FORMULATION AND STANDARDIZATION OF INSTANT SOUP MIXES USING FUNCTIONAL FOODS FOR LIFESTYLE DISORDER

By

S. PREETHI

(15PFN007)

A THESIS SUBMITTED TO THE

AVINASHILINGAM INSTITUTE FOR HOME SCIENCE AND HIGER EDUCATION FOR WOMEN, COIMBATORE – 641 043.

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

MASTER OF SCIENCE IN FOOD SCIENCE AND NUTRITION

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Certified as a Bonafide Research Work

S. Thilagavathy 10-4-17

Signature of the supervisor

M. Amirtham 10/4/17

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I INTRODUCTION

"Let food be thy medicine and medicine be thy food"

- Hippocrates

Food is defined as "anything solid or liquid which when swallowed, digested and assimilated nourishes the body". "Food" means substances, that are in solid, liquid, concentrated, frozen, dried, or dehydrated form and sold for ingestion or chewing by humans and are consumed for their taste or nutritional value (Ohio, 2015).

Within the last decade, knowledge about the significance of diet in human health has considerably increased and nutritionists have identified specific foods playing a key role in supporting the health status of consumers. Beyond meeting nutritional requirements, it is extensively recognized that dietary factors are able to change the detrimental development of different chronic diseases (Alkerwi, 2014 and Peiretti et al., 2015).

Diseases linked to the way of living are increasing in every country in the world. Lack of proper knowledge, inadequate time, faulty eating habits, lack of exercise and smoking are the main causes for lifestyle diseases like Obesity, Hypertension and Diabetes Mellitus. Among household women, the prevalence of Diabetes Mellitus was 0.30 percent while two percent were pre-diabetic, 16 percent were obese, 38 percent were overweight and six percent were found to be hypertensive (Hiremath, 2015). This alarming increase in lifestyle diseases can be controlled or prevented to some extent by increasing the intake of functional foods. Functional foods are similar in appearance to conventional foods, the former being consumed as part of the normal diet. In contrast to conventional foods, functional foods, have demonstrated physiological benefits and aids in reducing the risk of chronic disease beyond basic nutritional functions, including maintenance of gut health (Avrelija Cencic, 2010).

The term "Functional Food" was first coined in Japan. In 1984, The Japanese government allocated research funds for studying functional food or Foods for Specific Health Uses (FOSHU): "Food products fortified with special constituents that possess advantageous physiological effects." When functional food science migrated to Europe, researchers defined "Functional Food" as "Food products can only be considered

functional if together with the basic nutritional impact it has beneficial effects on one or more functions of the human organism thereby either improving the general and physical conditions or/and decreasing the risk of the evolution of diseases" (Clare M. Hasler, 2002).

In addition to government agencies, National and International Organizations developed their own definitions for functional food such as, The Institute of Medicine's Food and Nutrition Board (IOM/FNB, 1994) defined Functional Foods as "any food or food ingredient that may provide a health benefit beyond the traditional nutrients it contains." Functional foods are thought to provide benefits beyond basic nutrition and may play a role in minimizing the risk of certain diseases and other health conditions. Examples of these foods include fruits and vegetables, whole grains, fortified foods and beverages and some dietary supplements. Functional foods include foods developed for health purposes as well as for physical performances (Robert E.C Wildman, 2006).

Other definitions for functional foods include: The International Food Information Council (IFIC, 2013) defined the Functional Foods as, "food or dietary component that provide a health benefit beyond basic nutrition". The Nutrition Business Journal, (NBJ, 2006) asserted that, the functional foods are the foods fortified with added or concentrated ingredients to functional level, which improves health or performance.

The American Dietetic Association (ADA), a prominent organization of nutrition and dietetics experts, calls "functional foods" as "whole, fortified, enriched or enhanced" that should be consumed regularly and at effective amounts in order to derive health benefits (Amer, 2009).

Functional foods in addition to their basic nutritive value and natural being contain the proper balance of ingredients which helps to function better and more effectively in many aspects of lives, including helping directly in the prevention and treatment of illness and disease (Rajitha Sunkara and Martha Verghese, 2014). Functional foods are similar in appearance to conventional foods, the former being consumed as part of the normal diet. In contrast to conventional foods, functional foods, however have demonstrated physiological benefits and can reduce the risk of chronic disease beyond basic nutritional functions, including maintenance of gut health (FAO, 2007).

Epidemiological evidence showed that regular consumption of functional foods, value added food products and nutraceuticals is associated with a lowered risk of coronary heart disease, obesity, diabetes, cancer, osteoporosis and other chronic age-related degenerative diseases like Parkinson's disease and Alzeimer's disease (Kumar, 2011). The functional compounds either alone or synergistically have therapeutic potential or exert varying biological and pharmacological effects in human health as anti-carcinogenic, anti-diabetic, anti-inflammatory, anti-oxidants, anti-fungal, antipyretic, anti-apoptotic, chemopreventive, hepato-protective, hypolipidemic, analgesic, Central Nervous System (CNS) stimulant and stimulation of cellular immunity (Olaiya, Soetan and Esan, 2016).

Kumar Jitendra and Pal Amit (2014) states that functional foods from diverse sources include an important component in nutritional support program for prevention of non-communicable chronic diseases as well as in diet based therapies for specific diseases. Based on scientific evidence, numerous studies have established therapeutic properties of food ranging from anti-oxidant, anti-obesity, anti-inflammatory, anti-cancer in prevention of cardiovascular diseases. These studies suggest that all the foods are functional to some extent and diversified diets comprising all the categories of food play a vital role in maintenance of health and well being (Rajesh Kumar, Seema Bhayana and Sonia Kapoor, 2015).

Industrialization, globalization and urbanization, are the factors influencing Indian lifestyle and food habit. In India, incidence of lifestyle related health problems such as Diabetes, Cardiovascular Diseases, Hypertension and Obesity are increasing rapidly. Work related stress leads to many diseases such as Hypertension and Cardiovascular Diseases (Sharma, 2013). Day by day people are becoming disease prone due to the stressful work and less physical activity. In current scenario, functional food plays an important promising role in the healthy human life. Indian food markets are increasing with healthy foods as well as demand of functional foods is increasing in Indian food industry. (Ayyagari, Grover and Purvis, 2011).

Traditional Indian diets are rich in functional foods and Indians were using food items like lentils, soya beans, garlic, ginger, capsicum, cabbage, broccoli, fenugreek leaves etc., in their daily diet as basic food or therapeutic food in disease conditions like fever. It is also consumed during festive times and climatic changes. For example, in

summer, buttermilk or old rice, onion, coriander leaves and chillies are consumed in order to cool the body.

Garlic helps to regulate blood glucose level and it can reduce glucose metabolism in Diabetes, slows the development of atherosclerosis and lowers risk of heart attack in myocardial infarction patients. S-allyl cysteine sulfoxide present in garlic has antioxidant effect and it is believed to contribute beneficial effect in Diabetes. Allii cepa bulbus (onion) is used for pungency and flavouring in Indian cuisines are commonly used for treatment of Diabetes. The active components like allyl propyl disulfide and s- methyl cysteine sulfoxide is believed to have anti-diabetic and anti-hyperlipidemic effect (Pathirage Kamal Perera and Yunman Li, 2012).

Cruciferous vegetables like broccoli, cauliflower, allium vegetables contains various isothiocyanates such as sulforaphane, phenethyl isothiocyante and benzyl isothiocyanate which are formed from glucosinolyates by the action of myrosinase (Alvarez-Jubete et al., 2014). Allicin formed from alliin is rapidly converted to diallyl sulfide or diallyl trisulfide by the action of allinase. In both cruciferous and allium vegetables, these hydrolytic breakdown products is the health promoting functional components (Swanson 2003 and Anon 2013).

