STANDARDIZATION OF RECIPES BASED ON RICE - SOYA EXTRUDED PRODUCT

By

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DECLARATION

I hereby declare that this thesis entitled **"Standardization of recipes based on rice - soya extruded product"** is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

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Certified that this thesis entitled **"Standardization of recipes based on rice - soya extruded product"** is a record of research work done independently by **Miss. Anna Jacob** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

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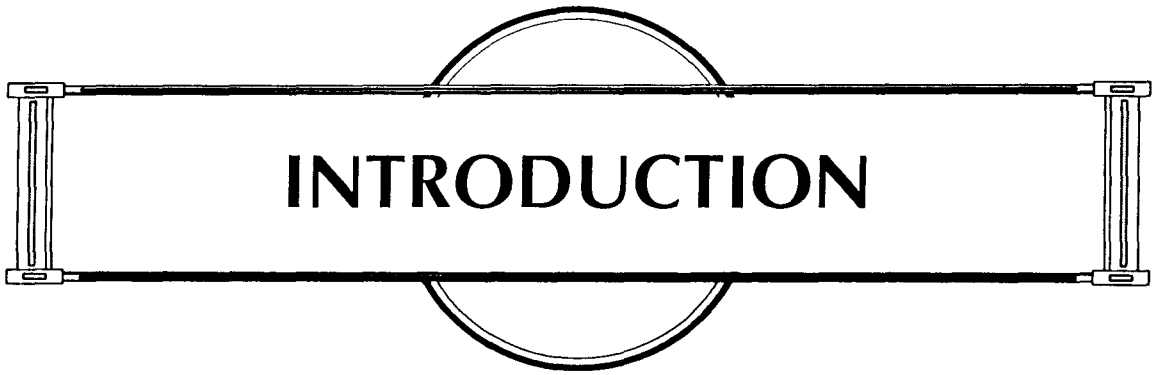
CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES



INTRODUCTION

INTRODUCTION

Through centuries, food has been recognised as important for human beings in health and disease. Food is essential for human existence just like the air we breathe or the water we drink. Good nutrition and good health are fundamental human rights. Devadas (1987) rightly points out that any investment towards improving the nutritional status of an individual with good quality food is an investment for the wealth of the nation.

The rapid process of urbanisation that is occurring in our country, especially in our state, is leading to marked changes in the food consumption patterns. A great variety of foods are being incorporated into the dietaries of the consumers. Besides the increase in the number of working women, the number of small and nuclear families is increasing, creating intensifying demands for processed foods. Processing of novel food items utilizing the locally available foods will provide the consumers with a variety of whole some foods.

Extrusion of food is an emerging technology for the food processing industries to process and market a large number of novel products of varying size, shape, texture and taste. Tribel torn and Harper (1980) and Linko *et al.* (1981) stress the importance of extrusion because of its versatibility, efficiency, flexibility, ease of obtaining products and economy of space and labour. Extrusion offers the possibility of modifying the functional properties of food ingredients and provides a wide range of shaped, precooked and texturised foods.

Rice is a vital food material for more than half of the world's population. According to Juliano (1985) 70 per cent of the world's dietary energy is reported to be obtained from this staple food. Although rice is primarily a source of carbohydrate, it also deserves to have high digestability coefficiency, biological value and protein efficiency ratio among all the cereals (Sood, 1989). It is the preferred staple cereal among Keralites. Usually rice or wheat is used as the cereal base for the production of extruded foods. They provide desirable characteristics like smoothness, flavour, colour and taste to the product. The protein content of the processed foods based on rice could still be improved with a source of vegetable protein of good biological value such as soybean.

Soybean being rich in protein and energy is considered to be a 'Wonder bean', to solve the protein energy gap in developing countries. Among different vegetable proteins, soybean is the cheapest source with its 40 per cent protein and 20 per cent oil which are characteristics of a good product having high protein energy ratio (Gandhi *et al.*, 1986). Soybean proteins supply all the essential amino acids, except methionine, the limiting amino acid, but they are good sources of lysine and threonine and supplement effectively cereal proteins (Swaminathan, 1986). It has the additional advantage in being comparatively less expensive than other vegetable proteins and is generally recommended for fortitying purposes (Arvind *et al.*, 1994). Blends of soy flour with cereals such as rice, wheat, corn and sorghum are widely used in the world feeding programmes (Book Walter, 1978).

In this context, rice-soya blend is an ideal combination for developing extruded foods. However rice-soya blended food products are not available in our state. Hence in the present study, an attempt is made to develop an extruded product based on rice-soya blend and to standardise recipes with the developed product.


REVIEW OF LITERATURE

REVIEW OF LITERATURE

Literature pertaining to the study entitled "Standardisation of recipes based on rice-soya extruded product" is reviewed under the following headings.

2.1. Significance of rice and soya in processed foods

2.2. Extrusion of food

2.3. Standardisation of recipes

2.4. Acceptability studies on new foods

2.1. Significance of rice and soya in processed foods

Significance of rice in processed foods

Rice is an important staple food consumed by more than half of the world's population. Its importance as a food crop increases along with the increase in human population. To Indians, it is the most important food crop supplying on an average, one third of the calorie requirement (Saikai, 1990).

The nutritional composition of rice grain is a major parameter influencing the quality of rice grains. According to Juliano (1985) rice is the chief source of

carbohydrates. Grist (1986) reports that, being a staple food, rice provides 80 per cent of the calorie requirement of the diet. The calorific value is meant to determine the carbohydrate content of rice which is composed of amylose and amylopectin.

Rice is reported to be a moderate source of protein. Rice varieties that cook well contained considerable amount of protein constituents, such as amino acids like glutamic acid, aspartic acid and arginine, Okazaki and Oki (1961).

Aberg (1994) has found that starch is the major constituent in rice grain and it is a mixture of amylose and amylopectin. Hogan *et al.* (1968) have reports that rice contains negligible amount of fat which is unevenly distributed with in the endosperm, the highest concentration being in the outer layer and the lowest in the central portion.

Rice is reported to have a moderate source of minerals. Pederson and Eggum (1983) had reported that the mineral content in different rice varieties decreased

considerably during milling and the extent of decrease differed between minerals.

According to Dutta and Barna (1978) calcium content of rice varieties varied from 15.77 to 29.70 mg/100 gm. Sood *et al.* (1980) had reported that rice bran contained maximum calcium, potassium, magnesium and phosphorus.

Damir (1985) found that puffed rice contains a high amount of iron. Roberts (1978) has estimated the iron content in the different rice varieties and had found a decrease during milling.

Hussain *et al.* (1987) has reported that red grain varieties had higher phosphorus content than white varieties. Sreedevi (1989) has reported a decrease in phosphorus content during parboiling. According to Adoracion *et al.* (1978) low protein rice had lower total ash content than the high protein rice.

Rice is reported to be a moderate source of fibre. Dutta and Barua (1978) found that rice with only the husk removed had more crude fibre than well milled rice and showed

a lower digestability and retension of nitrogen. According to Pillaiyar (1979) brown rice constituted 0.7 per cent crude fibre and 0.1 per cent dietary fibre where as milled rice had 0.1 per cent crude fibre and 0.6 per cent dietary fibre. Nandini (1995) in her study has analysed the variation in fibre content of raw and paraboiled rice. The variation ranged from 0.01 to 0.02 per cent which is not significant.

Eggum (1979) had stated that the low content of tannins and crude fibre in rice has positively influenced the digestability of rice protein and energy.

Rice is the major source of vitamin B. complex in the diet of Asians. According to Juliano (1970) among the water soluble B-vitamins, thiamine is present in a large proportion in the bran layers and embryo than riboflavin and maxin.

In a report of NlN (1978) it had been stated that the thiamine content of brown rice ranged between 0.35 and 0.44 mg/100 gm.

Vandrasek and Warthesan (1987) have reported an initial thiamine leaching and thiamine uptake as water was

absorbed during cooking of white rice. He has also reported that the extended cooking time required for tenderness in brown rice resulted in a greater percentage of thiamine loss.

The niacin content of brown rice ranged between 4.90 and 6.40 mg/100 g. Milling of raw rice caused 29 to 50 per cent loss in niacin (NIN, 1978).

Rice, as the staple food of keralities from ancient times has many diverse uses and is consumed in many forms (Mundy *et al.* 1989).

Rice is mainly starchy grain and consumed as cooked, (whole, milled, raw and parboiled) and also in the form of other traditional products like idli, dosai, puffed rice, noodles and vermicelli. In India, idiappam, idli, dosai, and rice pasta products are consumed as breakfast items as well as snack items (Sowbhagya *et al.* 1979). Ramnath *et al.* (1987) have studied the acceptability of different Indian snacks and their nutritive value based on rice.

Paymo *et al.* (1982) have prepared fortified high protein snacks from a combination of rice flour and full fat

soy flour by extrusion cooking and was found the product nutritionally superior. Malina *et al.* (1983) had processed an extruded snack food from rice and whole soyabean and it was found to be acceptable among consumers.

Satonga (1982) has reported that in Japan rice noodles is prepared from cleaned milled rice or from broken rice.

In Philippines rice flour is the main ingredient in noodles comprising 70 per cent, while remaining 30 per cent is contributed by equal quantity of corn flour and corn starch (Sukurai *et al.*, 1985).

In recent years the demand for pasta products especially quick cooking products is increasing. There is a potential for the growth of rice noodles industry in our country on account of availability of raw materials and market for the product.

Significance of soya in processed foods

Since the animal proteins are inadequate and more costly, it is of great importance to make the best possible

use of all locally available plant protein foods. Soybean occupies a key position in this aspect (Jelliffee, 1966). Natarajan (1989) also stresses that soybean is currently the largest commercially available vegetable protein source in most parts of the world. Although the use of soy protein is still relatively small, many of the major food companies are now incorporating them into some of their products (Walter, 1990). He also feels that one of the major constraints in the availability of soybased food is lack of simple low cost technologies at small industry level to prepare products similar to traditional foods.

Varma *et al.* (1987) feel that the lower cost of soyprotein when compared with milk, meat and fish, is the most favourable point, in utilizing soybean in human food preparation. As a protein source, soyabean contributes two thirds of world's consumption of protein foods. It is also the major source of oil providing for one third of the world's consumption by man (Gorvov 1989).

According to Gandhi *et al.* (1985) demand for soybean products is consistently increasing in India as they

have a great potential in solving the food shortage created by ever-expanding population.

It has been reported by Book Walter (1978) that, blends of soyflour with cereals such as corn, wheat, sorghum and oats are widely used in world feeding programmes. Soyflour is most attractive in price and quality and has been extensively recommended for fortifying purposes (Gupta *et al.* 1991).

Defatted soy flour is a common form in which soybean can be incorporated in various food preparations (Chauhan *et al.* 1985). Brand and Label (1988) feel that defatted soyflour contains 50 per cent protein, unmatched by any other known vegetarian sources. Easter (1981) also feels that defatted soy flour contains two times as much protein as in dal, three times as much as in eggs and fifteen times as much as in milk. According to Anita *et al.* (1994) incorporation of defatted soy flour in diets will not only enhance the protein content of the diet but also raise its nutritive value, there by helping in combating malnutrition.

The increased protein, ash, fat and calorie contents in soy bean incorporated blends were recorded by

Jayalakshmi and Neelakantan (1988). Seralathan *et al.* (1989) have observed that soy incorporated products had about 85.00 per cent acceptability.

According to Jimbu (1990), the quality of Vitamin A is low in soybean, but the vitamin is present to a level of 1.4 meq/g and prevents the oxidation of fatty acids. A fibre content of 9.90 g, ash of 7.52 g and protein of 53.54 g in soy flour was reported by Raunet *et al.* (1992). He has also observed that soy fibre contains 20 to 23 per cent soluble fibre which could help in controlling cholesterol.

Kauffman (1987) feels that soybean products suffer from objectionable beany flavour and this has to be over come by extensive studies.

Kanchana and Neelakantan (1994) feel that although soybean has some undersirable constituents like trypsin inhibitors, the information available on processing of soybean for food use could be judiciously adopted to get rid of these factors and to have delicious food items. Nelson *et al.* (1986) have suggested the subjection of soyabean to a

temperature of 135^{o}C for 30 seconds, for reducing the antinutritional factors.

It was reported by Kale (1985) that, soybean is very useful in the preparation of some Indian, Chinese, Japanese and European dishes.

Tandon and Sing (1987) feel that soy flour can be incorporated in various food preparations. Its use in bread, biscuits, chappathis, snacks and textured products has been successfully demonstrated by them. Incorporation of defatted soy flour in such products has also been demonstrated by Sushma *et al.* (1979), and Chauhan and Bains (1988). Manjhi (1985) has proved that soy flour can double the nutritional content of bread at no extra cost.

The acceptability of soy flour incorporated cassava chappathi was successfully demonstrated by Prema and Chellammal (1986).

Sing and Chauhan (1989) found that equally acceptable noodles of better nutritional value can be manufactured by supplementing of semolina flour with ten per-cent defatted soy flour.

Thirumaran and Seralathan (1989) conducted a study to incorporate whole and defatted soy flour at ten, twenty and thirty per cent levels for the manufacture of vermicelli. It was found that incorporation of defatted soy flour for the extrusion of vermicelli was feasible at 30 per cent level with increased nutritive value. The successful incorporation of soy flour in extruded products was also reported by Lunine *et al.* (1992).

Marino *et al.* (1983) have prepared an acceptable extruded product with fresh meat, wheat flour and soy flour. Laul *et al.* (1985) prepared an extruded finger shaped snack food with soy flour. Krishnan (1994) manufactured texturised soy chunks by extrusion using defatted soy flour.

The feasibility of incorporating soy flour in extruded food macroni was studied by Chellammal and Prema (1993).

Chopra *et al.* (1984) have prepared an acceptable yoghurt like fermented product from soy milk. Seralathan *et al.* (1987) prepared South Indian recipes with soybean like soy milk and vadai and both were found to be acceptable. Soy

bean proteins have been utilised in many kinds of traditional oriental foods, including soy sauce, soybean paste and others over the centuries (Yukako *et al.* 1994).

Jayalakshmi and Neelakantan (1987) have revealed that soy flour could be incorporated with sorghum flour up to 50 per cent level for making deep fat fried products like methupakkoda and murukku. For the preparation of puttu, laddu, sevai, uppuma and roti soyflour could be blended with sorghum flour up to 30 per cent level. Gandhi and Ali (1987) developed a simple technology for making soy paneer at home level which involved cleaning, splitting and soaking of soybeans, wet grinding, extraction of soy milk and preparation of protein with coagulants.

Based on the investigations carried out at Central Food Technological Research Institute, Mysore. Swaminathan (1977) had shown that infant foods prepared from blends of groundnut and soyabean possessed high nutritive value. A soy-whey weaning food constituted by grinding the soy whey mixture, oil and oil soluble vitamins was standardised by Kapoor and Gupta (1981). The feasibility of incorporating soy flour in weaning foods based on fermented cassava flour

was studied by Prema and Chellammal (1986) and it was observed that nutritive value could be considerably increased.

