Food World, 1991, 12-14.

Ulbrigat, T.L.V. : Coronary Heart Disease : Severe Dietary Factors, The Lancet, 1991, 338, 985-992.

Vaidehi, M.P. :"Tempe" - A Biotechnological boon for nutritionally rich foods", Beverage and Food World, 1993, 35-36.

Vaidehi, M.P., Karuna, B.and Vijyalakshmi, D. : Consumer evaluation of soy products in rural area - Indian Food - Packer, 1985, 39 (5), 29-32.

Vaidehi, M.P.and Shivaleela, H.B. : Soya incorporated gulabjamun, Beverage and Food World, July/Sep, 1989, 13-14.

Van Raaij , J.M.A., Katan, M.B. and Aermus, R.J.J. : Effects of casein versus soya protein diets on serumcholesterol and lipoproteins in young healthy volunteers. The American Journal of Clinical Nutrition, 1981, 34, 1261-71.

Varley, H., Gowenlock, A.H.and Bell, M. : Practical clinical biochemistry, 1980, Fifth Edition, William Heinemann Medical Books, Ltd, London, 545-548, 654-655, 665 and 673.

Vessby, G. : Soy protein diets and blood lipids, ASA Technical Bulletin, 1989, 4HN7.

Wolfe, B.M., Grace,D.M. : Substitution of mixed amino acids resembling soya protein for mixed amino acids resembling casein in the diet reduces plasma cholesterol in slowly but not rapidly fed nor fasted baboons, Metabolism, 1987, 36, 223-229.

Young, V.R. : Soy protein in relation to human protein and amino acid nutrition, The Journal of American Dietetic Association, 1991, 91, 7, 823, 834.

Young, V.R., Rand, W.M.and Scrimshaw, N.S. : Measuring protein quality in humans : A Review and proposed method, Cereal Chemistry, 1977, 54, 929-948.

APPENDIX

APPENDIX I

GLOSSARY OF INDIAN FOOD ITEMS

Bajji - a deep fat fried item made out of thin batter of bengal gram flour, rice flour and spice with a piece of vegetable.

Pakoda - a deep fat fried item made of a thick batter of bengal gram flour, rice flour, spices and onion.

Halwa -a sweet prepared with refined wheat flour, milk powder, sugar and fat.

Gulabjamun - a deep fat fried ball made out of refined wheat flour, milk powder and soaked in sugar syrup.

Bread rolls - a vegetable stuffing encased in bread slice, dipped in batter of bengal gram flour, rice flour and deep fat fried.

Potato rolls - a boiled and seasoned potato mixture, dipped in a batter of bengal from flour, rice flour and deep fat fried.

Burfi - a refined flour preparation with sugar and fat added to a thick consistency and cut into desired shapes.

Ladoo - a bengal gram flour preparation diluted with water and deep fat fried. Soaked in sugar syrup with nuts and raisins and pressed together into balls.

Papad - Black gram flour dough pressed into round shapes dried and deep fat fried.

Murukku - an item made of rice flour, roasted bengal gram flour dough pressed and deep fat fried.

Mysorepak - a preparation with bengal gram flour, sugar and fat, cooked and cut into rectangular shapes.

Sev - Bengal gram flour batter deep fat fried into thin strips.

Diamond cuts - a deep fat fried diamond shaped products made out of wheat flour and dipped in sugar syrup.

Ribbon pakoda - Ribbon shaped deep fat fried item made out of a thick batter of bengal gram flour, rice flour and salt.

APPENDIX II

RECIPES

BAJJI

S. No.	Ingredients	Amounts in g Percentage of soyaflour incorporated			
		Standard Recipe	10%	15%	20%
1.	Bengal gram flour	75	67.5	63.75	60
2.	Rice flour	25	25	25	25
3.	Chillie powder	5	5	5	5
4.	Omum seeds	2.5	2.5	2.5	2.5
5.	Cooking soda	1 pinch	1 pinch	1 pinch	1 pinch
6.	Salt	2.5	2.5	2.5	2.5
7.	Defatted soyaflour	-	7.5	11.25	15
8.	Plaintain	1 in number	1 in number	1 in number	1 in number
9.	Oil for frying				

Method

1. The plaintain was cut transversely into thin slices and kept aside
2. Batter of pourable consistency with instant mix was prepared
3. Dipped the plaintain slices in the batter and deep fried them.