Leaf and algal proteins are alternative sources of protein for humans who consume pulses, milk and meat products for their protein requirements. In nature, leaves are abundantly available, economical and are the highly renewable sources for many valuable nutrients. The leaf proteins are good to act as emulsifying agents and have the ability to emulsify water-oil dispersion (Pandey et al., 2006). This property is widely used for industrial applications. Green leafy vegetable gives heath promoting nutrients through its antioxidant property. As these are high in magnesium and potassium, it is believed to maintain the blood pressure by preventing the accumulation of excess homocysteine in the blood (Narsing Rao, 2015).

Spices are natural food additive which contributes immense taste to the food. Spices possess medicinal as well as nutritional properties and are used as one of the most important constituent in medical field worldwide. They have beneficial influence on lipid metabolism and have ability to stimulate digestion. Spices have anti-oxidant, anti-

inflammatory, analgesic, antipyretic, antimicrobial and anti-neoplastic properties (Murlidhar Meghwal, 2012).

Since side effects are common in drugs, the use of supplementary treatments and diet modification are considered as the best way to prevent chronic illness. Many studies have confirmed that legume consumption prevents, controls and protects against diseases like Cardio vascular disease and Diabetes. Lentil is the known functional foods among legumes that are convenient for human consumption. In addition, lentil shows health promoting issues on Blood Pressure, Diabetes, Cardio vascular disease and Cancers (Zahra Aslani, 2015).

Convenience food or processed food is commercially prepared food for ease of consumption. Products designed as convenience foods are often prepared food stuffs that can be sold as hot, Ready-To-Eat dishes at room temperature, shelf-stable products or as refrigerated or frozen products that require minimal preparation, typically just heating. Soups are one of the convenience food mostly used for consumption. It is a food made by combining ingredients such as meat or vegetable stock, juice, water or any other liquid. It is used as an appetizer or it can be served as main dish during convalescence (Kumari Swati, 2013).

Ready to drink dehydrated soup mixtures are convenient food items and consist of different ingredients, mostly corn starch, spices, salt, flavours and flavour enhancers (Hafeel et al., 2013).

In this era, commercially prepared instant soups such as canned, dehydrated and frozen soup have replaced home-made soup as preparing a soup is a time consuming process. Instant soup can become an alternative food for breakfast because it could fulfill the adequacy of energy and nutrient requirement by the body, very practical in preparation and taking very little time to serve (Niththiya, 2014).

The main problem encountered by dieters is, not surprisingly, hunger. Although this is often considered as unavoidable evil, new research shows that some foods help people stay satiated longer even on a diet with lower calories. It appears that soups can be an effective element of weight-loss diets that extends period of satiation and thus indirectly reduces further food intake. Decreasing the food intake to lose weight is a challenge as one may feel hunger after every restricted meal. If an adult is given a bowl

of soup 15 – 20 minutes before their meal or as the first course meal, it showed that they consumed 20 percent fewer calories during their main course. Consuming soup before a major meal is a normal approach in many traditional diets and it is known that foods which are high in water such as fruits, vegetables and soups on high volume, but lower in energy density. It is also suggested that energy density of food is directly related to calorie intake; satiety and overall body weight (Wjatschesslaw Wlassoff, 2015).

Dehydration is one of the most widespread processing technologies. When it is combined with improved food stores, it can lead to significant improvements in food security in most regions. Important examples of dried vegetables are cabbage, spinach, garlic and other flavourings, all of which are stored for use in daily working. The main purpose of processing fruits and vegetables in the home is to preserve seasonal foods, to provide cooking ingredients throughout the year, to increase the convenience by having part-prepared foods available when required and to provide greater nutritional balance in the diet (FAO, 2014).

Demand for convenient healthy foods has triggered introduction of several soup mixes in the consumer market with an expected growth rate of more than 25 percent within few years. Dry soup mixes are now an established food item in the world food markets. Instant Soup Mixes are preferred more as dry soup mixes by consumers (Sumeet Kaur, 2015).

Any dehydrated soup mix could be rehydratable and cooked within a minimum time period and should be nutritious and palatable like canned or frozen products. In comparison to freshly prepared soup, instant dry soup should also possess desired quality, representing the dominant flavour and aroma of the ingredients used. It is desirable that the product should be free from off flavours, off taste, unacceptable aroma and faulty texture. (Abeysinghe and Illeperuma, 2006).

Shelf-life studies can provide important information to product developers enabling them to ensure that the consumer will receive a high quality product for a significant period of time after production. The rate at which food deterioration occurs, the effect of temperature, water and the myriad of other parameters have become characterized factors contributing to the science of accelerated shelf-life studies. The principle mechanism in deterioration of processed foods includes microbial spoilage,

chemical and enzymatic activity and flavour change (Mark Sewald and Jon DeVries, 2006).

Quality parameters with respect to physical, chemical and nutritional characteristics of the product are necessary to be analyzed. Besides these parameters, cost, shelf-life and sensory attributes should also be ascertained. Physical parameters include appearance, moisture, yield, rehydration ratio, bulk density and water absorption index and Nutritional parameters such as carbohydrate, fat and protein should be analyzed (Megha S. Karthikeyan et al., 2015).

The present study is focused on formulation of Instant Soup Mixes for different lifestyle disorder like Obesity, Diabetes Mellitus and Hypertension based on the functional foods. The presence of functional components in the food assists to prevent the disease condition. The formulated product can be consumed as a beverage which serves as an appetizer and helps in reducing the food intake. The developed product can be rehydrated and served hot. The acceptability of the product is analyzed by organoleptic evaluation by semi-trained panel members. The objectives of the study are as follows: To

- Select ingredients like Capsicum, Broccoli, Cabbage, Fenugreek leaves, Soy beans, Horse gram that are rich in functional components like isoflavones, phytoestrogens, dietary fiber, tocopherols and tocotrienols and saponins which helps in preventing lifestyle disorder.
- Formulate and standardize Instant Soup Mixes using functional foods.
- Evaluate the acceptability of the developed Instant Soup Mixes based on organoleptic parameters.
- Analyze the nutrient content of the developed Instant Soup Mixes.

II REVIEW OF LITERATURE

The literature pertaining to the title "**Formulation and Standardization of Instant Soup Mixes using Functional Foods for Lifestyle Disorder**" was reviewed under the following headings:

A. Standardization of Instant Soup Mixes
   1. Standardization of recipes
   2. Acceptability of the product

B. Importance of Instant Soup Mixes

C. Role of functional foods in disease conditions

D. Prevalence of lifestyle disorders

E. Functional properties of selected ingredients

A. STANDARDIZATION OF INSTANT SOUP MIXES

1. Standardization of recipes

The United States Department of Agriculture (USDA) defines a standardized recipe as one that "has been tried, adapted, and retried several times for use by a given foodservice operation and has been found to produce the same good results and yield every time when the exact procedures are used with the same type of equipment and the same quantity and quality of ingredients" (USDA, 2012).

Soup is one of the traditional foods, classified as an appetizer or it is a warm food given during cold and sick. Commercially prepared instant soups such as canned, dehydrated and frozen soups have replaced home-made soups as preparing a soup is a time consuming process. Instant soups can become an alternative food for breakfast as it could fulfill the adequacy of energy and nutrient requirement by the body, taking very little time to serve (Niththiya, 2014).