2.2. Extrusion of food

Extrusion may be defined as the process by which moistered expansible starchy or proteinaceous materials are plasticized in a tube by a combination of pressure, heat and mechanical shear (Vaidehi, 1992). A whole range of products with different textures, forms and densities can be developed through extrusion. The utilization of extrusion technique has grown at a rapid pace throughout the food industry. Extrusion appears to have great promise in less developed nations where as ready supply of nutritious low cost preserved foods is an urgent necessity to solve the existing food problem.

According to Williams *et al.* (1977) extrusion is a very versatile process. They feel that it possesses large production capacities requiring less labour than any other system and limited floor space.

Extrusion causes practically no harm to protein quality and results in the destruction of growth inhibitors Janson *et al.*, (1978) and Wolfe *et al.*, (1978).

Snack foods, pre-cooked flour, flakes and other cereal products could be processed through extrusion (Smith, 1979). According to Payumo *et al.* (1979) weaning foods could be processed by extrusion, because of the ease of preparation and economy of space and labour. Cheftal (1986) opines that extrusion has become a well established industrial technology with a number of food applications.

According to Linko *et al.* (1981) complete starch gelatinization is achieved during extrusion provided with high shear and temperatures during extrusion.

Zenthen *et al.* (1984) have reported that, extrusion depends on the number of mechanical and thermal processing steps taking place in the screw and barrel, the high shear and pressure exerted on low moisture food mixes.

Cheftal (1986) reviewed the beneficial changes in the bio-availability and in the content of nutrient which may take place during extrusion.

Tsou *et al.* (1976) studied the qualities of rice sphagethi prepared by extrusion of commercial white rice and compared it with conventional sphagethi prepared from durum semolina. It was found that rice sphagethi required a shorter cooking time than conventional sphagethi, but was less tolerant to excess cooking. The cooked weight and cooking loss for both sphagethi increased with increased cooking time but the flavour of conventional sphagethi was better than that of rice sphagethi.

According to Eggum *et al.* (1986) extrusion cooking in a twin screw extruder of milled rice batter of two rice varieties at 15 per cent moisture and at 120-150^{o}C reduced the total lysine content.

Last (1979) studied the suitability for texturing by thermoplastic extrusion of mital wheat gluten and its blends with legume and oil-seed proteins, while Indrani *et al.*, (1987) studied 44 samples of durum wheat cultivars for the chemical milling and vermicelli quality characteristics. The dough consistency, appearance and texture of cooked vermicelli, water uptake and gruel solid loss were studied and a wide variation in the cooking qualities was observed.

Bakshi and Bains (1987) studied the noodle quality of improved durum wheat cultivars and found that certain varieties were out standing and were characterised by pigment content and gruel clarity.

Seiler (1976) studied the effect of temperature, particle size and screw speed on the extrusion characteristics of the quality of corngrits-based snacks and found that certain maize varieties were suitable for the manufacture of extruded products.

The effect of soy and cotton seed fortification on the nutritional characteristics, storage stability, flavour and colour of sorghum was determined by Walter *et al.* (1977). All combinations stored in different temperatures for different periods displayed adequate stability as measured by changes in available lysine, rancidity and flavour.

Conversion of sucrose molecules into glucose and fructose permitting malliard condensation during biscuit processing through extrusion was reported by Noguchi *et al.* (1982).

The nutritional qualities of rice, ragi, and defatted soy flour blends as affected by extrusion was studied by Dublish *et al.* (1988). They found out that extrusion resulted in the inactivation of trypsin inhibitor activity. The losses of the available lysine content varied as per temperature. The processed products based on rice, defatted soy flour, rice and ragi and defatted soy flour, blends were had a PER of 2.61, 2.41 and 2.23 respectively.

The extruded variables on physico-chemical properties of extruded rice legume blends were studied by Chauhan and Bains (1988). It was found that the physico-chemical properties altered to a great extent.

The texture of the extruded soybean products was found good by Vandor Ven (1975) and incorporation of extruded soy and cotton seed in traditional and popular foods was studied by Gutirrez (1979).

A low cost extruded powdered infant formula made from soybean, oats and sucrose fortified with methionine vitamins and minerals was developed by Valle *et al.* (1981).

The product was of good microbiological quality and dispersed readily in water to give milk like suspension.

Sing and Chauhan (1989) found out that noodles from the blends of durum semolina and acstirum flour with defatted soy flour exhibited harder texture as compared to those prepared from acstirum semolina defatted soy flour blend.

According to Bjorck *et al.* (1994) extrusion of wheat flour caused an apparent increase in dietary fibre due to the formation of amylose resistant starch fractions, and extrusion cooking of white wheat flour was found to cause a redistribution of insoluble dietary fibre.

The effect of extrusion on protein availability was studied by Beetner *et al.* (1974). The study revealed that there was an overall 32 per cent loss of lysine extrusion of a cereal mixture and Taso *et al.* (1976) have found that glucose molecules from disrupted starch accelerated lysine destruction.

Extrusion cooking results in denaturation of the protein components (Smith, 1979) and the soluble protein was broken down to from insoluble protein fractions.

Mega and Sizer (1979) have reported that there was significant loss in free amino acids during extrusion of potato flakes, especially at high temperature.

Cheftal (1986) has reported that low liquid level facilitates steady extrusion and improve the texture. Most extruded cereal foods contain less than 6.70 per cent lipids immediately after extrusion.

Destruction of thiamine and riboflavin occurs during extrusion. The average retension of B_1 was 54 per cent and that of B_2 was 92 per cent (Beetner *et al.* 1974). Maga and Sizer (1978) determined the retension of ascorbic acid and thiamine in potato flakes under varying conditions.

Lee *et al.* (1978) studied the stability of vitamin A and carotenoids in extrusion cooking. There was only 30 per cent retension.

A reduction of 13-35 per cent in the phytate content after extrusion was reported by Anderson *et al.* (1981).

2.3. Standardisation of recipes

Efforts in product development and testing cover a broad spectrum. Any product that is new, should be tested in small quantity before being used in regular production. Converted standard product should be first tested by producing in small quantities and then carefully evaluating the product. Adjustments should be made if needed, and then the quality should be increased. Each converted product should be tested three times before it is accepted (Eric son *et al.* 1983).

Standardisation of recipe is an essential strive for high quality products (Crusius, 1984). The procedure for recipe standardisation began with the process of recipe modification or adjustment (Tolule, 1984).

According to Merrucks *et al.* (1986) when proportions, ingredients and procedures are all in cooks mind

the results can be disastrous in terms of both quality and cost of the product and standardisation of recipes could solve this problem.

According to Reay (1983) the advantages of the use of standardised recipes are accurate, cost control and portion control, standard buying, issuing and recording of consistent yield, uniformity of size, standard costing and selling price and quick production resulting from the use of steam lined familiar methods.

The parameters to be considered with standardisation as quoted by Repko *et al.* (1989) and Sareen (1991) are quality of raw materials, conditions at their preparation site units to be prescribed for different parameters and also standardisation on nutritional, packaging and tabulating agents.

According to Ramdas (1993) standard recipe ensures distribution of work and job satisfaction. It avoids guess work and confusion and helps in training employees in good production. He also reported that recipe standardisation and modification play an essential role in the success of food

production, it also reduces labour and transportation costs by eliminating inventory shortages and also control raw food costs.

2.4. Acceptability studies on new foods

Organoleptic qualities play an important role in evaluating the quality of food product. For adjudging consumer acceptability, organoleptic evaluation of any food product is essential.

When the quality of food is assessed by means of human sensory organs, the evaluation is said to be sensory analysis. Sensory analysis of food depends upon evaluation through the use of our senses only by applying exact scientific testing methods (Skeleton 1984).

According to Mc Laren (1984) the criteria included in food quality system are general acceptance, taste, appearance, texture and aroma of food. Ylimaki *et al.*, (1989) revealed that sensory analysis is a multidisciplinary science that uses human panelists and their senses to measure the sensory characteristics and acceptability of food

products. It is applicable to product development and quality control. A sensory panel must be treated as a scientific investment to produce reliable valid results.

Sensory method in which palatability is evaluated by a panel of judges is essential to every standardisation procedure because they answer all important questions of the food tastes, smells, looks and feels (Mc Dernott *et al.* 1992).

Tandon and Singh (1987) studied the acceptability of soy-incorporated extruded products. Statistical analysis of consumer acceptability data revealed that addition of defatted soy flour up to 15 per cent in the product did not bring any significant difference in their over all acceptability.

The acceptance of soya based snacks and textured proteins has been successfully demonstrated by Hoover (1974).

The quality of rice-soya blended extruded snack food was evaluated by Paymo *et al.* (1982). The product was rated highly acceptable and was shown to be nutritionally superior.

Dahl *et al.* (1991) conducted acceptability trials with ready-to-eat extruded foods developed from soybean and were found to be highly acceptable.

An extruded finger shaped snack food prepared from starch, maida and defatted soy flour in the ratio of 2:2:1 was found to be acceptable on the basis of taste panel results (Laul *et al.* 1985).

Sing and Chauhan (1989) found that noodles manufactured from maida-soy blends were highly acceptable to consumers.

Vermicelli was processed with sorghum and soya by Sivaraj (1989). The organoleptic studies conducted revealed that the products were highly acceptable to the panel of members. Reddy (1990) found out that four weaning mixtures formulated using local foods and traditional processing techniques were highly acceptable to children and their mother, even after a storage period of one month.

Sevian was processed from colocasia mass by Manar

et al. (1991) and the organoleptic studies conducted revealed that the products were highly acceptable.

An extruded product macroni with cassava/sweet potato flour, soy flour and maida was found to be highly acceptable among farm women (Chellammal and Prema, 1993).

MATERIALS AND METHODS

MATERIALS AND METHODS

The present investigation on "Standardisation of recipes based on rice-soya extruded product" comprises :

3.1. Formulation of the extruded product

3.2. Assessing the acceptability of the extruded product and

3.3. Standardisation of recipes with the extruded product

3.1. Formulation of the extruded product comprises

3.1.1. Different combinations tried for the development of the extruded product

According to Eldash and Chang (1990) extruded products are very popular among consumers and they serve as an effective means for the introduction of important nutrients.

The major food ingredients selected for the development of the extruded product were rice and soya. Maida, cassava and sweet potato were tried along with rice and soya in different combinations for the development of the extruded product, viz. Sev.

Rice (*Oryaza sativa* L.) is an important staple food, consumed by more than half of the world's population. In India the total area under rice cultivation is 41.855 million hectares with production of 81.61 million tonnes (Farm guide, 1995). Rice is also used in other traditional products like noodles, vermicelly, idli, dosai, puffed rice etc.

Proteins are the most important, scarce and expensive nutrients all over the world, much more so in India. Among foods soybean is the richest, cheapest and best source of protein with a multiplicity of uses and hence suitable to be attempted as an ingredient in any novel food developed.

Maida or refined wheat flour contains gluten protein, which act as binders and provide strength to strands. Such quality is essential for an ingredient selected for formulating extruded foods.

According to Gosh (1985) Kerala accounts for about 75 per cent of the area and for about 71 per cent of the production of cassava. Although cassava has long been

consumed in various conventional forms, research is needed to develop more convenient food items based on cassava and hence expand its use for more various new food applications such as convenience food, snacks, break fast cereals and baby foods. Because of this reason, cassava was also selected as an ingredient in the extruded food.

The production and processing of sweet potato has received only limited attention from researchers. Presently sweet potato is ranked 7^{th} among world food crops (FAO Year Book, 1993). Earlier studies by Kays (1990) on sweet potato based products revealed its suitability for formulating different types of processed foods and this was tested in the present study by including sweet potato also as an ingredient.

3.1.2. Selection of the best combination for the development of the extruded product

Twelve combinations were tried for the development of the extruded product.

The principles governing the selection of suitable

combination were, protein quality, extrusion behaviour, cost and acceptability.

According to Jansen and Harper (1985) amino acid score provides an useful estimate of the protein quality of blended foods and is an acceptable substitute for the biological assay. Amino acid scores were computed for the different combinations to assess the protein quality. (Appendix I).

Extrusion behaviour was assessed through observation by ten technical experts.

Cost of different combinations were computed as per the market price of the ingredients selected and cost involved in processing.

The overall acceptability of the combinations were assessed through organoleptic evaluation (Appendix 2). Organoleptic qualities such as colour, flavour, taste, texture and appearance were assessed with a panel of ten judges selected using triangle tests (Watts, 1989) from a group of 30 women in the age group of 20 to 25 years. The

combination which got the highest scores was selected for the formulation of the product.

Preparation of raw ingredients

Rice flour

18kg of good quality rice was purchased and flour prepared. The procedure involved in flour preparation include, winnowing, washing, draining, sundrying for 2 days, cooling to room temperature, milling and seiving twice in a seive of 100 B.S. mesh.

Defatted soy flour

Defatted soy flour has the additional advantage of being comparatively less expensive than other pulses the cost being Rs. 12/Kg. 6 Kg of defatted soy flour was purchased in bulk from Shakthi Soyas, Pollachi, Tamil Nadu.

Maida

6 Kg of good quality maida was purchased in bulk from the supermarket. Maida was sundried for 6 hours to

improve the shelf-life quality and then seived twice in a seive of 100 B.S. mesh to remove the impurities.

3.1.3. Development of the extruded product

Blend of the selected combination was prepared by mixing rice flour, soy flour and maida. All the ingredients after mixing were seived 3 times in order to get uniform mixture. The quantity of water was adjusted in such a level that a pliable dough was obtained. The dough was fed into an extruder to get the finished product (Fig. 1). The product thus obtained was further dried and packed in polyethylene bags.

3.1.4. Cooking quality

Cooking quality of sev was ascertained through cooking time, water absorption index and bulk density.