PAKODA

S.No.	Ingredients	Amounts in g Percentage of soyaflour incorporated			
		Standard recipe	10%	15%	20%
1.	Bengal gram flour	80	72	68	64
2.	Rice flour	30	30	30	30
3.	Defatted soyaflour	-	8	12	16
4.	Chillie powder	5	5	5	5
5.	Omum seeds	2.5	2.5	2.5	2.5
6.	Green chillies	5	5	5	5
7.	Cooking soda	1 pinch	1 pinch	1 pinch	1 pinch
8.	Salt	2.5	2.5	2.5	2.5
9.	Onions	75	75	75	75
10.	Coriander leaves	5	5	5	5
11.	Garlic	5	5	5	5
12.	Oil for frying				

1. Sliced onion, garlic and coriander leaves into small pieces
2. Prepared a drop batter with instant mix, sliced onion, garlic and corriander leaves
3. Dropped the prepared batter in oil and fried them till golden brown
4. Served hot.

HALWA

S. No.	Ingredients	Amounts in g			
			Percentage of soyaflour incorporated		
		Standard recipe	10%	15%	20%
1.	Wheat flour (refined)	90	81	76.5	72
2.	Milk powder	10	10	10	10
3.	Defatted soyaflour	-	9	13.5	18
4.	Sugar	150	150	150	150
5.	Cardamom	2.5	2.5	2.5	2.5
6.	Ghee	200	200	200	200
7.	Cashew nuts	5	5	5	5

Method

1. Soaked the instant mix for five minutes and added cardamom, ghee and cooked on a low fire
2. Kept stirring continuously
3. When halwa separated from the sides, removed from stove and poured on a greased plate
4. Allowed it to set and then cut into pieces.

GULABJAMUN

S. No.	Ingredients	Amounts in g			
		Standard recipe	Percentage of soyaflour added		
			10%	15%	20%
1.	Wheat flour (refined)	75	67.5	63.75	60
2.	Defatted soyaflour	-	7.5	11.25	15
3.	Skim milkpowder	25	25	25	25
4.	Dalda	15	15	15	15
5.	Cooking soda	1 pinch	1 pinch	1 pinch	1 pinch
6.	Sugar	150	150	150	150
7.	Cardamom	2.5	2.5	2.5	2.5
8.	Refined oil for frying				

Method

1. Dissolved sugar in two cups of warm water and prepared the syrup
2. Kneaded the gulabjamun mix with dalda and water to form a soft dough
3. Prepared firm small balls from the dough and deep fried them until golden brown on low heat
4. Drained fat from the fried balls and soaked in syrup. When they swell to twice their size served with a little syrup.

APPENDIX III

SCORE CARD FOR BAJJI

Name of the Recipe : Bajji Name of the evaluator :

Evaluation date : Age:

Qualification:

S.No.	Charateristics	Scale
1.	Colour	
	Golden brown	5
	Brown	3
	Dark brown	1
2.	Flavour	
	Good	5
	Fair	3
	Poor	1
3.	Texture	
	Soft and crisp	5
	Moderately crisp	3
	Hard	1
4.	Taste	
	Good	5
	Fair	3
	Poor	1

SCORE CARD FOR PAKODA

Name of the Recipe : Pakoda

Evaluation date :

Name of the Evaluator:

Age:

Qualification:

S.No.	Charateristics	Scale
1.	Colour	
	Golden brown	5
	Brown	3
	Dark brown	1
2.	Flavour	
	Good	5
	Fair	3
	Poor	1
3.	Texture	
	Crisp	5
	Soft	3
	Hard	1
4.	Taste	
	Good	5
	Fair	3
	Poor	1

SCORE CARD FOR HALWA

Name of the Recipe : Halwa

Name of the Evaluator :

Evaluation date :

Age

Qualification:

S.No.	Characteristics	Scale
1.	Colour	
	Yellow	5
	Orange	3
	Reddish orange	1
2.	Flavour	
	Good	5
	Fair	3
	Poor	1
3.	Texture	
	Good (Non-sticky)	5
	Soft	3
	Sticky	1
4.	Taste	
	Good	5
	Fair	3
	Poor	1

SCORE CARD FOR GULABJAMUN

Name of the Recipe : Gulabjamun

Evaluation date :

Name of the Evaluator :

Age:

Qualification:

S.No.	Characteristics	Scale
1.	Colour	
	Golden brown	5
	Brown	3
	Dark brown	1
2.	Flavour	
	Good	5
	Fair	3
	Poor	1
3.	Texture	
	Soft	5
	Moderately hard	3
	Hard	1
4.	Taste	
	Good	5
	Fair	3
	Poor	1

APPENDIX IV

RECIPES DEVELOPED FOR PRE-SCHOOL CHILDREN

1. Sweet biscuit

Ingredients	Amount g	Protein g	Fat g	Energy Kcal
Maida	85	9.35	0.765	296
Soyaflour	15	7.94	0.202	52
Baking powder	1	-	-	-
Dalda	30	-	30	270
Sugar	30	0.03	-	119
Vanilla essence	1 drop			
		17.32	30.96	737

Method

Cream sugar and dalda, add baking powder and vanilla essence to it and then mix in maida. Knead to form a stiff dough, divide the dough into two parts and roll into sheets. Cut biscuits into shape with biscuit cutter. Place them on a greased tray and bake at 325° F for 5 minutes.

2. Salt biscuit

Ingredients	Amount g	Protein g	Fat g	Energy Kcal
Maida	85	9.35	0.765	296
Soyaflour	15	7.94	0.202	52
Baking powder	1	-	-	-
Dalda	30	-	30	270
Salt	2.5	-	-	-
Sugar	30	0.03	-	119
		17.32	30.96	737

Method

Cream sugar and dalda. Add baking powder and salt to the mixture and then mix in maida. Knead to form a stiff dough. Divide the dough into sheets. Cut biscuits into shape with biscuit cutter. Place them on a greased tray and bake at 325°F for 5 minutes.

3. Diamond cuts

Ingredients	Amount g	Protein g	Fat g	Energy Kcal
Wheat flour	85	9.35	0.765	296
Soyaflour	15	7.94	0.202	52
Dalda or butter	5	-	5	45
Sugar	30	0.03	-	119
Cooking soda	1	-	-	-
Oil for frying	10	-	10	90
		17.32	15.96	602

Method

Rub fat into the flour. Knead into a stiff dough. Roll into sheets and cut in diamond shape. Fry in oil, make a thick sugar syrup and put the fried square into it. Dry them on a big plate for sometime.

4. Ribbon pakoda

Ingredient	Amount g	Protein g	Fat g	Energy Kcal
Wheat flour	85	9.35	0.765	296
Soyaflour	15	7.94	0.202	52
Dalda or butter	5	-	5.00	45
Chilli powder	5	0.795	0.31	12
Ground nut	10	2.62	3.98	57
Turmeric	1	-	-	-
Salt	8	-	-	-
Oil for frying	10	-	10	90
		20.705	45.257	552

Method

Rub fat into flour. Mix salt, chilli powder, powdered ground nut, add it along with turmeric to the flour. Add water and knead it to a stiffdough. Roll into sheets and cut into ribbons with a knife. Deep fat fry in oil.

APPENDIX V

ORGANOLEPTIC SCORES OF BAJJI BEFORE AND AFTER STORAGE

Maximum score = 5 N = 10

Panelist	Percentage of soyflour incorporation					
	10		15		20	
	Before storage	After storage	Before storage	After storage	Before storage	After storage
1	4.75	4.85	4.50	4.75	4.00	4.50
2	4.18	4.75	4.25	4.75	3.75	4.00
3	4.13	4.58	4.25	4.50	3.73	4.25
4	3.83	4.75	4.40	5.00	3.50	4.00
5	4.25	4.75	4.00	4.75	3.50	4.75
6	4.25	4.75	3.83	4.33	3.75	4.50
7	3.65	4.50	4.00	4.50	3.58	4.25
8	4.00	4.50	4.12	4.75	3.90	4.65
9	4.78	4.40	3.90	3.75	3.64	4.00
10	4.48	4.65	4.25	4.00	3.83	4.25
Mean±	4.23±	4.65±	4.15±	4.51±	3.72±	4.315±
S.D	0.365	0.146	0.22	0.386	0.166	0.275
't' value	3.37**		2.56*		5.861**	