Convenience food or tertiary processed food is commercially prepared food for ease of consumption. Products designed as convenience foods are often prepared food stuffs that can be sold as hot, Ready-To-Eat dishes at room temperature, shelf-stable products or as refrigerated or frozen products that require minimal preparation, typically

just heating. Soups are one of the convenience food mostly used for consumption. It is a food made combining ingredients such as meat or vegetable stock, juice, water or another liquid. It is used as an appetizer or it can be served as main dish during convalescence (Kumari Swati, 2013).

The advantages of standardizing the recipes are consistent food quality, predictable yield, customer satisfaction, consistent nutrient content, food cost control, efficient purchasing procedures, inventory control, labour cost control, increased employee confidence, reduced record keeping and successful completion of State or Federal reviews.

The components of recipe standardization or Standard recipes will have the following:

- **Name of the item** – Recipe number / identification within file system.
- **Yield** – The total quantity the recipe prepared.
- **Portion size** – This may be listed by weight or number of pieces.
- **Garnish** – Specific and every plate goes out looking the same which includes plate setup.
- **Ingredients** – List in order, list quantities of ingredient used, and the abbreviation used for quantities and standard. If "oz" is used for ounce in one recipe, use it in all recipes.
- **Preparation Instructions** – Include any preheating instructions. Use the correct terms for instructions. This also should include pan sizes and preparation, cooking temperature, cooking time, how to test for doneness, and instructions for portioning.
- **Finishing** – Describe any finish, the product needs such as brushing with oil or melted chocolate drizzled on top.
- **Cost** - Total the cost of each ingredient for total price cost. This can then be divided by the number of portions.
- **Photo of Finished Dish** – Photos are not always included on recipes, but are an excellent reference to quickly determine garnish and furnishing (Lora, 2005).

2. **Acceptability of the product**

Sensory analysis can be considered to be an interdisciplinary science that uses human panelists sensory perception related to thresholds of determination of attributes, the variance in individual sensory response experimental design to measure the sensory

characteristics and the acceptability of food products, as well as many other materials. Using traditional methods of evaluation, products with different sensory characteristics, such as those are identified by a product flavour profile.

Any decisions regarding acceptability of food product cannot be made without the guidance of sensory evaluation but rather implies that the timely, successful development and launch of new products depend on the manner in which decisions are reached and new product strategies are formulated. This is where sensory science reduces the risk of product failure (Dimple Singh-Ackbarali, 2014).

Hedonic scale is a very useful tool for measuring food acceptability. It is usually termed as 9- point Hedonic scale ranging from 'extremely dislike' to 'extremely like'. It is a people oriented test with large number of panel members, usually 20 and above. Of all scales and tests methods, the nine-point hedonic scale occupies a unique niche in terms of its general applicability to the measurement of product acceptance– preference. When the primary concern of a study is measuring hedonic differences among foods, beverages and consumer products and predicting their acceptance, the 9 – point hedonic scale has proven itself to be a simple and effective measuring device (Juyun Lim, 2011).

Sensory testing is a method of evaluating food products in terms of the human senses of sight, smell, taste, touch and hearing. While taste appears to be a significant factor it is not the only consideration. Foods that may taste great lose appeal if the appearance is not pleasing. Visual interest is a key in consumer acceptance. The texture of a food also plays into how it is perceived. How foods feel to the touch is especially important if eaten out of hand. Foods that leave hands greasy or sticky are less pleasing to eat. Sensory testing is a way to dissect and evaluate all of the factors that can contribute to food product success or failure. Sensory testing utilizes panels of individuals who are selected to sample foods under controlled conditions (Brenda J. Reau, 2011).

B. IMPORTANCE OF INSTANT SOUP MIXES

Chandramouli (2012) states that in the preparation of soup powder corn flour, coriander powder, pepper powder, salt are added. Leafy vegetables can also be added in soups or salads and are eaten as a vegetable. Leafy vegetable soups are typically low in calories, low in fat, high in protein per calorie, high in dietary fiber, high in iron and

calcium, and very high in phytochemicals such as vitamin C, carotenoids, lutein, folate as well as vitamin K**.**

The adjuncts in soup mix namely onion powder, citric acid, corn flour, capsicum powder, coriander leaves, white pepper powder, ginger powder, garlic powder and salt are to be mixed in different combinations and proportions (g) All the adjuncts were dehydrated at 65°C and powdered separately. They were then mixed thoroughly to form the instant soup mix. Soup was prepared by boiling 200ml of water and adding the soup mix as a paste and simmering for one minute. The formulations were prepared and subjected to sensory evaluation. The cooked weight of product was noted (Megha S. Karthikeyan, 2015).

In a study conducted by Sudharani (2013) revealed that ash gourd and amla based instant soup mixes are prepared as a dietetic drink. The amla fruit is highly nutritious and it is the richest source of vitamin 'C'. Whereas, Ash gourd is bland in taste and pale in colour and amla is astringent in taste, hence it is not consumed widely for the table purpose but the excellent nutritive and therapeutic value of this fruit and vegetable offers a great potential for processing into various quality products. In spite of having amazing health benefits, ash gourd is not much consumed. Hence, instant soup mix based on the nutritive value, was prepared and was well - accepted by the consumer panel members**.**

CFTRI (2012) have developed instant mushroom soup mix using appropriate equipment, optimal product recovery of right quality. Good quality fresh mushrooms and other ingredients are required to formulate a value added instant soup mix. The mushroom in dried powdered form finds a place to impart mushroom flavour in a mixture of starch, protein and fat, when the mix is dispersed and boiled in water. The product being in dried form can be stored for several months. The soup mix serves the function to generate mushroom flavour in hot beverage form. Laminated aluminium foil polyester-polyethylene is found to be the best packing material, preferably the product to be packed under nitrogen flushing

CFTRI (2012) have developed Moringa leaves powder, Wheat germ, Corn starch, Maltodextrin, Skim milk powder were selected for the study in preparation of instant moringa leaves soup mix. Soups are considered as liquid side dish or starters in continental dietary and are served warm as watery liquid or gruels of spoon-feeding

consistency. It is normally used as a starter at the beginning of lunch or dinner mainly as appetizers. Although, the role of nutrient density of soups is underplayed, the soups that provide higher loads of dietary fibre and yet provide more protein and phyto-chemicals with nutraceuticals per unit volume of food would be highly desirable. Shelf life of the product is found to be about 6 months.

Spill (2011) stated that consuming low-energy-dense vegetable soup could influence hunger, satiety and energy intake. In adults, consuming soup as a first course has been shown to enhance satiety, reduce intake of the main course and reduce overall energy intake at the meal (Amal Abdel-Haleem, 2014).

Barley and flaxseed based functional dry soup mix (BFSM) was developed from whole barely flour (46.3%), roasted flaxseed powder (23%) and the seasoning (30.6%) comprising several flavouring compounds and anticaking agent, using simple processing technique and was nutritious. It was low glycemic soup, free of antinutritional risk and had calorific value of 319.8 kcal/100 g (wet or sample basis) estimated from its composition. Hundred gram of Barley and Flaxseed Soup mix contained 4.36 g β-glucans and 8.08 g total lipid of which 25.6 percent was ω-3 fatty acids (Sumeet Kaur, 2015).