Cooking time

The cooking time of the product was assessed by cooking 25g of of sev with 100 ml water. The product was

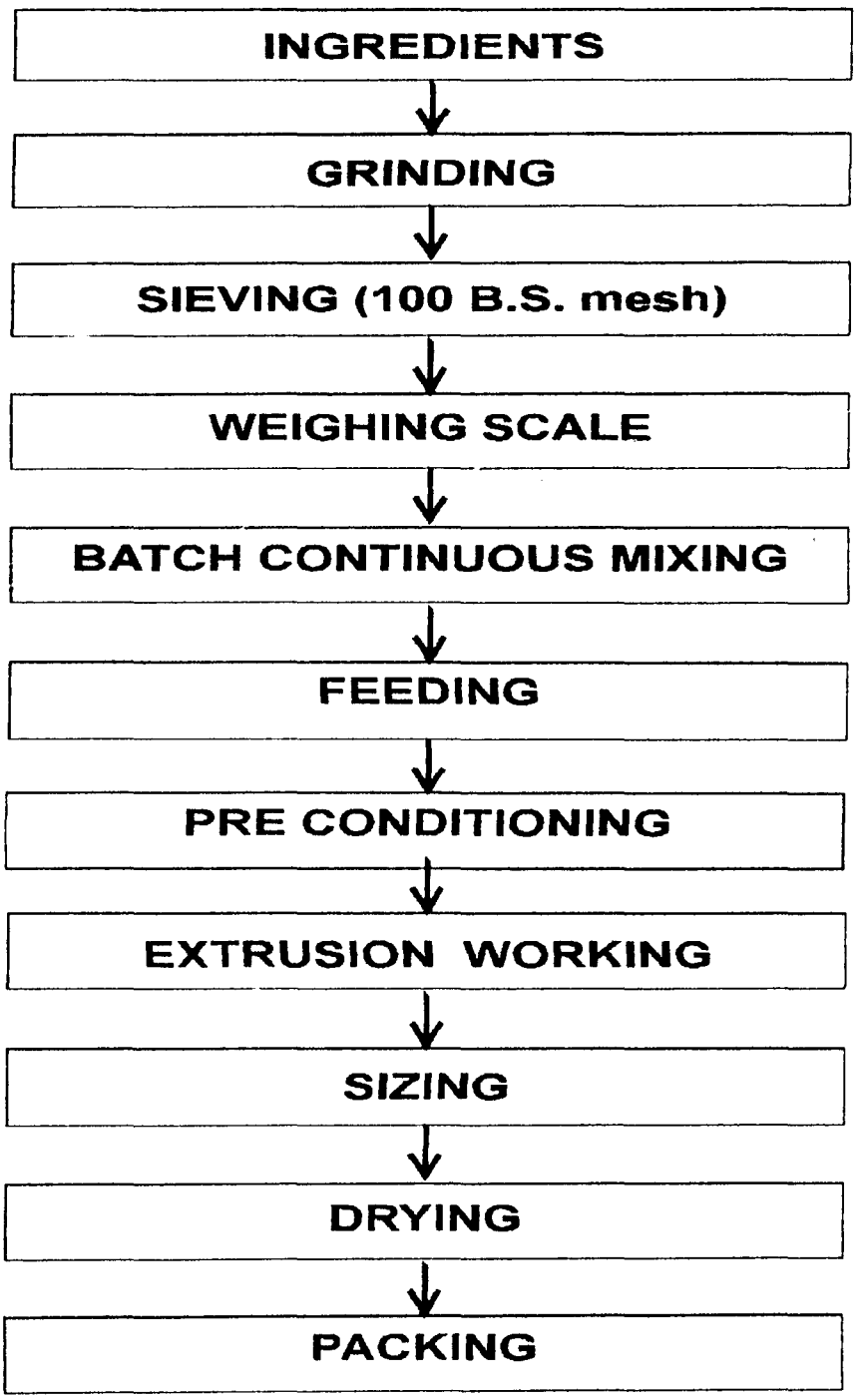


Fig. 1. Flow chart for the development of sev.

cooked till done and the time taken was recorded. The end point was tested by pressing the cooked samples between two glass slides.

Water absorption index

Water absorption index is the quantity of water absorbed by a known quantity of food samples. This is mainly used to assess the rehydration capacity of the extruded product. 50g raw sev was taken in a glass beaker. 100ml of water was added to it. Water was drained after 10 minutes. The weight of hydrated sample was recorded. The water absorption index was calculated by weight of hydrated sample minus weight of raw sample.

Bulk density

Bulk density is the ratio of the weight of sample to the weight of equal volume of water. Bulk density is used as an index for comparing the volume of different foods. The required quantity of sev was taken at a height of 20cm in a 250ml beaker until it is filled up. It was levelled without compressing. The weight of sample with the beaker was

recorded. The sample was then removed from the beaker and water was filled at the same level (20cm). The weight of water with beaker was recorded.

$$\text{Bulk density} = \frac{\text{Weight of sample}}{\text{Weight of equal volume of water}}$$

3.1.5. Type tests administered to the developed product

The Bureau of Indian Standards has specified certain type tests for various products to maintain quality during processing and marketing.

Estimation of moisture, total ash, acid insoluble ash, protein and total solids in gruel, are the major type tests administered to sev. These tests were, carried out using standard techniques (IS 9487, 1980).

3.2. Assessing the acceptability of the extruded product

The acceptability of the developed extruded product was ascertained with special reference to physical characteristics, organoleptic qualities and nutritional significance.

3.2.1. Physical characteristics

Physical characteristics are one of the important criteria for the acceptance of any product. The important physical characteristics of any extruded product are fineness, shape, uniformity of strands, tensile strength and packaging quality. A panel of ten technical experts were selected using triangle test (Watts *et al.*, 1989), to ascertain the physical characteristics of the developed product using a standardised pretested score card (Appendix 3).

3.2.2. Organoleptic qualities

The organoleptic qualities of the developed product was assessed by the same panel of judges. The major quality attributes included in the score card (Appendix 4) were appearance, colour, flavour, texture and taste. A scale from five to one was used, five representing the optimum for all the quality characteristics.

3.2.3. Nutritional quality of the product

The nutritional significance of the developed extruded product was assessed by estimating the major nutrients using standard techniques.

Sl.No.	Estimations	References
1.	Energy	Swaminathan (1984)
2.	Protein	Microkjeldal (ICMR, 1983)
3.	Carbohydrate	Antherone method
4.	Minerals (Fe, Ca, Mg & Zn)	Jackson (1973)

3.3. Standardisation of recipes with the developed product

Standardisation of recipe is an essential strive for high quality products (Crusius, 1984).

According to Tolule (1984) the procedure for recipe standardisation began with the process of recipe modification or adjustment.

As a first step for the standardisation of new recipes sources of recipe such as standard cookery books, journals and magazines were referred.

Fifteen recipes based on sev were formulated and standardized in the laboratory, as detailed below :

1. Sev Kheer
2. Sev Idli
3. Sev Uppuma
4. Sev Puttu
5. Sev Sweet samosa
6. Sev Triflower
7. Vegetable sev
8. Sev Kofta pulao
9. Sev Biriyani
10. Sev Loaf
11. Mango sev
12. Lime sev
13. Sev Bolongness
14. Sev Kedgeree
15. Italian sev

3.3.1. Acceptability of the developed recipes

Organoleptic quality of the developed recipes were assessed as explained in 3.2.2.

3.3.2. Preference test for the recipes

According to Swaminathan (1984) for preference tests a large number of persons are required. Their evaluation should come spontaneously based on their judgment.

Preference tests for the fifteen recipes were conducted among college students of the institution and farm women.

3.3.2.1. Preference test for the recipes among College students

In the newly emerging era of fast and convenience foods, snack foods, are becoming increasingly popular among College students.

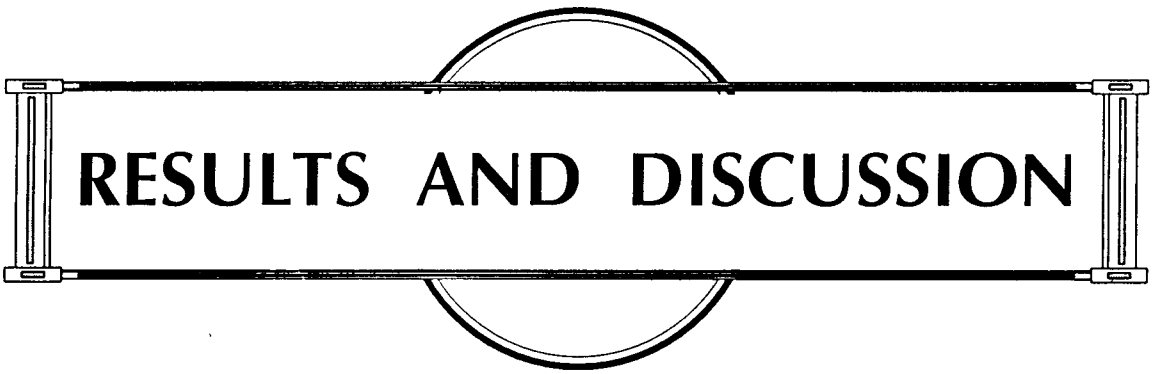
Hundred students from the ladies hostel were selected at random. The prepared recipes were served to them and they were requested to rank each recipe according to their preference. A scale from nine to one was used, nine representing the optimum. Steps were taken to avoid discussion among them during rating.

3.3.2.2. Preference test for the developed recipes among rural women

Any result obtained in the laboratory should reach the land for the timely utilization of the findings. In todays fast changing world, farmer's life style and food habits are also changing. Hence introducing cheap and nutritious the snack food products, to farm women is highly essential. Fifty farm women were selected at random from Kalliyoor Panchayath in Nemom block. A good rapport had already been established through several extension education programmes and the university personnel were very familiar to the women in this area. The prepared recipes were served to the women and they were requested to rank the products according to their preference. The rating scale used for this test was the same, as used for the College students (Appendix 6).

Statistical analysis

The data generated during the study were compiled analysed statistically and presented under results and discussion.


RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

The present investigation on "standardisation of recipes based on rice soya extruded product" gives a comprehensive information on :

4.1. Formulation of the extruded product

4.2. Acceptability of the extruded product

4.3. Standardisation of recipes with the extruded product

4.1. Formulation of the extruded product

Significant progress has been made by food industries in our country in recent years in the area of development of food products (Rao, 1993). In the present study an extruded product sev was developed. The major steps observed in product development were selection of raw ingredients and the different combinations tried for the formulation of sev, ensuring the cooking and nutritional quality and assessing the physical characteristics of the developed product.

4.1.1. Different combinations tried for the formulation of the extruded food product sev

The raw ingredients selected for any food product play an important role in determining the quality of product. Mixing the food ingredients selected in different combinations will decide the nutritional quality, extrusion behaviour in the case of extruded products, cost and sensory properties of the product. Hence, the combination of ingredients in a product is equally important as the nature and properties of its ingredients.

Rice and defatted soy flour were the basic materials for the development of sev. Maida, cassava and sweet potato flour were tried with these food ingredients in different proportions for the processing of sev. The different combinations of food materials attempted for the processing of sev are presented in Table 1.

As indicated in Table 1, rice was added in the proportion ranging from 50 to 70 per cent. Rice, the staple cereal of Keralites was the major ingredient in sev. According to Pillaiyar (1988) rice has been recognised as a

initial food material for more than half of the world's population and among cereals, it has a comparatively high content of essential amino acids. More over as revealed by Pillaiyar (1988) the true protein digestability and the biological value of rice protein are the highest when compared with wheat and other cereals.

The pulse complement used to formulate the extruded food along with rice in the present study was defatted soya flour. This food material though unfamiliar to Keralites, has been chosen since soybean has long been recognised as an excellent source of protein for feeding both animal and man (Irwin, 1994). Soyabean is one of the cheapest source of protein available today (Jayalakshmi *et al.* 1987). As stated in a CFTRI (1992) report it has about 40 per cent protein, which is twice the protein content of the common pulses. Schorden *et al.* (1973) has concluded that soyabean protein is unique among plant proteins by virtue of their high biological value and the essential amino acid pattern. Due to the above mentioned reasons soybean has been added in the proportion ranging from 5 to 25 per cent.

Maida or refined wheat flour, the third ingredient in the combinations was added at 15 to 30 per cent level. Refined wheat flour is extensively used in the preparation of various items like biscuits, cakes, crackers and breakfast items. Maida or refined wheat flour contains gluten, a protein which acts as a binder. This binding property of maida is very essential for the processing of extruded food products, and with this objective maida was tried in different proportions for the formulation of sev.

According to Gosh (1984) cassava is a poor man's food crop and it is used as a partial substitute for cereals to a considerable extent. The tuber is mainly a carbohydrate food and can be used in place of cereals partly supplementing it with protein. Hence cassava flour was tried in combinations ranging from 23 to 35 per cent.

Sweet potato, in addition to its starch content, also contains various sugars, minerals and proteins with all essential amino acids. It also contains a sufficient amount of carotene and it is locally available (Tsou and Hong, 1992). Hence sweet potato flour was also tried at different levels ranging from 28 to 30 per cent.

Table 1. Composition of the food ingredients in the different combinations of the extruded food

Sl. No.	Combinations	Ingredients	Proportions
1.	C_1	Rice : Soya : S. potato	65 : 5 : 30
2.	C_2	Rice : Soya : S. potato	60 : 12 : 28
3.	C_3	Rice : Soya : Cassava	60 : 17 : 23
4.	C_4	Rice : Soya : Cassava	50 : 15 : 35
5.	C_5	Rice : Soya : Maida	70 : 15 : 15
6.	C_6	Rice : Soya : Maida	65 : 15 : 20
7.	C_7	Rice : Soya : Maida	60 : 10 : 30
8.	C_8	Rice : Soya : Maida	60 : 15 : 25
9.	C_9	Rice : Soya : Maida	55 : 17 : 28
10.	C_{10}	Rice : Soya : Maida	50 : 25 : 25
11.	C_{11}	Rice : Soya : Maida	50 : 20 : 30
12.	C_{12}	Rice : Soya : Maida	60 : 20 : 20

S. Potato - Sweet potato

Selection of the best combination for the stress development of sev.

The principles governing the selection of the suitable combination were protein quality, extrusion behaviour, cost and organoleptic evaluation.

Protein quality

The protein quality of each combination was assessed on the basis of amino acid score, inorder to identify the proportion with the favourable amino acid composition. The amino acid scores of the twelve combinations were computed.

The amino acid scores vary from 68.10 to 78.34 (Table 2). The highest amino acid score was obtained for combination 12, which contained rice - soya maida mix in the ratio 60 : 20 : 20. Combination two has got an amino acid score of 74.70 and combination 3 has got an amino acid score of 72.60. The reason for their comparitively low amino acid score may be mainly due to the low content of soy flour in them. While combination four was found to be better than

combinations two and three, with the ratio 50 : 15 : 35 (amino acid score was 77.660. The amino acid sore of the fifth and the sixth combinations were 71.80 and 70.80 respectively, both of these contained only 15 per cent soy flour.

Combination eight (rice 6, soya 15 and maida 25 per cent) was found to be superior to combination seven (rice 60, soya 10 and maida 30 per cent) and the amino acid score for the eighth combination was 76.70 and for the seventh combination was 72-60. Combination nine has got an amino acid score of 73.80 which had 17 per cent soy flour. The amino acid score obtained for combination 10 and 11 were 75.13 and 76.95 respectively and these were superior to combination nine. The lowest amino acid score of 68-10 was observed for combination one (rice 65, soya 5 and maida 30 per cent).

The twelfth combination got the highest amino acid score of 78.34 when compared with other combinations.