* Significant at 5 per cent level

** Significant at 1 per cent level

ORGANOLEPTIC SCORES OF PAKODA BEFORE AND AFTER STORAGE

Maimum score - 5 N - 10

Panelist	Percentage of soyaflour incorporation					
	10		15		20	
	Before storage	After storage	Before storage	After storage	Before storage	After storage
1	4.50	3.70	4.00	4.50	4.50	4.50
2	4.50	3.50	4.00	4.25	4.25	4.25
3	5.00	3.50	3.75	4.25	3.75	4.25
4	4.75	3.75	4.75	4.25	4.75	4.50
5	4.58	3.75	4.25	4.25	3.66	4.25
6	4.25	3.75	4.33	4.25	3.74	4.25
7	4.50	3.50	4.25	4.25	4.08	4.25
8	4.25	3.75	4.75	4.25	4.00	4.25
9	4.25	3.75	4.25	4.25	4.50	4.25
10	4.25	3.75	4.50	4.25	4.25	4.25
Mean±	4.48±	3.67±	4.282±	4.275±	4.148±	4.3 ±
S.D.	0.25	0.118	0.322	0.079	0.368	0.105
't' value	9.288**		0.29NS		0.488NS	

** Significant at one per cent level

NS Not significant

ORGANOLEPTIC SCORES OF HALWA BEFORE AND AFTER STORAGE

Maximum score - 5 N = 10

Panelist	Percentage of soyaflour incorporation					
	10		15		20	
	Before storage	After storage	Before storage	After storage	Before storage	After storage
1	4.50	4.25	4.25	4.75	4.75	4.50
2	4.50	4.25	4.00	4.75	4.50	4.50
3	4.50	3.75	4.50	4.75	4.50	4.50
4	4.75	5.00	4.25	5.00	5.00	4.75
5	4.50	4.75	4.25	4.50	4.08	4.50
6	4.50	5.00	4.25	4.75	4.17	4.50
7	4.25	4.75	4.25	4.75	4.75	4.75
8	4.25	4.75	4.25	4.75	4.75	4.50
9	4.00	4.25	4.50	4.50	4.75	4.50
10	4.50	4.25	4.50	4.75	5.00	4.25
Mean±	4.425±	4.5 ±	4.3 ±	4.725±	4.62±	4.525±
SD	0.2056	0.408	0.158	0.142	0.31	0.142
't' value	0.232^{NS}		6.335**		0.88^{NS}	

NS Not significant

** Significant at 1 per cent level

ORGANOLEPTIC SCORES OF GULABJAMUN BEFORE AND AFTER STORAGE

Maximum score - 5 N = 10

Panelist	Percentage of soyaflour incorporation					
	10		15		20	
	Before storage	After storage	Before storge	After storage	Before storage	After storage
1	3.25	3.25	3.25	3.25	3.50	2.25
2	2.75	3.25	3.50	3.25	3.50	2.25
3	3.00	3.00	3.25	3.25	3.33	2.75
4	3.50	3.25	3.25	3.75	2.83	2.50
5	3.50	4.00	3.25	3.50	2.98	3.00
6	3.00	3.25	3.50	3.25	3.58	2.50
7	3.25	3.50	3.50	3.50	3.75	3.75
8	3.00	3.00	3.00	3.50	3.25	2.50
9	3.25	3.50	3.00	3.50	3.25	2.00
10	3.25	3.00	3.00	2.75	3.25	1.75
Mean ±	3.175±	3.30 ±	3.25 ±	3.375±	3.335±	2.525±
S.D	0.237	0.307	0.204	0.269	0.266	0.558
't' value	0.533^{NS}		0.367^{NS}		4.121**	

NS Not significant

** Significant at one per cent level