Vegetable and prawn added soup mix was prepared by incorporating palmyrah tube flour. But the popularity of this soup is decreasing due to difficulty in the preparation of quality product. The developed vegetable and prawn added instant dried soup mix had an acceptable sensory, nutritional and microbial quality and can be stored under ambient condition without affecting the quality characters. The cost of production was also at acceptable level. The developed soup mix was more convenient than traditional product (Niththiya, 2014)

The instant soup mix has been prepared from the combination of black rice, okra powder and barley. This value added product is convenient and nutritious. It can be easily swallowed by patients, who cannot chew. Black rice is rich in antioxidant and anthocyanin; it should be included in regular diet to keep human health away from any kind of inflammatory condition like allergies, cancer, asthma, atherosclerosis and arthritis. It provides idea about how much black rice and other ingredients should be incorporated in convenient healthy food, which can be easily swallowed by patients, who cannot chew (Seema Sonkar, 2015).

Rahman (2012) conducted a study for the development of instant fish soup mix and finding out the effect of fish powder on it. Ingredients of soup mix were cooked and dried up to desired moisture content. After drying the dried products were ground and made into powder. These were then mixed with desired composition. The fish powder was added in different composition in various samples at 5 percent, 10 percent and 15 percent in Mix-1, Mix-2 and Mix-3 respectively. The result was concluded that Mix-2 was best and secured a score of eight containing 10 percent fish powder.

Senanayake (2014) in her study revealed a potential application of physically modified sweet potato starch as a thickener for a food mixture which shows superior quality from corn starch. Three types were tested for starches which showed a significant level of thickening in the soup mixture. Pasting properties of starches were determined in duplicate replications using a Rapid Visco – Analyzer (RVA). Dry soup powder had 6 month shelf life and can be successfully substituted to corn starch as a food additive in viscosity enhancement**.**

Raw Sardinella longiceps contains more than 20 percent of Omega 3 in its fatty acid profile and this is nearly 55 percent of the total PUFA content of the fish. Frying Sardinella longiceps cannot provide the recommended minimum "EPA" Omega 3 intake (0.22 g per person) when taken alone without any other Omega 3 sources. Omega 3 enriched instant soup powder 30g pack can provide 2.5g of EPA + DHA and for one serving it is 0.85g. This value is larger than 0.65, and lower than 3.0g, which are the recommended minimum and maximum daily intakes respectively. And also it can provide EPA and DHA, the biologically important two Omega 3 PUFAs, each in higher amount than 0.22g, the recommended. Hence, the developed Omega 3 enriched fish soup powder can be suggested as a well-balanced omega 3 supplements (Udari, 2015).

C. ROLE OF FUNCTIONAL FOODS IN DISEASE CONDIITONS

Functional foods improve the overall conditions of body, reduce the risk of some diseases and could even be used for curing some illnesses (Laudadio et al., 2015). It was demonstrated that there is a high demand for functional food as many studies reported that the medical service of the aging population is quite costly. In the developed world, there has been an explosion of consumer attention in the active role of foods in the well-being and life prolongation as well as in the prevention of initiation, promotion and

development of cancer, cardiovascular diseases and osteoporosis (Pandey and Rizvi, 2009).

There is evidence that consumers who have a positive attitude toward functional foods are the ones who have faced illness among relatives or have experienced illness themselves. Chronic diseases are strongly associated with the demand for functional food products targeted at preventing widespread diseases such as heart diseases and cancer capture a great deal of attention from consumers (Danik M. Martirosyan and Jaishree Singh, 2015). A functional food is a food that is similar in appearance to, or may be a conventional food that is consumed as part of a usual diet, with demonstrated physiological benefits and/or reduce the risk of chronic disease beyond basic nutritional functions‘(International market bureau, 2009).

Functional components have health-promoting roles at various stages of disease control that are associated with multiple progressive steps, from initiation to development. Thus, they can be effectively applied in the treatment and prevention of diseases. Hence, in a time when the role of a healthy diet in preventing non-communicable diseases is well accepted, the borderline between food and medicine is becoming very thin (Pravst, 2012).

The concept of functional foods, nutraceuticals and other bioactive components in human diet leads to promotion of healthy life and prevention of various age and lifestyle related chronic diseases. Functional foods, by virtue of bioactive compounds, possess antioxidant activities and scavenge free radicals which damage proteins, lipids and DNA thus maintain the homeostasis of the cells. Thus, they play a vital role in providing immune support, energy enhancement, stress relief, weight loss and ensuring overall well being of the individual besides basic nutritive value (Rajesh Kumar, 2105).

It was thought that functional components occur predominantly only in plant foods including whole grains, fruits, and vegetables as phytochemicals. However, probiotics, conjugated linolenic acid, long-chain omega-3, −6 and −9 polyunsaturated fatty acids, and bioactive peptides are equally found in animal products such as milk, fermented milk products and coldwater fish. These functional foods helps in preventing diseases like obesity, cardio vascular disease, diabetes mellitus, hypertension, gastro intestinal dysfunctions etc., (Christian Izuchukwu Abuajah, 2015).

D. PREVALENCE OF LIFESTYLE DISORDERS

Chronic diseases are frequently classified as a major component of non-communicable diseases (NCDs), affecting the middle or old age individuals after prolonged exposure to an unhealthy lifestyle relating mainly to economic transition, rapid urbanization and 21st-century lifestyle. The leading NCD risk factor globally in terms of attributable deaths are high blood pressure (13%), tobacco use (9%), diabetes (6%), lack of physical activity (6%), and obesity (5%). Nowadays, lifestyle disorders are becoming more common, affecting younger population especially the young urban population (Parvin Mirmiran, Zahra Bahadoran and Fereidoun Azizi, 2014).

Diabetes mellitus (DM) is the most common metabolic disorder affecting nearly 20 percent of global population today and expected to double the figure by 2030. Diabetes is regarded as one of the main causes of death across the globe and has become one of the most challenging health disorders of the 21st century. Though earlier Diabetes Mellitus was thought to be disease of urban and privileged population, it is now found to be equally prevalent among rural or low income strata globally and in India (Seema Abhijeet Kaveeshwar, Jon Cornwall, 2014). Compared to Type 1 Diabetes Mellitus, Type 2 Diabetes Mellitus are less familial and mostly influenced by the environmental factors, unhealthy life style and food habits. A recent review suggests that the association of gut microbiome and interaction of these with genetic components of human is also very vital to determine the onset and the nature of Diabetes Mellitus (Sabyasachi Senapati, 2015).

According to the World Health Organization (WHO), obesity is one of the most common, yet among the most neglected, public health problems in both developed and developing countries. According to WHO, World Health Statistics Report 2012, globally one in six adults are obese and nearly 2.8 million individuals die each year due to overweight or obesity. Due to the increased risk of morbidity and mortality, obesity is now being recognized as a disease in its own right. Nearly 70 per cent of India's population resides in rural areas. Even a small increase in prevalence of obesity in rural areas could lead to a huge increase in the number of obese individuals in India (Rajendra Pradeepa, 2015).

Hypertension (HTN) is an important public health problem in both economically developed and developing nations. As per World Health Organization report, about 40 percent of people aged more than 25 years had hypertension in 2008. Worldwide, 7.6

million premature deaths (about 13.5% of the global total) were attributed to high blood pressure. About 54 percent of stroke and 47 percent of ischemic heart disease worldwide were attributable to high blood pressure.

Hypertension has been associated with increased risk of coronary artery disease and is an independent risk factor for cardiovascular and cerebro-vascular diseases. The hypertensive group was significantly higher in individuals more than 35 years than those less than 35 years. (Jugal Kishore, 2016) reported that out of 142 hypertensive subjects, previous history of hypertension was given by 68 (6.8%) of subjects and 50 (5%) subjects with history of high blood pressure for the past one year. Out of these 68 subjects, only 29 (42.6%) reported that they were taking antihypertensive medications, 49 (72.1%) reported lesser intake of salt in diet, 25 (36.8%) were doing exercise for control of blood pressure, and 43 (63.2%) were taking efforts for weight control for blood pressure.