Table 2. Amino acid score of different combinations

Sl.No.	Combinations	Amino acid scores
1.	C_1	68.10
2.	C_2	74.70
3.	C_3	72.60
4.	C_4	77.60
5.	C_5	71.80
6.	C_6	70.80
7.	C_7	72.90
8.	C_8	76.70
9.	C_9	73.80
10.	C_{10}	75.13
11.	C_{11}	76.95
12.	C_{12}	78.34

Extrusion behaviour

The extrusion behaviour of the combinations was assessed by ten technical experts using a standardised pre tested score card. Extrusion behaviour was observed by the rate of flow and uniformity of strands and recorded three times with a time interval of 15 days by each panel member to have accurate assessment.

As revealed in Table 3, it could be observed that the highest mean score for extrusion behaviour was obtained for the twelfth combination (rice 60, soya 20, maida 20 per cent) and the lowest mean score of 3.30 was obtained by the first combination (rice 65, soya 5 and sweet potato 30). The second and third combinations have got the same mean score for extrusion behaviour. Fourth combination has got a mean score of 37.20 and this was found to be superior than the second and the third combinations. The fifth combination was better than the sixth and the seventh combinations. The eight combination has got a mean score similar to the sixth combination. Ninth combination was observed to be better than the tenth and eleventh combinations.

The variation in extrusion behaviour of the combinations were statistically analysed using Kruskal Wallis test and the results obtained are presented in Table 3.

The extrusion behaviour was superior for the twelfth combination when compared to all the other combinations. At the same time the tenth combination was found to be better than the combinations one, two, three, and fourth. All the other combinations were observed to be on par with the extrusion behaviour.

Table 3. Extrusion behaviour of the combinations

Sl.No.	Combinations	Mean score
1.	C_1	33.30
2.	C_2	38.45
3.	C_3	38.45
4.	C_4	37.20
5.	C_5	55.30
6.	C_6	60.45
7.	C_7	65.60
8.	C_8	60.45
9.	C_9	70.75
10.	C_{10}	81.05
11.	C_{11}	78.25
12.	C_{12}	106.75

Critical value - 30.49

Kruskal Walli's test criterian : X^2_{11} = 54.77^{**}

** Significant at 1% level

Table 4. Cost analysis of the combinations

Sl.No.	Combinations	Cost/Kg
1.	C_1	1.12
2.	C_2	1.20
3.	C_3	1.20
4.	C_4	1.21
5.	C_5	1.30
6.	C_6	1.20
7.	C_7	1.50
8.	C_8	1.20
9.	C_9	1.20
10.	C_{10}	1.20
11.	C_{11}	1.20
12.	C_{12}	1.10

Cost analysis

The cost of each combination was computed according to the market price of the ingredients. The prices of the food materials were collected from the local markets and the actual price of the different ingredients used for 1 kg of the product were computed and are presented in Table 4.

The highest cost of Rs. 1.50 was obtained for combination seven. For the second, third, sixth , eighth, ninth, tenth and eleventh combinations the cost was found to be uniform (Rs. 1.20). The cost analysis of the first, fourth and fifth combinations were Rs. 1.12, 1.21 and 1.30 respectively. The lowest cost of Rs. 1.10 was observed for combination twelve.

Organoleptic evaluation

According to Neelofer (1992) quality is a degree of excellence and is a composite characteristic determining acceptability. The organoleptic qualities can be assessed by sensory evaluation. The significance of sensory evaluation of food is increasing as this provides information which may be utilized for development of a product and its improvement.

According to Kramer and Twigg (1970) food quality detectable by our senses can be broken down into the main categories viz. appearance, colour, flavour, texture and taste.

The organoleptic qualities of the twelve combinations were carried out by a panel of ten selected judges using a standardised pre-tested score card.

The results of organoleptic qualities showed that the highest mean score for appearance was obtained for combination twelve. For the qualities viz. colour and flavour, the mean score was maximum for the twelfth combination. The twelfth combination has got the highest score for the qualities such as texture and taste also.

The variation in organoleptic qualities of the combinations were tested using Kruskal Walli's test and all the qualities were found to vary among the combinations. The results are presented in Table 5.

The appearance of the twelfth combination was found to be superior to all the other combinations, and it had a mean score of 113.20. While the eleventh combination was

found to be superior to combinations one, two, three, five and eight. All the other combinations were found to be on par with the quality appearance.

Colour and flavour of the twelfth combination was best when compared to other combinations. The eleventh combinations was better than the combinations one, two, three, four, five, six, seven and eight for the quality colour and for flavour the eleventh combination was superior to combinations one, two, three, four, five and six.

For the quality texture and taste the difference was found to be significant for the twelfth combination, among the different combinations tried. At the same time for the quality texture the eleventh combination was observed superior to combinations one, two, three, four, five, seven and eight, and the mean score obtained for the eleventh combination was higher than the combinations one, two, three four, five, six and eight for the quality taste.

The analysis revealed that the twelfth combination was superior in all the parameters viz. amino acid score, extrusion behaviour, cost and organoleptic evaluation, when

compared to all the other combinations. Hence the twelfth combination with rice 60, soy 20 and maida 20 per cent was selected for the formulation of the extruded product, sev.

Table 5. Organoleptic evaluation of the combinations

Sl. No.	Combinations	Mean Score				
		Appearance	Colour	Flavour	Texture	Taste
1.	C_1	46.90	48.40	56.20	53.55	37.65
2.	C_2	25.05	28.80	29.60	36.00	29.10
3.	C_3	51.35	43.50	42.90	36.00	33.50
4.	C_4	55.70	53.30	43.00	36.00	41.80
5.	C_5	42.55	38.60	42.80	44.80	49.85
6.	C_6	55.70	62.05	51.80	75.40	62.80
7.	C_7	64.40	48.40	65.00	44.75	67.20
8.	C_8	51.25	53.30	65.00	49.15	54.50
9.	C_9	68.85	75.70	65.00	66.70	67.20
10.	C_{10}	68.85	65.90	65.00	79.75	76.00
11.	C_{11}	82.20	94.95	87.50	92.80	93.60
12.	C_{12}	113.20	113.10	112.20	111.10	112.80

Critical value = 30.49

Kruskal Walli's Test criterian :	53.46^{**}	63.03^{**}	54.71^{**}	65.44^{**}	66.42^{**}

** Significant at 1% level

4.1.3. Development of the extruded product

30 kg of the extruded product was developed as explained in 3.1.3. sample of the developed product was further analysed for cooking quality though cooking time, water absorption index and bulk density.

4.1.4 Cooking quality of the extruded food sev

Time, labour and fuel saving factors of any food product play a decisive role in conditioning their popularity among consumers. Products which can be cooked using less energy will have a large potential (Natarajan, 1993), and hence the cooking time of the developed extruded product sev was determined. The cooking time was ascertained from the time of adding the product to boiling water till it got completely cooked, using a stop watch (Table 6). When the cooking time of the developed rice-soy sev was compared with the standard sev, it was found that there was not much variation. The cooking time obtained for rice-soy sev was 7.13 minutes and for standard sev it was 7.18 minutes.

Table 6. Cooking characteristics of the rice - soy sev.

Product	Cooking time (mts)	Water absorption index	Bulk density
Rice-soy sev	7.13	0.61	0.46
Standard sev	7.18	0.51	0.46

Water absorption index

The water absorption index or rehydration capacity of the rice-soy sev was analysed as 0.61 and this was observed to be slightly higher than the standard sev (0.51) which is desirable since higher water absorption can increase the volume.

Bulk density

Bulk density is the characteristic physical property of solid foods (Potter, 1988). The bulk density of the developed rice-soy sev was compared with the standard sev and this was found to be same for both the products.

4.1.5. Type test administered to the extruded product

Implementation of quality system standards for the food products would result in several benefits. Through total efforts for improvement and sustenance of quality, cost, benefit could be achieved which would give consumer satisfactions and better image for the products. The Bureau of Indian Standards has specified certain type tests for various products to maintain quality during marketing. Estimation of moisture, total ash, acid insoluble ash, protein and total solids in gruel, are the major type tests administered to sev (IS 9478, 1980) (Table 7).

Table 7. Type tests administered to the developed product

Sl.No.	Tests	Sev	ISI specification
1.	Moisture (per cent)	8.20	11.00
2.	Total ash (per cent)	0.80	0.70
3.	Acid insoluble ash (per cent)	0.04	0.05
4.	Total protein (g)	13.50	10.00
5.	Total solids in gruel (per cent)	8.00	8.00

Moisture content of the sev was found to be 8.20 per cent while the ISI has specified a maximum limit of 11.00 per cent. The lower moisture content of the product is beneficial since it may improve the keeping quality of the product.

The ash content of sev was analysed and found to be 0.80 per cent, which is slightly higher than the ISI specified value (0.70 per cent). On of the raw ingredients present in the sev was soy flour which is rich in minerals. So, the increased mineral content of the product may be the reason for the higher ash content.

The acid insoluble ash, which gives informations regarding the inorganic salts present in the product was found to be 0.04, per cent. However, this value was within the limit specified by ISI (0.05 per cent).

ISI has prescribed 10.00 per cent protein for sev. But the product processed in the present investigation was found to be higher in protein content (13.50 per cent), which will help in improving the nutritional quality of the product. The incorporation of soy flour in the product may

be the reason for this higher value. Thirumaran (1993) has also observed 11.20 per cent protein in soy-incorporated vermicelli.

The total solids in gruel will give information regarding the water soluble ingredients and percentage of cooking loss. For sev, total solids in gruel was estimated as 8.00 per cent, which was the same as specified by the ISI.

4.2. Acceptability of the developed extruded product

The acceptability of the developed extruded product sev, was ascertained with special reference to :

4.2.1. Physical characteristics

4.2.2. Organoleptic qualities and

4.2.3. Nutritive value

4.2.1. Physical characteristics of the extruded product

In our country more emphasis is given to the chemical standards of the food product rather than to the

physical and culinary standards. The physical characteristics is an important criteria for product acceptance. The physical characteristics which may decide the acceptance of extruded products are fineness, shape, uniformity of strands, packaging quality and tensile strength. The fineness, shape and uniformity of strands determine the acceptance of the product. According to Prince *et al.* (1994), tensile strength is the ability to with- stand force. Veeraraju (1993) feels that packaging quality of a product should also be given emphasis since it is the link between the food processor and consumer.

The physical characteristics of the extruded product `sev' was assessed with a panel of ten technical experts, using a standardised pretested score card. A scale from five to one was used, five representing the optimum for all the quality characteristics. The score obtained are presented in Table 8.

Table 8. Physical characteristics of the extruded product

Product	Quality parameters				
	Fineness	Shape	Uniformity of strands	Packaging quality	Tensile strength
Rice-soy sev	4.60	4.90	4.30	4.6	4.80
Standard sev	4.60	4.80	4.80	4.9	4.70

The fineness of rice-soy sev and standard sev were found to be same. The shape of the rice soy sev was better than the standard sev (4.80). In the case of uniformity of standards the standard sev (4.80) was better than the rice-soy sev (4.30).

Naratta (1986) has defined packaging quality as the ability of the product to withstand insect infestation, absorption of moisture, heat and dynamic stress. The packaging quality of the developed sev was slightly lower than the standard sev.

The developed sev could be rated as better than the standard sev in the quality parameter `tensile strength'. Incorporation of soyflour in the developed sev has increased the protein content and that may be the reason for higher score obtained for tensile strength. This finding is in line with the findings of Chellammal (1995). In her study she had found an increasing trend in tensile strength with the increased level of soya in the dough mix.

The assessment on the physical characteristics of the rice-soy sev revealed that the fineness and shape of the rice-soy sev were good. For the quality uniformity of strands there was slight only slight difference between the rice-soy sev and standard sev. The packaging quality and tensile strength of the rice-soy sev was also found to be good.

4.2.2 Organoleptic qualities of the extruded product

The quality of a food, is a combination of the attributes that determine the degree of acceptability of the product. For an average consumer, the concept of food

quality consists of those related to the sensory characteristics with the human senses of perception as appearance, colour, flavour, kinesthetics and taste (Setty, 1989).

Any new food product should be formulated, keeping in mind the requirements and acceptance of consumers and their regional bias. It should aim at the targetted groups of consumers, opines Datta (1993).

According to Jayalekshmi (1991), a consumer is an individual, male or female, belonging to high medium or low income groups for an urban or rural area of labour, administrative or business class, who buys articles and services. Hence, before transferring the technology the organoleptic qualities of the developed foods have to be assessed by the consumers.

Accordingly quality parameters such as appearance, colour flavour, texture and taste were assessed by ten technical experts (Table 9).

Table 9. Organoleptic qualities of the extruded product

Products	Quality parameters				
	Appearance	Colour	Flavour	Texture	Taste
Rice soy sev	4.50	3.00	4.40	4.30	4.40
Standard sev	4.70	4.50	4.60	4.50	4.40

The first impression of food is usually visual and major part of our willingness to accept a food depends on its appearance. It is a composite of all information about the product and its environment which reaches the eye (Birch *et al.* 1988). The appearance of rice-soy sev and standard sev was assessed and the results revealed that the scores were 4.50 and 4.70 respectively. The score obtained for rice-soy sev was slightly lower the standard sev. Rice-soy sev was light brown in appearance, which is not acceptable for such a product and that might have contributed to the low score.

Colour, one of the important visual attributes, has been used to judge the over all quality of foods for a very long times. If the colour is unattractive, a potential consumer may not be impressed by the other major attributes. The score obtained for the colour of the rice-soy sev was 3.00, while that of standard sev was 4.50. The brown colour of rice-soy sev was not appealing and that may be the reason for its low score. The addition of soy flour in the product was the reason for the brown colour. Lower acceptability due to brown colour in soy incorporated vermicelli was also observed by Shama and Chellammal (1996).

Odour preference is generated by stimulation of the sensory cells by specific compounds present in the food. According to Birch (1988). flavour is the mingled but unitary experience of sensation produced by a material taken in the mouth perceived principally by the senses of basic smell and by the other cutaneous sensation in the mouth. The score for flavour for rice-soy sev was found to be 4.40 while a score of 4.50 was obtained for standard sev.

Texture constitute a physical property of food stuffs apprehended by the eyes, skin and muscle senses located in the mouth. The score obtained for texture by rice-soy sev was 4.30 and that of standard sev was 4.50.

Taste is the major attribute which determines the acceptability of a food material. It is not only a sensory response to soluble materials but also aesthetic appreciation of the mouth. The scores for taste for rice-soy sev and standard sev was the same (4.40).

The assessment of the organoleptic qualities of rice-soy sev revealed that for quality parameters such as appearance and colour it has got slightly low score compared to standard sev. The reason for this may be due to the slight brown colour and this could be improved in future. However the taste of the rice-soy sev was rated equal to standard sev.

4.2.3. Nutritive value of the developed extruded food

Acceptability, nutritive value and cost are the prime elements of good food. Traditional food satisfied these parameters adequately. So any new food product should be developed based on these principles (Potty, 1993). According to Rao (1992) the consumer expects to meet his nutritional needs as much from processed foods as from the natural food when he partially substitutes the latter for the former.