E. FUNCTIONAL PROPERTIES OF INGREDIENTS SELECTED FOR INSTANT SOUP MIXES

1. CRUCIFEROUS VEGETABLES

Members of cruciferous family are cultivated and widely consumed universally as a part of daily diet. Besides nutritional components, these vegetables are also rich in health beneficial secondary metabolites, which include sulfur containing glucosinolates and S-methylcysteine sulfoxide, flavonoids, anthocyanins, coumarins, carotenoids, antioxidant enzymes, terpenes and other minor compounds. Evidences shows some therapeutic and prophylactic benefits of commonly used cruciferous vegetables has positive effect on cancer and cardiovascular disease (Shivapriya Manchali, 2012)

2. LENTIL

Low glycemic index, high fiber and phytochemical content of legumes have made them functional food for diabetic patients. Lentils (Lens culinaris), the most consumed legume grains, are rich sources of dietary fiber, slowly digestible starch and resistant starch, tannins, β-glucan, functional antioxidant ingredients, a wide range of phenolic acids including gallic acid, proanthcyanidins, prodelphinidin, procyanidins, catechins, epicatechin, kampferol, quercetin, cinapic acid and apigenin (Zou Y and Chang, 2011).

Lentil is a functional food among legumes that are convenient for human consumption. Due to the side effects of using drugs, use of supplementary treatments and diet modification are good ways to improve chronic diseases. Many studies have confirmed that consumption of legumes improves health, control and protect against Cardio Vascular Diseases and diabetes. Lentils have low glycemic index (GI), which slowly release glucose into the bloodstream and create a constant insulin response. Hence, lentils are recommended for patients with Type 2 Diabetes and Cardio Vascular Diseases (Zahra Aslani, 2014).

3. BEANS

Beans like pinto, dark red kidney, black beans in diet planning for Type 2 Diabetic patients effectively helps weight management, attenuates postprandial glycemic response, and improves dyslipidemia. Beans are also other important legume grains in the human diet with high content of fiber, phytate, ω3 fatty acids, antioxidants, phenolic compounds. The hypoglycemic effect of beans (via inhibition of α-amylase and β-glucosidase activity) has been reported as being similar to those of anti-diabetic drugs (Thompson SV, 2012).

Soybean diet may be a good option in Type 2 Diabetic individuals due to its effect on hypertension, hypercholesterolemia, atherosclerosis and obesity, which are very common diseases in diabetic patients. Soluble fiber from soybean is useful for its insulin-moderating effect. It is generally accepted that a high fiber diet, particularly soluble fiber, is useful to control plasma glucose concentration in diabetics. Soybean fiber intake shows beneficial effect in the improvement of the blood glucose levels of diabetics (Ajay K. Dixit, 2011).

4. BITTER MELON

Momordica charantia plant is usually used as a hypoglycemic and antidiabetic agent and many components have been identified which possess hypoglycemic properties. The present study was a step towards in this era to develop dietetic beverage. The functional drink with 15 percent bitter gourd extract was found best. Further research is needed to develop such products for dietetic and health conscious people with low calorific value from medicinal plants (Ahmad Din, 2011).

Momordica charantia L. (bitter gourd) is a nutritious vegetable, used in traditional medical practices to treat Diabetes. Experimental studies with animals and humans suggested that the vegetable has a possible role in glycemic control. Oral administration of the extract, fruit juice or seed powder of Momordica charantia caused a significant reduction in fasting blood glucose and improved glucose tolerance in normal and diabetic animals and in humans (Suja pandian, 2013).

Lectin of bitter gourd has insulin-like activity which is due to its linking together of two insulin receptors. This lectin lowers blood glucose concentrations by acting on peripheral tissues and, similar to insulin's effects in the brain, suppressing appetite. Lectin is likely a major contributor to the hypoglycemic effect that develops after eating bitter gourd and it may be a way of managing adult-onset diabetes (Kandangath Raghavan Anilakumar, 2015).

5. CAPSICUM

Capsicum is a genus of plants from the *Solanaceae* family that have a variety of names depending on location and type, and the most common pepper names are chili, bell, red, green or just pepper. Pepper contain a wide array of phytochemicals, such as neutral and acidic phenolic compounds, which are important nutritional antioxidants that may reduce the risk of degenerative, mutagenic and chronic diseases. The nutritive composition of pepper depends mainly on the variety and stage of maturity. The phytochemicals in pepper have been reported to possess many biochemical and pharmacological properties, such as antioxidant, anti-inflammatory, anti-allergic and anticarcinogenic activities (Ozgur, 2011).

6. HORSE GRAM

The horse gram, *Macrotyloma uniflorum* (Fabaceae) is considered a food with medicinal qualities. It is prescribed for persons suffering from jaundice or water retention and as part of a weight loss diet. Although rich in proteins (20 %), due to less acceptable taste and flavour of cooked products, it is consumed only by the farming community and low-income groups. Thus, it has remained an underutilized food legume. Consumption of seeds and sprouts has become increasingly popular among people interested in improving and maintaining their health status by changing dietary habits. The seeds and sprouts are

excellent examples of 'functional food', lowering the risk of various diseases and exerting health promoting effects in addition to its nutritive value (Marimuthu, 2013).

7. FENUGREEK LEAVES

"*Kasuri Methi*" is very famous for its appetizing fragrance and it is used for culinary preparations. In recent trend, fenugreek is also used as spice adjunct. It is used in functional food, traditional food, nutraceuticals as well as in physiological utilization such as antibacterial, anticancer, antiulcer, anthelmintic, hypocholesterolemic, hypoglycemic, antioxidant, and antidiabetic agent. Green fenugreek leaves are one of the most ancient medicinal herbs. Fresh fenugreek leaves contain ascorbic acid of 220.97 mg per 100 g of leaves and β-carotene of 19 mg per 100 g of leaves.

The green fenugreek leaves (fresh or dried) are used as herb. The fresh leaves are used in the vegetables as green leafy vegetable in the diets. It is suggested for better retention of nutrients in fenugreek leaves and should be stored in refrigeration. It can be dried in oven, blanched for a short period of time (5 minutes) and should be cooked in pressure cooker. Some studies suggest that there is no change in the calcium and zinc content of the processed fenugreek leaves. Medicinally, fenugreek leaves has been found to have little effect on glycemia. These leaves provide β-carotene, fibre, calcium and zinc content compared to those available in other food items (Muralidhar Meghwal and Goswami, 2012).

8. BULBUS VEGETABLES

A clove of garlic a day for 12 weeks has great effects in the treatment of hypertension. Aged garlic extract is superior to placebo in lowering systolic blood pressure (Ried et al., 2010). Garlic in moderate dose (250 mg/kg) with added hydrochlorothiazide possesses synergistic cardio protective and antihypertensive properties (Asdaq et al., 2011). The eating lots of sulfur rich vegetables such as garlic and onions may help protect against hypertension.

Onion and its juice may be used to treat appetite loss, prevention of age-related changes in blood vessels (arteriosclerosis), minor digestive disturbances and other traditional uses such as colds, cough, asthmas and diabetes. Onions undergo enzymatic breakdown of sulphur-containing substances due to damages of tissue to give pungent

volatiles that cause weeping. The pharmacological activity as well as the pungent smell are due to several sulphur-containing compounds – mainly sulphoxides such as trans-5-(1-propenyl)-L-(+)-cysteine sulphoxide) and cepaenes (Abdullahi Mann, 2011).

9. CHIA SEEDS

Chia seeds are an excellent source of healthy polyunsaturated fats, especially omega-3 fatty acids, which are not made by the body and must be obtained from foods. Soluble fiber, found in chia seeds, dissolves in water and passes though the digestive system more slowly than insoluble fiber. Soluble fiber with a healthy diet may help lower LDL (bad) cholesterol levels without lowering HDL (good) cholesterol. chia seeds are a good source of electrolytes, which regulate fluid and are important for muscle function. Calcium, typically obtained in the diet through foods like milk and cheese, is quite high in chia seeds. The phenolic compounds found in chia seeds may decrease the invasiveness of cancer cells and improve the clinical outcomes (Alexandra M. Franklin and Nobuko Hongu, 2016).

10. SPICES

The major compounds in the fresh pepper are trans – linalool oxide and α-terpineol. Pepper has long been recognized as a carminative, (a substance that helps prevent the formation of intestinal gas), a property likely due to its beneficial effect of stimulating gastric acid secretion by piperine, an alkaloid found in pepper (Abdullahi Mann, 2011).

Black pepper is a spice which can provide natural nutritional and medicinal benefit. It has analgesic, antipyretic, anti-inflammatory, antimicrobial and antineoplastic properties. Piperine is the major alkaloidal constituent of pepper. Systematic pharmacological studies on piperine have revealed its analgesic, antipyretic, anti-inflammatory and central nervous system depressant activities. It improves digestion by stimulating the taste buds in such a way that an impulse is sent to the stomach to increase hydrochloric acid secretion (Murlidhar Meghwal, 2012).

II METHODOLOGY

The methodology followed for the present study, "**Formulation and Standardization of Instant Soup Mixes using Functional Foods for Lifestyle Disorder**" was carried out under the following headings:

A. Selection of ingredients

B. Development of soup mixes using functional foods

C. Organoleptic evaluation of the developed Instant Soup Mixes

D. Nutrient analysis of the Instant Soup Mixes

E. Shelf - life of Instant Soup powders stored in zip lock covers

A. Selection of Ingredients

Soups play an important role in the Human nutrition as they fulfill present and future social consumer requirements. The advantages of the dehydrated foods, particularly, dry soup mixes could be as a protection from enzymatic and oxidative spoilage and flavour stability at room temperature over long periods of time (6 - 12 months). Refrigerator is also not required and has high nutritive value, particularly as a source of protein. Instant Soup mixes exert light weight for shipping and availability at all time of the year and are ready for reconstitution in a short time for working families, hotels, hospitals, restaurants and institutional use as well as to military rations (Rekha, 2010).

In the 1980s, the concept of functional foods was born in Japan. In 1991, the concept of **Foods for Specified Health Use (FOSHU)** was established. According to Food and Nutrition Board functional foods are defined as "any food or food ingredient that may provide a health benefit beyond the traditional nutrients it contains." Today, nutrition science has moved on from the classical concepts of avoiding nutrient deficiencies and basic nutritional adequacy to the concept of "positive" or "optimal" nutrition (Annunziata and Vecchio, 2012). There is now increasing scientific evidence to support the hypothesis that some foods and food components have beneficial physiological and psychological effects over and above the provision of the basic nutrients (Stavroula Malla, 2013).

Ingredients are the most essential part of product development. In such case, the ingredients chosen for the development of soup mixes are broccoli, cabbage, onion, garlic, capsicum, soy beans, lentils, kidney beans, horse gram, chia seeds, fenugreek leaves, pepper, salt and corn flour. The ingredients selected for the study contains functional properties, which are believed to possess specific health benefits beyond its nutritional stand point.

The selected ingredients were grouped according to its functional role it has in metabolic syndrome diseases like obesity, diabetes mellitus and hypertension.

- **Diabetes**

It is a chronic metabolic syndrome affecting the world's population at a higher rate and is a serious cause of morbidity and mortality. In diabetic individuals, insulin resistance is more common and inability of the cells to take up dietary glucose and burn it for energy utilization. Diabetic individuals suffer from hyperglycemia since their blood glucose levels are high. The diet suggested by ICMR is low carbohydrate, low fat, moderate protein, liberal vitamins and minerals for diabetic individual.

Lentil is the excellent source of dietary protein, non-digestible carbohydrates including dietary fiber, resistant starches, oligosaccharides and bioactive compounds such as functional fatty acids, isoflavones, phenolic acids, saponins and phytic acid. Some polyphenols are also found in legumes. Low glycemic index, high fiber and phytochemical content of lentils made them functional food for diabetic individuals (Zahra Aslani, 2015).

Fenugreek leaves (fresh or dried) are used as herb. The fresh leaves are used in the vegetables as green leafy vegetable in the diets. Medicinally, fenugreek leaves has been found to have positive effect on glycemia. These leaves provide β-carotene, fibre, calcium and zinc (Mona Boaz, et al., 2011).

Soybean, a rich source of unique phytoesterogens, is another important functional food which has been considered in diabetes; the isoflavones and bioactive peptides of soybean have favorable effects on glycemic control and insulin sensitivity, dyslipidemia, and kidney function. Regular consumption of soy products could help diabetic patients in the management of dyslipidemia (Ajay Dixit, 2011).

Bitter gourds have synergistic effects with oral hypoglycemic and it aggravates hypoglycemia in type II diabetic patients. The hypoglycemic potential components were identified as glycosides, saponins, alkaloids, triterpenes, polysaccharides, proteins, and steroids. The blood glucose lowering effects were closely associated with its inhibitory activity against disaccharidase. This effect is important to prevent high blood glucose levels after meals (Kandangath Raghavan Anilakumar, 2015).

- **Hypertension**

High blood pressure is otherwise known as Hypertension. It is not a disease but the symptom for many underlying diseases, with diastolic pressure exceeding 90 mm Hg and systolic pressure exceeding 140 mm Hg. The blood pressure of the arteries is more due to any block in the arteries supplying blood to the organs. Sodium – rich diets are believed to induce hypertension in the individual. Hence the diet commonly called "DASH diet" is suggested. The diet suggested for hypertensive individuals are low carbohydrate, low fat, low sodium and normal protein.

Broccoli, has Sulforaphane Glucosinolate (SGS) in it, which is a naturally-occurring compound found to be helpful in reducing high blood pressure as well as cardiovascular disease and stroke risk. It has blood pressure-regulating minerals like magnesium, calcium, and potassium (Ya-wen Zeng, 2011).

Cabbage is high in a chemical compound called glutamic acid, which help in reducing blood pressure. Glutamic acid is the most common amino acid and accounts for almost a quarter of vegetable protein and nearly a fifth of animal protein (Rajesh Kumar, 2015).

Onion is also useful in managing hypertension. The sulfur-containing compounds in onions have shown to reduce high blood pressure and onion belongs to the family of garlic (Ya-wen Zeng, 2011).

Garlic has been used as a medicinal plant. In addition, extracts of garlic contains various biologically active compounds such as alliin, allicin, ajoene, diallyl disulfide, diallyl trisulphide. Garlic has various biological benefits like hypocholesterolemic, hypoglycemic, antihypertensive, anticancer and antioxidant effects (Rintu Das, 2016 and Mohammad Shafiur Rahman, 2007).

- **Obesity**

Obesity is characterized by an excess of adipose tissue. Regulation of balance between energy intake and energy expenditure will result in optimal body weight. The standard medical definition of obesity is based on BMI value. It is defined as "the accumulation of excess body fat over and above the required BMI for particular age and height". Obesity is highly related with heart disease and considered as one of the lifestyle disorder. The diet suggested for obese individuals are low carbohydrate, low fat, moderate protein, liberal vitamins and minerals.