The nutritive value of the extruded food developed was estimated in the laboratory. According to Amla (1993) when new food products are developed, the nutritive value may get lost because of the inappropriate processing methods. To ascertain the nutrient loss during processing the nutritive value of the rice-soy sev was also determined before processing. These datas are presented in Table 10 to bring out the details pertaining to nutrient losses if any during processing.

Protein

Protein is one of the most important nutrients required by the body to carry out a wide range of functions

essential for body building and the maintenance of life. On analysis the protein content of the developed extruded food was found to be 13.50g. The protein content of the food revealed a higher value (14.68)' before processing than in the final product. This finding is in line with the results obtained by Chellammal and Prema (1995). In their study of extrusion of tubers, they found that during extrusion there was an overall loss of protein. Maga and Sizer (1979) have also reported a similar significant loss of protein during the extrusion of potato flakes.

Energy

Energy is essential for rest, activity, growth and maintenance of good health. The estimated value for energy of the extruded food was found to be 360 K Cal, while the value before processing was slightly high (364 Kcl). This variation may be due to loss during processing.

Carbohydrates

Carbohydrates in any processed foods account for about 50 to 60 per cent of energy. The extruded food developed in the present study was found to have 66.36 g of

carbohydrates while the value before processing exhibited a slightly higher value (69.00 g) revealing losses during processing. Chang and Johnson (1977) who studied the effect of extrusion on carbohydrate stated that the loss during processing may be due to the gelatinization of cereal starches.

Calcium

The calcium content of the extruded food was analysed and it was found to be 53.00 mg. The value obtained for calcium before processing was 55.00 mg. This variation may be due to the loss during processing.

Magnesium

The magnesium content of the developed food was estimated as 81.10 mg. The value before processing for magnesium was slightly higher (82.00 mg).

Zinc

Zinc is an important element as it acts as a co-factor for a number of enzymes in the body. The

estimation of the zinc content of the extruded food was found to be 1.078 mg and the value before processing was 1.84 mg and this may be due to loss during processing.

Iron

The iron content of the product was analysed as 2.23 mg, while the value obtained for iron before processing was 3.22 mg, indicating the loss of iron during processing.

Table 10. Nutritive value of the extruded food

Nutrients	Before processing	After processing
Protein (g)	14.68	13.50
Energy (K Cal)	364.00	360.00
Carbohydrate (g)	69.00	66.36
Calcium (mg)	55.00	53.00
Magnesium (mg)	82.00	81.10
Zinc (mg)	1.84	1.78
Iron (mg)	3.22	2.23

4.3. Standardization of recipes with the extruded product

According to Crusius (1984) standardization of recipes is an essential strive for high quality products.

Any recipe that is new or has to be changed should be tested in small quantity before being used in regular production. The procedure of standardization consisted of

* Listing ingredients required for each recipes with their amounts
* Converting the ingredients of each recipe to metric system
* Determination of, the edible portion weight from the as purchased weight
* Cooking the recipes according to the procedure by maintaining the time, quality and quantity

In the present study fifteen recipes based on the extruded product sev, was formulated and standardized in the laboratory and are listed below.

1. Sev kheer
2. Sev idli
3. Sev upuma
4. Sev puttu
5. Sev sweet samosa
6. Sev triflower
7. Vegetable sev
8. Sev kofta pulao
9. Sev briyani
10. Sev loaf
11. Mango sev
12. Lime sev
13. Sev bologness
14. Sev kedgeree
15. Halian sev

4.3.1. Acceptability of the developed recipes

Organoleptic qualities of the standardized recipes were assessed by the already selected judges. The judges of the taste panel comprised of ten technical experts. The recipes were presented for tasting to the taste panel. A five point scale scoring sheet was formulated for each recipe and the judges were requested to assess the recipes in terms of appearance, colour, flavour, texture and taste.

According to (Christensen, 1985) as the consumer's preference to appearance is one of the major factor leading to the increasing demand of the product, it is very essential to keep the appearance of the product may very attractive.

Colour is associated with every aspect of our life and influences many of our day-to-day decisions, involving food. According to the reports from CFTRI (1990), the aesthetic, sensory characteristics and acceptability of food are all affected by colour.

According to Rolls *et al.* (1981) flavour is the quality attribute which stands next to taste. Ranganna (1986) has stated that flavour is an important factor which

enriches the consumer preference of a particular product. He further states, that texture is the property of food which is associated with the sense of feel or touch experienced by the finger or the mouth. According to Rolls *et al.* (1981) in the various quality attribute tests, the first preference goes to taste. Accordingly all the quality parameters were assessed for the developed recipes. The scores obtained for the recipes are presented in Table 11.

As per the decision of the panel members the first recipe sev kheer has got a mean score of 4.20 for appearance. For the other quality parameters such as colour, flavour and texture the mean scores obtained were 4.30, 4.20 and 4.00 respectively. The mean score obtained for taste was highest for sev kheer (4.60). The overall acceptability score obtained for sev kheer was 4.30.

Sev idli has secured a mean score of 3.80 (Table 11) for appearance, 3.00 for colour, 3.60 for flavour, 3.10 for texture and 3.70 for taste. Though sev idli was found to be acceptable it has got low scores for all the quality parameters when compared with sev kheer.

Sev upuma has got low scores for the quality parameters appearance and colour. The colour of the product was slightly brown and that may be the reason for this. But the flavour, texture and taste of the sev uppuma was found to be good. But when compared with sev kheer and sev idli the over all acceptability of sev upuma was low (3.28).

Sev puttu obtained comparatively low scores for appearance (2.80) and colour (2.80) which is due to its brown colour. Flavour, texture and taste of this preparation was 3.40, 3.60 and 3.30 respectively. Sev puttu has got an overall acceptability of 3.18 which was less than the scores obtained for sev kheer, sev idli and sev uppuma.

Sev sweet samosa obtained better scores for all the quality parameters. The score ranged from 3.30 to 4.00. The score for appearance was 3.90 for colour 4.00, for flavour 3.40, for texture 3.30 and for taste 3.70. Its over all acceptability revealed that, sev sweet samosa was better than sev puttu, sev uppuma and sev idli, but comparatively less preferred than sev kheer.

For all the quality parameters sev triflower secured good scores. The score obtained for appearance 4.40,

for colour 3.90, for flavour 3.90, for texture 4.30 and for taste 4.50. The over all acceptability of sev triflower was 4.20 which shared that it was better than sev sweet samosa, sev puttu, sev upuma and sev idli.

Vegetable sev has got the same scores for the quality parameters texture and taste (4.00). For appearance it has got a score of 3.50. For colour and flavour the scores were 3.70 and 3.50. When compared with the other recipes it can be seen that vegetable sev was better than sev that sweet samosa, sev puttu, sev upuma and sev idli. But it has got low score compared to sev kheer and sev triflower.

Sev kofta pulao was scored 3.60 for appearance 3.90 for colour, 3.90 for flavour, 4.10 for texture and 4.50 for taste. It has got a score of 4.00 for overall acceptability. Sev kofta pulao was better than vegetable sev, sev sweet samosa, sev puttu, sev uppuma, and sev iddli. But the scores obtained for sev kheer and sev tri flower were better when compared with sev kofta pulao.

The result of acceptability test obtained for sev biriyani revealed that for appearance and colour it has

secured the same score and for flavour and texture also the scores were same (Table 11). For taste, sev biriyani has got a score of 4.20. The overall acceptability score obtained for sev biriyani and vegetable sev were the same. Sev biriyani was found to be better than sev, sweet samosa, sev puttu, sev uppuma and sev iddli. Sev kheer, sev triflour and sev kofta pulao exhibited higher overall acceptability when compared to sev biriyani.

Sev loaf has got a score of 3.20 for appearance, 3.00 for colour, 2.90 for flavour, 3.00 for texture and 3.50 for taste. The over all acceptability of sev loaf was 3.12 and from this it is clear that sev kheer, sev iddli, sev uppuma, sev puttu, sev sweet samosa, sev tri flower, vegetable sev, sev kofta pulao and sev biriyani were better than sev loaf.

The scores obtained for mango sev ranged from 2.60 to 3.20. It has got an overall acceptability score of 2.80. The quality flavour has got very low score (2.60). The addition of mango in the recipe may be the reason for this.

Table 11 Mean scores of organoleptic qualities for the recipes

Quality parameters	Sev kheer	Sev idli	Sev upma	Sev puttu	Sev sweet samosa	Sev triflower	Vegetable sev	Sev kofta pulao	Sev biriyani	Sev loaf	Mango sev	Lime sev	Sev bolognes	Sev kedgeree	Italian sev
Appearance	4.20	3.80	2.80	2.80	3.90	4.40	3.50	3.60	3.20	3.20	2.70	2.70	3.10	2.60	2.70
Colour	4.30	3.00	2.80	2.80	4.00	3.90	3.70	3.90	3.20	3.00	2.70	2.60	2.60	2.60	2.80
Flavour	4.20	3.60	3.50	3.40	3.40	3.90	3.50	3.90	4.00	2.90	2.60	2.60	3.20	2.80	3.30
Texture	4.00	3.10	3.40	3.60	3.30	4.30	4.00	4.10	4.00	3.00	3.00	2.60	2.70	3.20	2.80
Taste	4.60	3.70	3.90	3.30	3.70	4.50	4.00	4.50	4.20	3.50	3.20	3.30	3.30	3.30	3.40
Over all acceptability	4.30	3.44	3.28	3.18	3.66	4.20	3.74	4.00	3.74	3.12	2.80	2.78	3.00	2.90	3.00

The different scores for lime sev was 2.70 for appearance, 2.60 for colour, 2.60 for flavour, 2.60 for texture and 3.30 for taste. The lowest score (2.78) for over all acceptability was obtained for lime sev, which revealed that all the other recipes were superior to lime sev.

Sev bologness has obtained a score of 3.10 for appearance, 2.60 for colour, 3.20 for flavour, 2.70 for texture and 3.30 for taste. The overall acceptability score was 3.00. Sev bologness was better than lime sev, mango sev, and sev kedgerce in overall acceptability. Sev kheer, sev iddli, sev uppuma, sev puttu, sev sweet samosa, sev tri flower, vegetable sev, sev kofta pulao, sev biriyani and sev loaf were superior to sev bologness.

Sev kedgeree got 2.60 for appearance, 2.60 for colour, 2.80 for flavour, 3.20 for texture and 3.30 for taste. The overall acceptability score was 2.90 which showed that sev kedgeree was superior than mango sev and lime sev but inferior to other recipes developed.

The scores obtained for italian sev ranged from 2.70 to 3.40. The overall acceptability was 3.00. Italian

sev and sev bologness were comparable. It was better than mango sev, lime sev and sev kedgeree.

The variation in organoleptic qualities like appearance, colour, flavour, texture and taste were statistically analysed using Kruskal Walli's test and the results are depicted in Table 12 and Fig. 2.

Among the fifteen recipes sev tri flower has got the highest total mean score for appearance (131.30) (Table 13) followed by sev kheer, sev sweet samosa, sev kofta pulao, vegetable sev, and sev idli. The total mean score were 123.00, 108.85, 98.10, 98.25 and 92.25 respectively. Of the different recipes, sev kedgerce has got the lowest mean score (36.75) for appearance.

Statistical analysis of the data revealed that for the quality appearance sev tri flower was found to be excellent when compared to all the other recipes. At the same time sev kheer was superior to sev biriyani, sev loaf, sev bologness, sev uppuma, sev puttu, mango sev, lime sev, Italian sev and sev kedgeree.

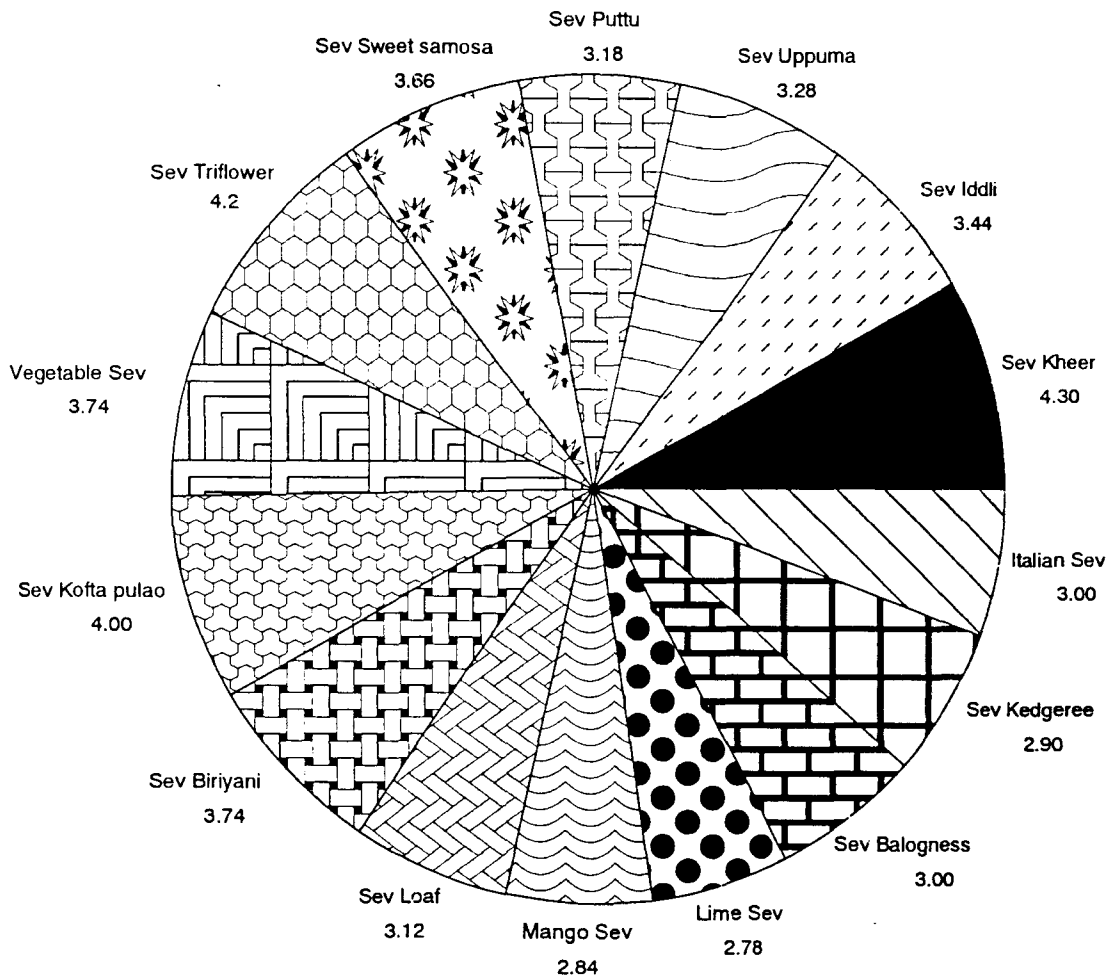


Fig. 2. Overall acceptability of recipes

For the quality colour sev kheer was scored superior and the mean score was 128.70. This was followed by sev sweet samosa, sev tri flower, sev kofta pulao and vegetable sev. While there was no significant difference observed between the recipes like sev idli, sev upuma, sev puttu, Italian sev, sev biriyani, sev loaf, sev bologness, sev kedgeree, mango sev and lime sev for the quality colour.