Capsicum is one of many alkaloids that are referred to as a *Capsaicinoid,* which are commonly associated with chilli products. Capsiate also appears to elevate body heat and suppress fat gain. Capsaicin has been noted to reduce food intake in mice that are on a high fat diet as well as the normal control, although it lost efficacy after ten days of oral supplementation. Capsaicin can also induce heat production via neuronal stimulation (Ozgur, 2011).

Green gram is another important legume grains in the human diet with high content of fiber, phytate, ω_3 fatty acids, antioxidants and phenolic compounds. The hypoglycemic effect of green gram has been reported as being similar to those of anti-diabetic drugs (Lakshmy, 2016).

Horse gram is one of the most commonly used pulses with higher content of fiber and protein. It is an anti-obese agent, helps in reducing the body fat and is found to be helpful for obese individuals. Horse gram and oats can be combined to help obese individuals (Marimuthu, 2013).

Chia seeds are the seeds that are acting as an anti-obese agent. Many studies have been conducted using chia seeds in the supplementation for obese individual. The dietary fiber and fat present in it are considered as supporting agent for an effective weight management (Alexandra Franklin, 2016).

Other ingredients

Pepper and onion powder are the spice mix used for the formulation of instant soup mixes. Dried onion powder gives flavour to the product. Pepper has also got some functional property like anti-inflammatory. Pepper and onion powder gives a

moderate spicy flavour in soups. Hence, pepper and onion were used as the spice mix in the study.

Corn flour is used as a thickening agent. It is used to bring the consistency of soup. Corn flour was added in adequate amount which helps in proper binding of the ingredients. Hence corn flour is used for the study.

Salt is the main ingredient that enhances the flavour and taste of the product. Since, the study deal with metabolic syndrome, salt was added in restricted amounts according to the disease condition. For hypertensive individuals, salt was added in less quantity compared with that of obesity and diabetes mellitus.

In the present study, functional foods are used as the main ingredients to gain the health benefits in the formulation of Ready – To –Eat instant soup mixes. The functional property of food plays a major role in preventing disease conditions. Based on the functional property of food, the ingredients were selected for disease conditions like diabetes, hypertension and obesity.

B. Development of Soup mixes using Functional foods

- **Drying of ingredients**

Dehydration is the most essential processing of ingredients to remove moisture for the development of Instant Soup Mixes. Two methods of drying process such as sun drying and cabinet drying were carried out for efficient dehydration. Ingredients like broccoli, capsicum, bitter gourd, cabbage and garlic were dried in cabinet drier at 70^0c for eight hours, cooled, powdered and stored in zip lock covers until it was used for the formulation of soup mixes.

Ingredients like onions and tomatoes were blanched in boiling water and sun dried for three days. The dried onions and tomatoes were ground to fine powder and stored in zip lock covers until used for the formulation of soup mixes.

Plate – I presents the Drying of Ingredients for Instant Soup Mixes

Figure – I presents the ingredients selected and the procedure followed for drying of ingredients for the formulation of Instant Soup Mixes.

FIGURE – I

DRYING OF INGREDIENTS FOR INSTANT SOUP MIXES

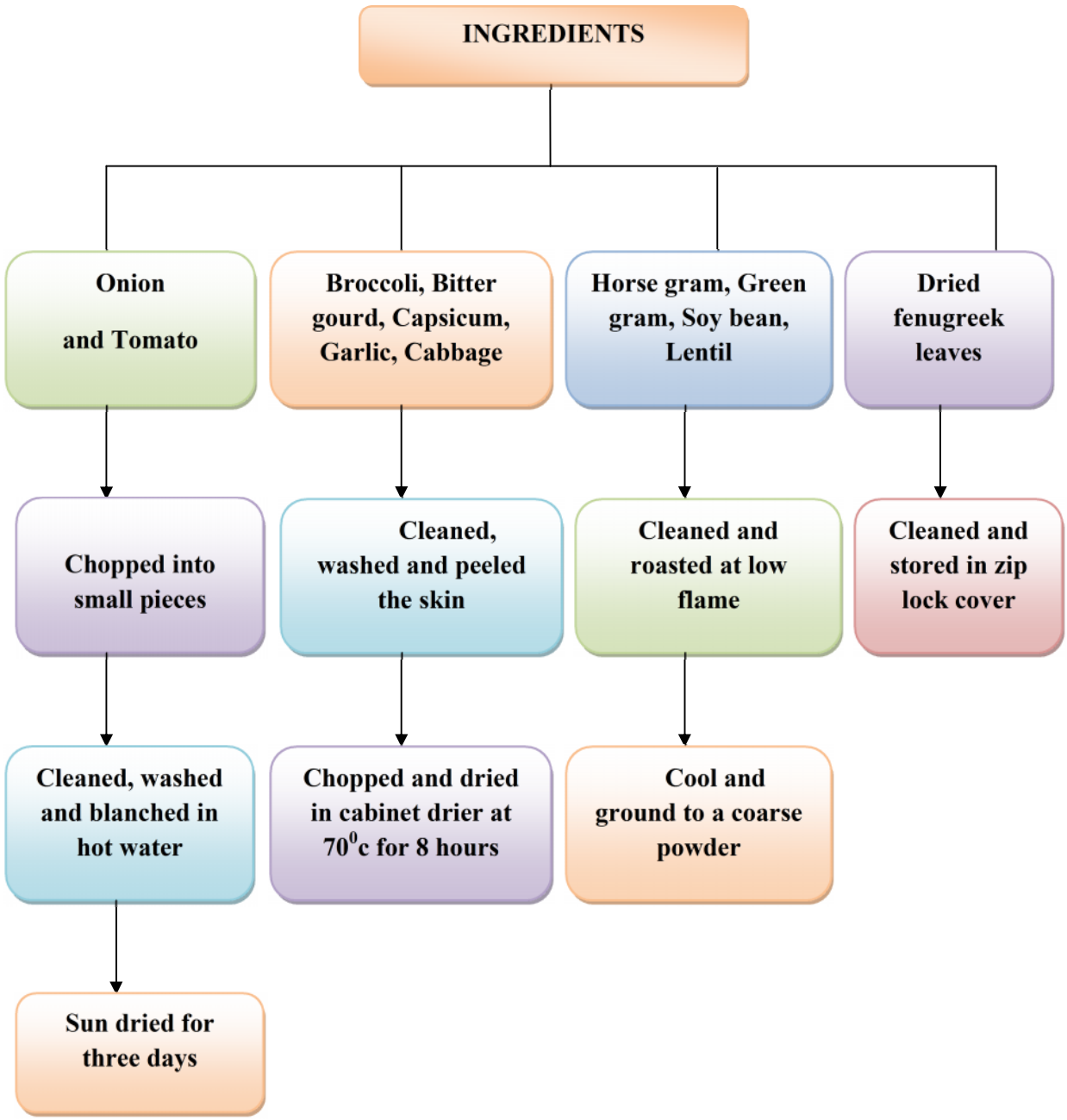


PLATE – I

DRYING OF INGREDIENTS FOR INSTANT SOUP MIXES

- **Formulation of soup**

Soup is a food that is made by combining ingredients such as meat, vegetables in stock or hot or boiling water, until the flavour is extracted, forming a broth. Ready to drink dehydrated soup mixtures are convenient food items and consist of different ingredients, mostly corn starch, spices, salt, flavours and flavour enhancers (Hafeel et al., 2013).