The mean score obtained for flavour by sev kheer was 119.85, and this was significantly higher than the other recipes. For sev tri flower, sev kofta pulao, sev biriyani, and vegetable sev the mean scores were 104.60, 104.60, 104.60, and 86.50 respectively. Besides that sev tri flower, sev kofta pulao and sev biriyani were found to be superior to sev loaf, mango sev, time sev, sev bologness, sev kedgeree and Italian sev for the quality flavour.

For the quality texture sev kofta pulao has got a highest mean score of 128.00, followed by sev tri flower, sev biriyani sev kheer and sev with vegetables. The mean scores obtained were 121.40, 111.50, 108.50 and 105.50 respectively. At the same time sev tri flower was superior to sev sweet samosa, mango sev, lime sev, sev loaf, sev bologness, sev kedgeree and Italian sev, for the quality texture.

In the case of the quality taste, sev kheer was found to be superior to all the other recipes (121.90). This was followed by sev biriyani and sev uppuma. While sev tri flower was superior to sev iddli, sev puttu, sev sweet samosa, sev loaf, mango sev, lime sev, sev bologness, sev kedgeree and Italian sev for the quality taste. It could be observed that sev kheer was the best among the fifteen recipes.

4.3.2. Preference test for the developed recipes

Development of new food product or the reformulations of existing products can be attained either by introducing by different processing methods, or by the use of new ingredients, and the acceptability of these products could be assessed by conducting preference test on a large number of consumers (Watts *et al.* 1989). They also state that preference studies are designated to determine consumers subjective reactions to external phenomena and their reasons for having them. While conducting preference test the consumer expects to be favourably impressed with the food he tastes and exprsses displeasure if the product does not measure upto his anticipations.

Table 12. Organoleptic evaluation of the recipes (statistical analysis)

Sl. No.	Name of recipes	Mean Scores				
		Appearance	Colour	Flavour	Texture	Taste
1.	Sev kheer	123.00	128.70	119.85	108.50	121.90
2.	Sev iddli	92.25	67.30	80.30	61.10	74.30
3.	Sev uppuma	53.70	62.00	86.50	77.00	87.10
4.	Sev puttu	37.75	51.00	80.30	86.30	50.70
5.	Sev sweet samosa	108.85	126.00	80.30	67.40	72.30
6.	Sev triflower	131.30	114.10	104.60	121.40	117.50
7.	Vegetable sev	92.25	106.80	86.50	105.50	91.50
8.	Sev kofta pulao	98.10	114.10	104.60	128.00	95.90
9.	Sev biriyani	75.50	56.50	104.60	115.50	104.30
10.	Sev loaf	74.70	56.50	32.25	48.50	63.50
11.	Mango sev	42.80	56.50	27.60	48.50	44.30
12.	Lime sev	47.85	40.00	36.90	31.70	50.70
13.	Sev bologness	68.85	45.50	67.90	35.90	50.70
14.	Sev kedgerce	37.75	45.50	46.20	61.10	50.70
15.	Italian sev	47.85	62.00	74.10	40.10	57.10

Critical value - 38.08

Kruskal Walli's test criterian :

X^2_{14} = 85.13^{**} 90.12^{**} 72.23^{**} 94.06^{**} 59.72^{**}

** Significant at 1% level

In the present study preference test for the developed recipes were conducted among college students and farm women.

4.3.2.1 Preference of college students for the developed recipes

Convenience, novel and instant foods are becoming increasing by popular especially among college students. Hence in the present study preference test for the developed recipes were conducted among college students. Hundred college students from ladies hostel, College of Agriculture, Vellayani were selected at random and the significance of rice-soy recipes were explained to them by the investigator. The students were requested to taste the recipes and their preference on the degree of liking were recorded (Table 13). Data was collected using a nine point rating scale which varied from like extremely (9) to dislike extremely (1).

Among the fifteen recipes sev kheer was preferred most followed by sev triflower, sev biriyani and vegetable sev positively (92 per cent like extremely and 8 per cent like very much). Sev idli, sev upuma, and sev puttu were also rated positively. No negative scores were assigned to

any of these breakfast items. Sev sweet samosa and sev triflower were also scored positively and no negative ratings were recorded.

Both vegetable sev and sev kofta pulao got the same rate of preference by the respondents. In the case of sev biriyani 60 per cent of the respondents scored like extremely, 30 per cent as like very much and 10 per cent as like reasonably well.

Majority of the students rated positively for sev loaf, lime sev and sev bolognes, 6 per cent of them neither like nor disliked sev loaf. In the case of lime sev it was 24 per cent for sev bolognes it was 14 per cent. At the same time mango sev was opined to be positively rated by all the students.

56 per cent scored `like extremely', 34 per cent as `like very much' and 10 per cent as `like reasonably well' for sev kedgeree. Italian sev was rated by 62 per cent of the students as `like extremely', 26 per cent as `like very much' and 12 per cent as `like reasonably well'.

Statistical analysis of the data revealed that, there was significant difference among the recipes as far as the preference by college students are concerned.

4.3.2.2 Preference of farm women for the developed recipes

Any new technology developed in the field of food processing should reach the farm families from the laboratory, so that the technology can be called as complete.

In the present study samples of the developed recipes were distributed to farm women. They were requested to taste the recipes and their opinion on the degree of liking were recorded (Table 14).

Maximum percentage of women rated the recipes positively as like extremely, like very much, like reasonably well and like somewhat. Rates as do not like or dislike and "dislike somewhat" were recorded by only a small percentage of women.

Among the fifteen recipes sev kheer was preferred as high followed by sev triflower.

All the women (100 per cent) rated sev kheer positively as `like extremely' and `like very much'. Majority of the women (72 per cent) rated sev idli positively. While 10 per cent opined that they neither liked nor disliked it. 80 per cent women scored sev upama as `like extremely' and `like very much', while 20 pre cent as `like reasonably well'. Sev puttu was rated positively by 80 per cent women and 20 per cent as `like some what'.

Sev sweet samosa and sev triflower were scored positively as `like extremely' and `like very much' and as `like reasonably well' by many women.

Vegetable sev and sev kofta pulao were rated positively by majority of the women. However 10 per cent rated like `some what' for vegetable sev and 46 per cent for sev kofta pulao.

Sev biriyani was preferred positively by the women as `like extremely', `like very much' and `like reasonably well'. 94 per cent of the women rated sev loaf positively,

while 6 per cent neither liked nor disliked 76 per cent rated mango sev positively, however 16 per cent neither liked nor disliked it and 8 per cent rated as `disliked it some what'. Lime sev was rated positively by 96 per cent women, while 4 per cent neither liked nor disliked, it. Sev bologness was preferred positively by 92 per cent women and 8 per cent felt that they do not like as dislike it. Sev kedgerce was rated positively by the women. Italian sev was rated positively by most of the women (88 per cent), however 12 per cent opined that they neither liked nor disliked it.

Statistical analysis of the data showed that, there was significant difference between the recipes as far as the preference of farm women were concerned.

When the preference of college students and farm women were compared (Fig. 3) it could be observed that, sev kheer was scored as best by both the group. In the case of sev iddli there was difference between college students and farm women. The scores given by college students for sev

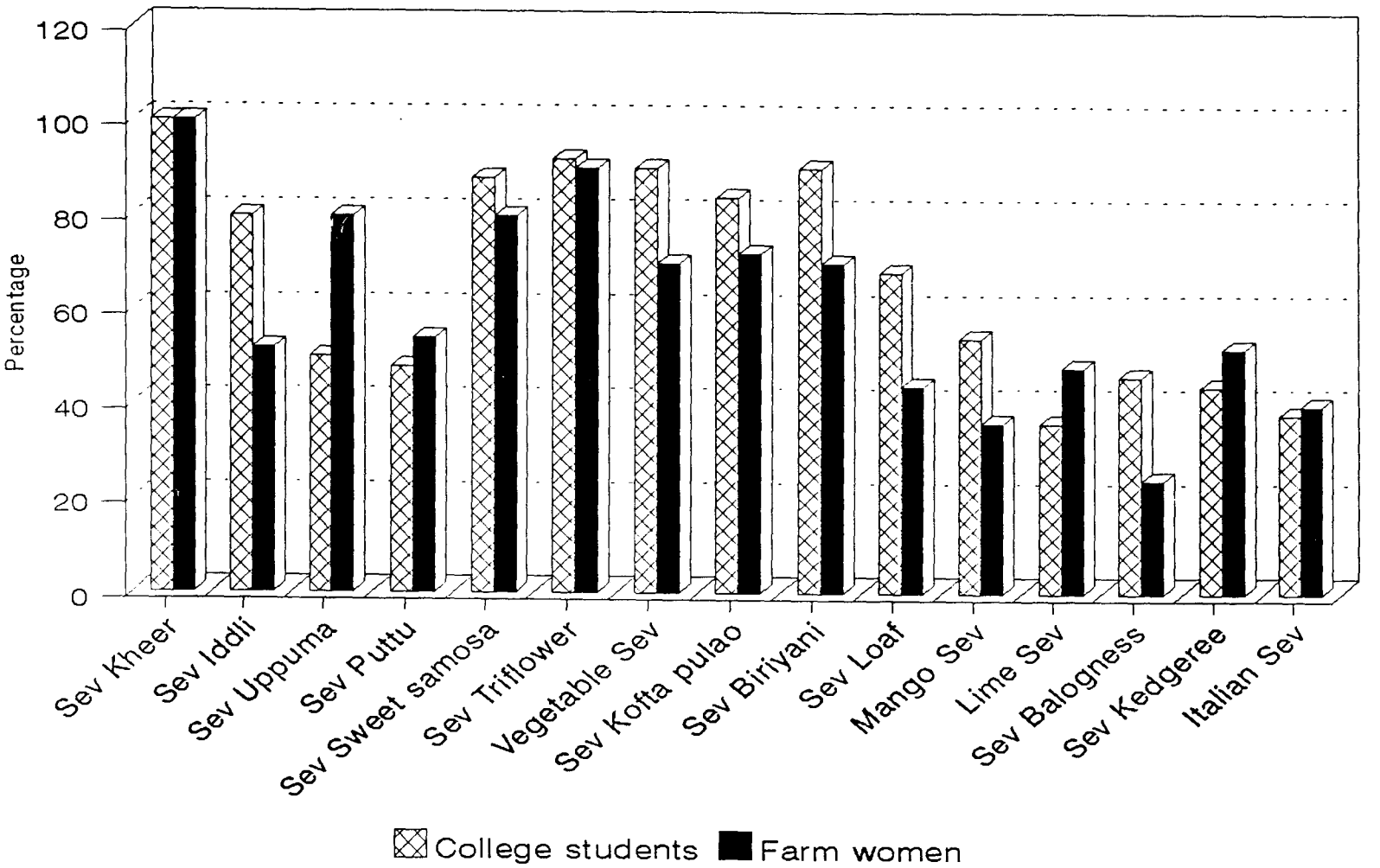


Fig. 3. Preference of College students & Farm women

iddli was high compared to farm women. Sev upama has got the highest preference by farm women than the college students. While there was only slight difference between the two groups for their preference to sev puttu. In the case of sev sweet samosa also, there was only slight difference among the groups for their liking. The difference was very less in the case of sev triflower.

For vegetable sev there was difference between the two groups. The preference given by the college students were higher than the rates given by farm women. For sev kofta pulao and sev biriyani the preference given by the college students were high compared to farm women. There was difference between the two groups for their liking to sev loaf. It is clear from the figure that the rating by college students was high compared to farm women for sev loaf. Mango sev was preferred by college students than farm women. While lime sev was preferred by farm women than the college students. Sev bologness was preferred by college students, while the preference given by farm women for sev bologness was very low compared to all the other recipes. Sev kedgerce and italian sev were preferred by farm women than college students.

Table 13. Rate of preference of the college students for the develop

Sl. No.	Name of recipes	Rating				
		Like extre-mely	Like very much	Like reaso-nable	Like some what	Do not like or dislike
1.	Sev kheer	92	8	--	--	--
2.	Sev iddli	12	68	10	10	--
3.	Sev uppuma	18	32	50	--	--
4.	Sev puttu	10	38	42	10	--
5.	Sev sweet	56	32	12	--	--
6.	Sev triflower	68	24	8	--	--
7.	Vegetable sev	38	52	5	5	--
8.	Sev kofta pulao	44	40	10	6	--
9.	Sev biriyani	60	30	10	--	--
10.	Sev loaf	18	50	16	10	6
11.	Mango sev	14	40	40	6	--
12.	Lime sev	12	24	20	20	24
13.	Sev bologness	20	26	25	15	14
14.	Sev kedgeree	34	10	56	--	--
15.	Italian sev	26	12	62	--	--

N = 50

Kruskal Walli's test criterion : $X^2_{26} = 424.69^{**}$

** Significant at 1% level

Table 14. Rate of preference of farm women for the recipes developed

Sl. No.	Name of recipes	Rating					
		Like extremely	Like very much	Like reasonable	Like some what	Do not like or dislike	Dislike some what
1.	Sev kheer	40 (80)	10 (20)	--	--	--	--
2.	Sev iddli	6 (12)	20 (40)	10 (20)	9 (18)	5 (10)	--
3.	Sev uppuma	16 (32)	24 (48)	10 (20)	--	--	--
4.	Sev puttu	5 (10)	22 (44)	13 (26)	10 (20)	--	--
5.	Sev sweet samosa	10 (20)	30 (60)	10 (20)	--	--	--
6.	Sev triflower	36 (72)	9 (18)	5 (10)	--	--	--
7.	Vegetable sev	20 (40)	15 (30)	10 (20)	5 (10)	--	--
8.	Sev kofta pulao	18 (36)	18 (36)	7 (14)	7 (14)	--	--
9.	Sev biriyani	25 (50)	10 (20)	15 (30)	--	--	--
10.	Sev loaf	4 (8)	18 (36)	15 (30)	10 (20)	3 (6)	--
11.	Mango sev	6 (12)	12 (24)	10 (20)	10 (20)	8 (16)	4 (8)
12.	Lime sev	5 (10)	19 (38)	15 (30)	9 (18)	2 (4)	--
13.	Sev bologness	--	12 (24)	16 (32)	18 (36)	4 (8)	--
14.	Sev kedgeree	14 (28)	12 (24)	14 (28)	10 (20)	--	--
15.	Italian sev	4 (8)	16 (32)	15 (30)	9 (18)	6 (12)	--

(Number in parenthesis denotes percentage)

N = 50

Kruskal Walli's test criterion : $X^2_{26} = 158.10^{**}$

** Significant at 1% level

Economics of the developed recipes

The cost of each recipe per serving was computed as per market price of raw ingredients and the results are presented in Table 15. The cost of sev kheer was found as Rs 2.00. Cost of sev iddli, sev uppuma and sev puttu were Rs. 1.50, 1.75 and 2.00 respectively. For sev sweet samosa and for sev triflower the price were Rs. 1.00 and Rs. 2.00. The cost for vegetable sev was observed as Rs. 2.50. For sev kofta pulao and sev biriyani the cost were Rs. 8.00 and Rs. 12.00 respectively. For sev loaf it was Rs. 1.25. Mango sev and lime sev have got the same price (Rs. 1.75). For sev bologness, sev kedgerce and italian sev, the prices were Rs. 3.00, 4.00 and 8.00 respectively.

All the sweet items were costly than savoury ones with exception to biriyani and kofta pulao. Addition of chicken and meat may be the reason for the high cost. Ordinary breakfast items like sev uppuma, sev puttu, sev iddli and vegetable sev were very cheap when compared with those prepared with rice or wheat. In general the cost analysis revealed that all the recipes developed are suitable for the middle income as well as low income families.

Table 15. Cost of the developed recipes

Name of Recipes	Cost/serving
Sev kheer	2.00
Sev iddli	1.50
Sev uppuma	1.75
Sev puttu	2.00
Sev sweet samosa	1.00
Sev triflower	2.00
Vegetable sev	2.50
Sev kofta pulao	8.00
Sev biriyani	2.00
Sev loaf	1.75
Mango sev	1.75
Lime sev	1.75
Sev bologness	3.00
Sev kedgeree	4.00
Italian sev	8.00

In the development of the extruded product sev, twelve combinations were tried with rice, soya, maida,

cassava and sweet potato. The combination with rice 60 per cent, soya 20 per cent and sweet potato 20 per cent was selected for the development of sev. The organoleptic qualities as well as the nutritive value of the developed sev was found to be comparable with the standard one. With the developed sev fifteen recipes were formulated and standardized. The organoleptic qualities of the developed recipes were acceptable to technical experts. Preference test conducted among college students and farm women revealed that the recipes were preferred positively by most of them.

SUMMARY

SUMMARY

The present study "Standradization of recipes based on rice-soya extruded product" was undertaken to formulate an extruded product sev based on rice and soya and to standardize recipes with the above developed product.

Rice and soya were the basic ingredients for the formulation of the product. Maida, cassava and sweet potato were tried along with rice and soy. Twelve combinations with the above food ingredients were tried for the development of the product. The principles governing the selection of suitable combination were protein quality, extrusion behaviour, cost and acceptability.

Protein quality of the combinations were assessed through amino acid scores. Extrusion behaviour was assessed through observation by ten technical experts. Cost of the different combinations were computed as per the market price of the ingredients. The acceptability of the combinations were assessed through organoleptic evaluation with a panel of ten selected judges. The combination which got the

highest score for all these parameters Rice, soya and maida in the proportion of 60 : 20 : 20 was selected for the development of sev. Accordingly 30 kg of the product was processed.

The cooking quality of the developed product was ascertained through cooking time, water absorption index and bulk density and was observed as good. The developed product Type tests administered to the developed product revealed that the product was comparable with ISI specification.

The acceptability of the developed sev was ascertained with special reference to physical characteristics, organoleptic qualities and nutritional significance.

The physical characteristics of sev such as fineness, shape, uniformity of strands, packaging quality and tensile strength were found to be comparable with the standard one. The shape of the developed sev was even better than the standard.

The organoleptic qualities of the developed sev was also comparable with the standard sev. The nutritional significance of the sev revealed that the developed food sev contained all the nutrients in optimum quantity. The nutrients were slightly higher before processing than after processing especially protein, energy and calcium indicating losses during processing.

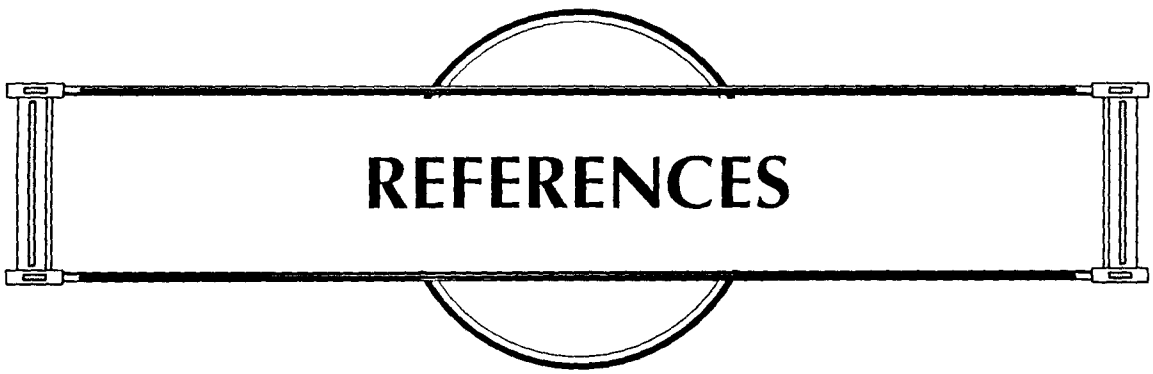
Fifteen recipes were formulated and standardized in the laboratory with sev. They are sev kheer, sev iddli, sev uppuma, sev puttu, sev sweet samosa, sev tri flower, vegetable sev, sev kofta pulao, sev biriyani, sev loaf, mango sev, lime sev, sev bologness, sev kedgeree and Italian sev.

The organoleptic qualities of the fifteen recipes were assessed by the selected experts and it was found that all the developed recipes secured good scores for organoleptic qualities. Among the fifteen recipes tested, sev kheer was ranked first.

The preference test for the fifteen recipes were conducted among college students of the institution and farm women. Both the groups rated majority of the recipes

positively. Sev kheer has got the highest preference by college students as well as by farm women.

From the above observations and findings, it can be concluded that it is possible to develope protein rich extruded food based on rice and soya, with good nutritional and organoleptic qualities and recipes could be standardized from the product which will add novelty and variety in our dietaries.



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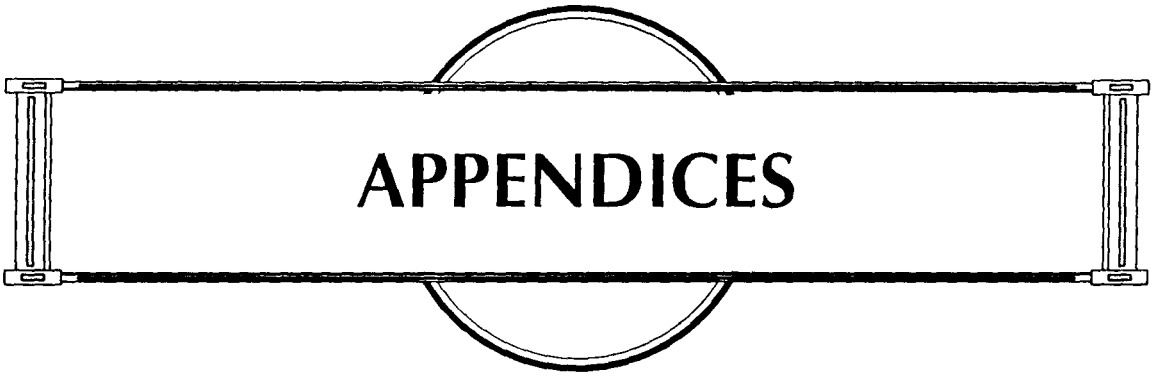

APPENDICES

Appendix - 1

Amino acid scores of different combinations of the extruded food

Ingredients	Arginine	Hystidine	Lysine	Tryptophan	Phenyl alanine	Tyrosine	Methionine	Cystein	Thriomine	Lieucine	Isolencine	Valine
Rice 65	312.0	84.5	149.5	52.0	182.0	188.5	97.5	58.5	149.5	32.5	195	247
Soya 5	22.5	7.5	20.0	4.0	15.0	10.5	4	5	12	29	16	16
Sweet potato 30	60.0	30.2	36.0	20.0	90.0	42.0	32.0	48.0	47.0	122.0	72.0	74.0
	391.5	128	202.5	74	284	238	128.5	105.5	206.5	176.5	277	335
Amino acid score = 68.10												
Rice 60	288	78	138	48	168	174	90	54	138	300	180	220
Soya 17	54	18	48	9.6	36	25.2	9.6	12	28.8	57.6	6.4	6.4
Sweet potato 28	57	36	33	18	87	39	27	42	45	120	66	72
	420.4	121.8	258.8	88.4	279.6	241.2	127.6	74.4	245.2	458.4	267.6	340.8
Amino acid score = 74.70												
Rice 60	288	78	130	48	168	174	90	54	138	300	180	228
Soya 17	76.5	25.5	68	13.6	51	36	14	17	41	82	54.5	54.4
Cassava 23	133.4	25.3	66.7	18.4	41.4	23	11.5	20.7	46	69	57.5	55.2
	497.9	128.8	264.7	80	260.4	233	115.5	91.7	225	451	291.9	337.6
Amino acid score = 72.60												
Rice 50	240	65	115	40	140	145	75	45	115	250	150	190
Soya 15	67.5	22.5	60	12	45	31.5	12	15	36	72	48	48
Cassava 35	203	38.5	101.5	28	63	33	17.2	31.5	70	105	87.5	84
	510.5	126	276.5	80	248	209.5	104.2	91.5	221	427	285.5	322
Amino acid score = 77.60												
Rice 70	35.6	91	161	56	196	203	105	63	161	350	210	266
Soya 15	67.8	22.5	60	12	45	31.5	12	15	36	72	48	48
Maida 15	28.5	18	16.5	9	43.5	19.5	13.5	21	22.5	60	33	45
	129.9	131.5	237.5	77	284.5	254	130.5	90	219.5	482	291	35
Amino acid score = 71.80												

Ingredients	Arginine	Hystidine	Lysine	Tryptophan	Phenyl alanine	Tyrosine	Methionine	Cystein	Thriomine	Lieucine	Isolencine	Valine
Rice 65	312	84.5	149.5	52	182	188.5	97.5	58.5	149.5	32.5	192	247
Soya 15	67.5	22.5	60	12	45	31.5	12	15	36	72	48	48
Maida 20	38	24	22	12	58	26	18	28	30	80	44	48
	417.5	131	231.5	76	285	246	127.5	101.5	215.5	184.5	287	343
Amino acid score = 70.80												
Rice 60	288	78	130	48	168	174	90	54	138	300	180	228
Soya 10	45	15	40	8	30	21	8	10	24	48	32	32
Maida 30	57	36	33	18	87	39	27	42	45	120	66	72
	390	129	203	74	285	234	125	106	207	468	332	332
Amino acid score = 72.90												
Rice 60	288	78	130	48	168	174	90	54	138	300	180	228
Soya 15	67.5	22.5	60	12	45	31.5	12	15	36	72	48	48
Maida 25	47.5	30	27.5	15	72.5	32.5	22.5	35	37.5	100	55	60
	403	130.5	217.5	75	285.5	238	124.5	91.5	211.5	472	283	336
Amino acid score = 76.70												
Rice 55	264	71.5	126.5	44	154	159.5	82.5	49.5	126.5	275	165	209
Soya 17	76.5	28.5	68	13.6	51	36	14	17	41	82	54.4	54.4
Maida 28	53.2	33.6	30.8	16.8	81.2	36.4	25.2	39.2	42	112	61.5	67.2
	393.7	130.6	225.3	74.4	286.2	231.9	121.7	105.7	209.5	40	281	330.6
Amino acid score = 73.80												
Rice 50	240	65	155	40	140	145	75	45	115	250	150	190
Soya 25	112.5	37.5	100	20	75	52.5	20	25	60	120	80	80
Maida 25	47.5	30	27.5	15	72.5	32.5	22.5	35	37.5	100	55	60
	382.5	132.5	282.5	75	287.5	230	117.5	105	212.5	470	285	330
Amino acid score = 75.13												
Rice 50	240	65	155	40	140	145	75	45	115	250	150	190
Soya 20	90	30	80	16	60	42	16	20	48	96	64	64
Maida 30	57	36	33	18	87	39	27	42	45	120	66	72
	387	131	268	74	287	226	118	107	208	466	280	326
Amino acid score = 76.95												

Ingredients	Arginine	Hystidine	Lysine	Tryptophan	Phenyl alanine	Tyrosine	Methionine	Cystein	Thriomine	Lieucine	Isolencine	Valine
Rice 60	288	78	130	48	168	174	90	54	138	300	180	228
Soya 20	90	30	80	16	60	42	16	20	48	96	64	64
Maida 20	38	24	22	12	58	26	18	28	30	80	44	48
	416	132	232	76	286	242	102	124	216	476	288	340
Amino acid score = 78.34												

Appendix - 2

Score card for organoleptic qualities of the combinations

Product — Combinations

Date : — Tasted by :

Age :

1 Appearance	Excellent	5
	Good	4
	Satisfactory	3
	Mediocre	2
	Poor	1
2 Colour	Cream	5
	Creamy white	4
	Light brown	3
	Brown	2
	Dark brown	1
3 Flavour	Excellent	5
	Good	4
	Satisfactory	3
	Mediocre	2
	Poor	1
4 Texture	Soft	5
	Spongy	4
	Hard	3
	Very hard	2
	Shiny	1
5 Taste	Excellent	5
	Good	4
	Satisfactory	3
	Mediocre	2
	Poor	1

Appendix - 3

Score card for physical characteristics of the extruded food

Product

Date :

Combinations

Tasted by :

Age :

1 Fineness

☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1

Very fine — Not at all fine

2 Shape

☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1

Uniform sticks — Uniform sticks

3 Strands

☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1

Round strands — Uneven strands

4 Packing quality

☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1

Highly suitable — Not at all suitable

5 Tensile strength

☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1

With stand weight — May not with stand weight

Appendix - 4

Score card for organoleptic qualities of the extruded food

Product — Tasted by :

Date : — Age :

1 Appearance

Excellent	5
Good	4
Satisfactory	3
Mediocre	2
Poor	1

2. Colour

Light Brown	5
Brown	4
Dark Brown	3
Blackish Brown	2
Black	1

3. Flavour

Excellent	5
Good	4
Satisfactory	3
Mediocre	2
Poor	1

4 Texture .

Soft	5
Spongy	4
Hard	3
Very hard	2
Shiny	1

5 Taste

Excellent	5
Good	4
Satisfactory	3
Mediocre	2
Poor	1

Appendix – V

RECIPES

1. Sev Kheer

Ingredients

Sev	-	150 gm
Coconut milk	-	3 cups
Sago	-	30g
Ghee	-	45 g
Broken nuts	-	10 g
Sultanas	-	10 g
Cardamom powder mixed with I tsp sugar	-	3 g
Sugar	-	150g

Method :

Extract one cup of milk and three cups of second milk from the coconut. Fry the sultans and nuts in ghee first and then the sev. Cool the sev and sago in second milk. Add the milk and sugar and stir on a slow fire till rather thick. Then add the first milk cardamom powder and the fried nuts and sultans.

2. Sev Iddli

Ingredients

Sev	-	75 g
Buttermilk	-	1 cup
Grated coconut	-	40 g
Minced onions	-	40 g
Minced ginger	-	2 g
Curry leaves	-	2 stalks
Baking soda	-	1 g
Dalda	-	20 g

Method :

Fry the sev in dalda. Mix the baking soda in buttermilk. Add enough salt. Soak the sev in it for about half an hour. Blend the minced things and the grated coconut. Steam it in an idli cooker.

3. Sev Uppuma

Ingredients

Sev	-	200
Mustard seed	-	5g
Onions slicedfine	-	100 g
Black gram dal	-	15 g
Broken nuts	-	20 g
Coriander leaves	-	20 g
Lime juice	-	from half lime
Colour	-	2
Pepper	-	5
Cardamom	-	2
Cinnamon	-	1
Dry chillies	-	4
Minced ginger	-	5 g
Minced garlic	-	5 g
Grated coconut	-	30 g
Minced green chillies	-	10g
Salt	-	to taste
Oil	-	20 g

Method :

Fry the sev in 1/2 tsp oil. Fry the broken dry chillies, pepper, the spices nuts and blackgram in oil. Add ginger, onion, garlic and green chillies. Saute for five minutes. Pour 2 cups of water, lime juice and salt. When it boils, sprinkle the fried sev stirring well without getting them into lumps. Blend the coconut. Put the lid on and keep it over a very low fire till it is served.

4. Sev Puttu

Ingredients

Rice flour	-	300 g
Sev	-	200 g
Grated coconut	-	75 g
Finely chopped onion	-	75 g
Green chillies sliced round	-	5 g
Ginger finely chopped	-	5 g
Curry leaves	-	15 g
Cabbage sherdded and steamed	-	75 g
Mustard seeds	-	1 g
Oil	-	15 g

Method :

Extract milk from the coconut grating without adding water. Cook the sev in this. Steam the cabbage. Mix the cooked sev and the grated coconut from which milk has been extracted, with the rice flour. Splutter mustard in hot oil and saute onion, green chilli, ginger and curry leaves. Add cabbage, mix well and remove from fire. Put the flour and the seasoned cabbage alternatively into a puttu mould and steam serve hot.

5. Sev sweet samosa

Ingredients

For filling

Sev	-	125 g
Coconut	-	50 g
Sugar	-	40 g
Dalda	-	5 g

For Pastry

Maida	-	150 g
Salt	-	to taste
Water	-	as required
Baking powder	-	a pinch
Oil	-	for frying

Method :

Cook the sev in enough water. After cooking it add the coconut, sugar and dalda to it and mix carefully.

Mix the salt, water and baking powder to the maida and prepare a dough. Rolled out light into round of 3 inch diameter. Cut rounds in 1/2 and form into cones. Fill the sev-coconut mix inside and dampen the edges and press together. Deep fry in oil until done.

6. Sev triflower

Ingredients

Milk	-	2 cups
Egg	-	1
Sev	-	100 g
Sugar	-	45 g
Rind of lime	-	from 1
Plantains (Poovan)	-	3
Ghee	-	45 g
Lime juice	-	15 g
Dried bread crumbs	-	20 g
Powdered sugar	-	20 g

Method :

Boil milk, Sprinkle the sev over it and stir. Add the grated lemon rind and sugar and thicken the mixture. Remove from fire, beat the egg till stiff and fold into the mixture. Add a spoon full of ghee and spread this in a greased cake dish, cut plantains into long slices and arrange over the pudding. Sprinkle lime juice over it and pur one spoon of ghee over it. Mix the powdered sugar and the bread crumbs together and sprinkle on the top and put the remaining ghee bake (375^{o}).

7. Vegetable sev

Ingredients

Sev	-	350 g
Carrot cut in to thin strips	-	150 g
Cabbage leaves cut into thin strips	-	50 g
Beans (thin strips)	-	50 g
Onion (sliced)	-	50 g
Green chillies	-	6
Ginger	-	1 piece
Hot water	-	4 cups
Lime	-	1
Oil	-	20 g
Salt	-	to taste

Method :

Fry the sev in 1 tsp of oil. In another vessel saute the onions, split chillies and ginger cut into small pieces. Add the vegetables. After santing it for a few minutes, pour the hot boil well, keep all the vegetables towards one side of the vessel and sprinkle the sev in the boiling water. Now mix everything together and cook with a few hot coal underneath on the lid on stir it till dry serve hot, add spices and coriander leaves.

8. Sev Kofta Pulao

Ingredients

Beef	-	200 g
Onions sliced	-	15 g
Garlic	-	5 g
Corriander powder	-	5 g
Grated coconut	-	20 g
Ginger	-	1 small piece
Flour	-	15 g
Egg	-	1
Oil	-	60 g

For sev

Sev	-	180 g
Cinnamon, colour, cardamom	-	a little
Sliced onions	-	100 g
Cashew nuts	-	6
Curd	-	100 g
Turmeric powder	-	a pinch
Ghee or dalda	-	20 g

Method :

Mince meat. Ground together coconut, ginger, 4 cashew nuts, garlic, small onions and coriander powder to a paste. Mix the ground masala, a little salt and the flour with the meat. Form into even sized balls and deep fry in fat.

In a dekshi, fry the nuts and sultans. Then for the sliced onions. Put the cinnamon, coloures and finally the sev. Reduce the heat and add 3 cups of boiling water and cook with the lid covered. Stir the curd, add the turmeric powder and half the fried onions and mix with the sev. Take and aluminium dish, spread 1/2 the cooked sev and o top of it prepared kufta. Then cover it with the remaining sev and cook for some time on a very slow fine with the fried onions, suilfanas and nuts. If convenient use a little mint add corriander leaves.

9. Sev Biriyani

Ingredients

Sev	-	400 g
Chicken	-	200 g
Cinnamon pieces	-	2
Cloves	-	4
Tomato	-	2
Onion (sliced)	-	2
Lime juice (from half lime)	-	15 g
Cardamom	-	2
Ghee	-	25 g

To Graind

Garlic	-	15 g
Ginger pieces	-	15 g
Dry chillies	-	6
Turmeric powder	-	5 g

Method :

Cut the chicken into small pieces, clean and drain. Fry the spices in 4 tsp of ghee and then saute the onion pieces well, followed by the ground masala. Sprinkle a little water each time it sticks to the bottom. Add the tomatoes, the chicken and after sauting them for 10 minutes on a low fire, pour 2 cups of hot water and enough salt and cook the meat till soft. Remove from fine when the gravy is thick.

In a big frying pan fry the sev carefully in 2 tsp of ghee. Use spatules in both hands to turn the sev while frying. When they are evenly fried add 2 cups of hot water and the meat curry. Cook till the sav is done. Cook on a very slow fire and when the water has evaporated sprinkle lime juice and remove from fire and put the lid on without steam escaping. Keep it like that till it is served.

10. Sev Loaf

Ingredients

Minced meat	-	100 g
Fresh bread crumbs	-	150 g
Egg	-	1
Powdered nutmeg	-	5 g
Minced onins	-	40 g

Milk	-	1 cup
Powdered pepper	-	5 g
Salt	-	to taste

Filling

Sev	-	350 g
Oil	-	5 g
Garlic and ginger	-	5 g
Greated coconut	-	20 g
Shreddey onion	-	10 g
Green chillies	-	5 g
Coriander leaves	-	2.5 g

Method :

Mix all the ingredients in the first part. Boil 1½ cups of water, put the sev and when it boils, cover the pan and cook the sev on a slow fire. Grind the coriander leaves, gastic, ginger, green chillies and coconut together. Fry the onions in oil and before it turns colour, put the ground masala and saute well. Mix the sev and salt to taste and remove from fire when the sev gets cold mix the egg in it.

Grease and flour round vessel and spread half the cooked meat. Spread the sev on top of it and cover with the remaining meat pressing it well. Put it in a pre-heated oven (350 degree) for about an hour. Unmould it into a plate. Cut in wedges and serve.

11. Mango sev

Ingredients

Sev	-	150 g
Grated coconut	-	150 g
Green mango	-	1
Red chillies	-	6
Mustard seeds	-	5 g
Salt	-	To taste
Turmeric	-	1 small piece
Curry leaves	-	1 spring
Bengal gram	-	10 g
Black gram	-	10 g
Oil	-	50 g

Method :

Wash and Soak Bengal gram and black gram in water. Cook sev in water, drain and spread in a dish skin and cut the mango and grind the mango, mustard seeds, turmenric, a red chillies and salt together to a paste, and add the coconut and grind coarsely. Mix the ground massala and sev well. heat oil in a dekshi, add the soaked dals and 2 broken red chillies, add curry leaves and mix with the prepared sev, serve hot.

12. Lime sev

Ingredients

Sev	-	300 g
Lime	-	2
Grated coconut	-	150 g
Nuts	-	20 g
Turmeric powder	-	a pinch
Oil	-	30 g
Curry leaves	-	2 stalks
Green chilly	-	10
Cariander leaves	-	5g

Method :

Cook the sev in salted boiling water and drain spread the sev in a dish. Sprinkle the turmeric powder over the sev and mix carefully. Add the lime juice, enough salt and the coconut.

Fry the broken nuts and onions separately. Sante the curry leaves and pieces of green chillies and mix the sev and broken nuts. Serve it hot with the fried onion on top.

13. Sev Bologness

Ingredients

Minced beef	-	150 g
Minced onions	-	150 g
Tomato pure	-	40 g
Salt	-	5 g
Pepper powder	-	2g
Nutmeg powder	-	1 g
Crushed garlic	-	5 g
Carrot	-	1
Flour	-	15 g
Oil	-	10 g

For sev

Sev	-	250 g
Butter	-	20 g
Grated chese	-	20 g

Method :

Cook sev in boiling water and salt, and drain when it is cooked. Heat oil and saute onions and carrot, then add meat and garlic. Fry till brown. Add flour, pepper and nutmeg powders. Mix the tomato puree with the prepared meat, adding a little water and salt to taste. Bring to boil and remove from fine when the gracy thickness.

Heat sev with butter. Arrange it round a dish and sprinkle grated cheese over it. Place the prepared meat in the middle of the sev and serve.

14. Sev Kedgeree

Ingredients

Sev	-	300 g
Minced onins	-	150 g
Fish (bone less)	-	100 g
Egg	-	2
Pepper powder	-	2 g
Butter	-	20 g
Milk	-	½ cup
Lime	-	1
Pappadoms	-	4
Salt	-	to taste

Method :

Cook the fish in vinegar and salt. Hard boil egg and grate the yolks. Flake the fish into small pieces and the chopped egg white with it. Cook the sev in salted water, drain and sprinkle the lime juice in it. Saute the minced onions in butter and then add fish, egg white and sev. Mix carefully. Beat the 2 egg, add milk, pepper, salt and sprinkle over the sev. Saute till the sev is dry. Remove it into the serving dish and decorate with small strips of cut pappadoms fried and greated egg yolk over the sev and serve hot.

15. Italian sev

Ingredients

Sev	-	200 g
Tomato	-	200 g
Onions	-	100 g
Meat pieces	-	100 g
Pepper powder	-	2 g
Greated cheese	-	40 g
Salt	-	to taste

Method :

Slice the tomatoes and onions. Cook the meat in a water, vinegar and salt and remove a little gravy. In an aluminium dekshi arrange layers of tomato, onions, meat, sev and cheese till all the ingredients are used up. Add the meat gravy to the water, salt and pepper and pour about 1½ cups of liquid into it and put on fire till it starts to boil when the sev is cooked and the gravy is thick it is ready for use.

Appendix - 6

Score card for preference test

Sl. No.	Name of Recipes	Like extremely	Like very much	Like reasonably	Like somewhat	Do not like or dislike	Dislike somewhat	Relatively dislike	Dislike very much	Dislike extremely
1	Sev kheer									
2	Sev iddli									
3	Sev uppuma									
4	Sev puttu									
5	Sev sweet samosa									
6	Sev tri flour									
7	Vegetable sev									
8	Sev kufta pulao									
9	Sev biriyani									
10	Sev loaf									
11	Mango sev									
12	Lime sev									
13	Sev kedgeree									
14	Sev bologness									
15	Italian sev									

STANDARDIZATION OF RECIPES BASED ON RICE - SOYA EXTRUDED PRODUCT

By

ANNA JACOB

ABSTRACT OF THE THESIS
SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENT FOR THE DEGREE
MASTER OF SCIENCE IN HOME SCIENCE
(FOOD SCIENCE AND NUTRITION)
FACULTY OF AGRICULTURE
KERALA AGRICULTURAL UNIVERSITY

DEPARTMENT OF HOME SCIENCE
COLLEGE OF AGRICULTURE
VELLAYANI, THIRUVANANTHAPURAM

1997

ABSTRACT

The study on "Standardization of recipes based on rice-soya extruded product" was undertaken to formulate an extruded product `sev', and to standardize recipes with the developed product.

Rice and soya were the basic ingredients selected for the formulation of the extruded food. Maida, cassava and sweet potato flour were tried along with rice and soya. With these food ingredients twelve combinations were tried for the development of sev, protein quality, extrusion behaviour, cost and acceptibility of the twelve combinations were assessed.

The combination with rice, soya and maida in the proportion 60 : 20 : 20 got the maximum overall score and this combination was selected for the development of the product, sev.

The cooking characteristics such as cooking time, water density and water absorption index of the developed sev was found to be good.

The type tests administered to be revealed that the product was compared with ISI specifications.

The acceptability of the developed sev was ascertained with special reference to physical, organoleptic and nutritional qualities. The physical characteristics of sev was well comparable in all the parameters and shape of the sev was better than the standard one.

The organoleptic quality attributes such as appearance, colour, flavour, texture and taste of the sev was also comparable with standard one.

The developed sev contained all the nutrients in optimum quantity. However there was slight decrease in the nutrient content after processing due to of loss in nutrients during processing.

Fifteen recipes with sev were formulated and standardized in the laboratory such as sev Kheer, sev idli, sev upuma, sev puttu, sev sweet samosa, sev triflower, vegetable sev, sev kofta pulao, sev biriyani, sev loaf, mango sev, lime sev, sev kedgeree, sev bolognes and italian sev.

The organoleptic qualities of the fifteen recipes were assessed and sev kheer was ranked first among them.

The preference test for the recipes were conducted among college students and farm women. Majority of the recipes were scored positively by both the group. Sev kheer was ranked first by both the group.

From the above observations and findings it is clear that, it is possible to develop an organoleptically and nutritionally adequate extruded food based on rice and soya, and different novel recipes could be standardised from the product, and this could also be taken as an income generating activity.