The formulation of Instant Soup Mixes was done with three different proportions such as 30 percent, 40 percent and 50 percent. Standard vegetable soup was prepared using beans, onion, tomato, carrot, spices like pepper and salt for taste and corn flour for the consistency of soup. The soup mixes were formulated in the following ratio.

Table – I presents the Composition of Standard Vegetable Soup and Appendix III presents the recipe for Standard Vegetable Soup.

TABLE – I

COMPOSITION OF STANDARD VEGETABLE SOUP

INGREDIENTS	Amount (%)
Beans	10
Carrot	20
Tomato	20
Onion	30
Pepper powder	1
Salt	2
Corn flour	17
Total (%)	**100**

Plate – II presents the Formulation of Instant Soup Mixes for Lifestyle Disorders.

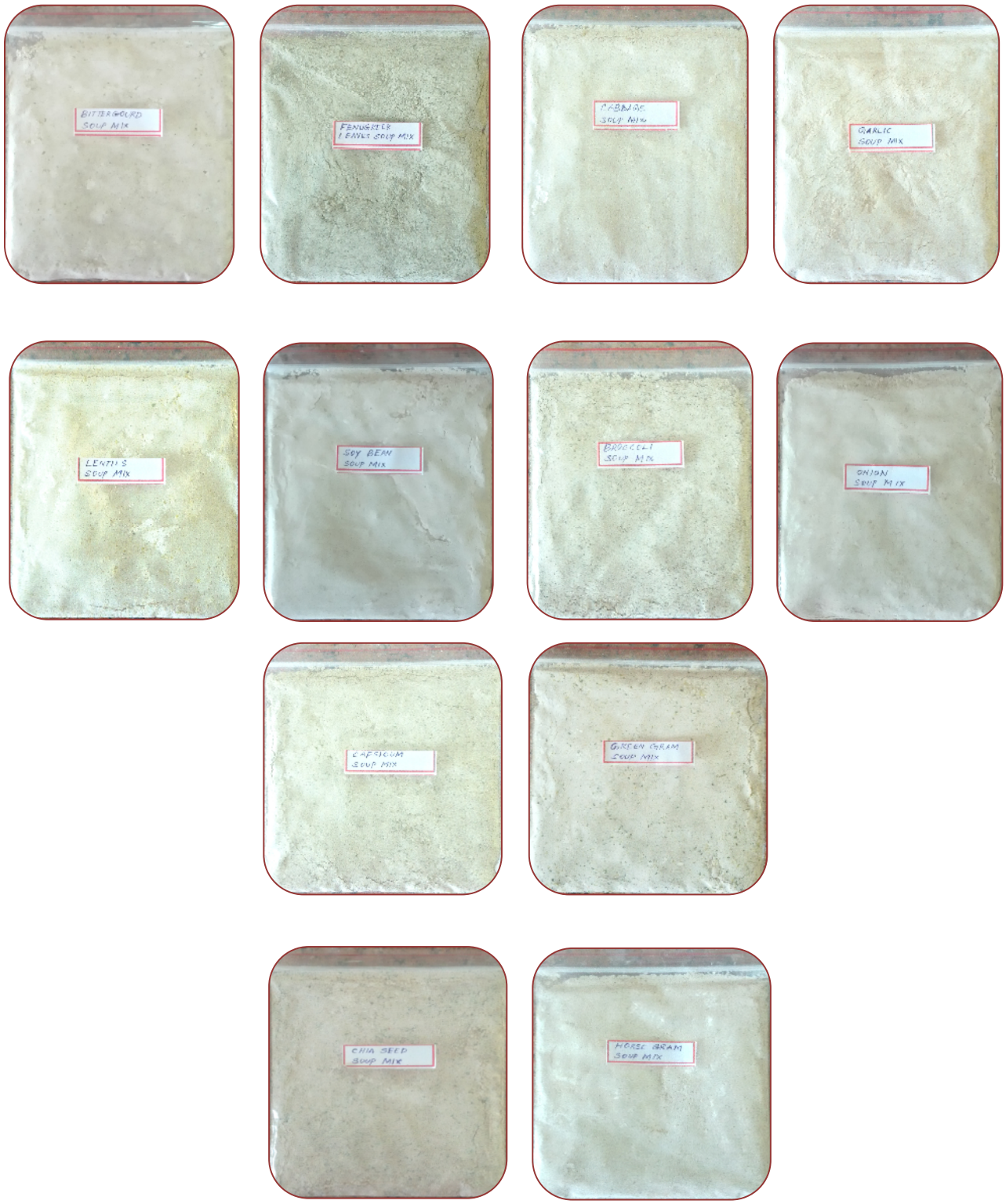


PLATE – II

FORMULATION OF INSTANT SOUP MIXES

Table – II presents the Composition of Instant Soup mix prepared for Diabetes Mellitus.

TABLE – II

COMPOSITION OF INSTANT SOUP MIX FOR DIABETES MELLITUS

INGREDIENTS	VARIATION – 1 (%)	VARIATION – 2 (%)	VARIATION – 3 (%)
FENUGREEK LEAVES/ SOY BEANS/ LENTILS/ BITTER GOURD	30	40	50
PEPPER POWDER	5	5	5
ONION POWDER	10	10	10
TOMATO POWDER	5	5	5
SALT	10	10	10
CORN FLOUR	40	30	20
TOTAL (%)	100	100	100

Soy beans, bitter gourd, lentils and fenugreek leaves were used in the formulation of instant soup mix for diabetic individuals. The functional foods selected for the condition was based on its functional properties. Soy beans with other ingredients like salt, onion powder, tomato powder, corn flour and pepper were used in the formulation of Instant soy bean Soup mix in different proportions like 30 percent, 40 percent and 50 percent. Similarly, bitter gourd along with other ingredients was used in the formulation of instant bitter gourd soup mix. Lentil and other ingredients were combined to formulate Instant lentil Soup mix. Fenugreek leaves and other ingredients were used in the formulation of Instant fenugreek leaves Soup mix. Three different proportions like 30 percent, 40 percent and 50 percent were formulated in each Soup mixes to check the acceptability of the soup mix and were labelled as V1, V2 and V3.

Table –III presents the Composition of Instant Soup mix prepared for Hypertension

TABLE - III

COMPOSITION OF INSTANT SOUP MIX FOR HYPERTENSION

INGREDIENTS	VARIATION – 1 (%)	VARIATION – 2 (%)	VARIATION – 3 (%)
BROCCOLI/ CABBAGE/ ONION/ GARLIC	30	40	50
PEPPER POWDER	5	5	5
ONION POWDER	10	10	10
TOMATO POWDER	10	10	10
SALT	5	5	5
CORN FLOUR	40	30	20
TOTAL (%)	100	100	100

Onion, broccoli, cabbage and garlic were selected for the formulation of Instant Soup mix for hypertensive individuals as these are considered to have low level of sodium content. Onions and other ingredients like salt, onion powder, tomato powder, corn flour and pepper were used in the formulation of Instant onion Soup mix in different proportions like 30 percent, 40 percent and 50 percent. Similarly, broccoli along with other ingredients was used in the formulation of Instant broccoli Soup mix. Cabbage and other ingredients were combined to formulate Instant cabbage Soup mix. Garlic and other ingredients were used in the formulation of Instant garlic Soup mix. Three different proportions like 30 percent, 40 percent and 50 percent were formulated in each Soup mixes to check the acceptability of the soup mix and were labelled as V1, V2 and V3.

Table – IV presents the Composition of Instant Soup mix prepared for Obesity.

TABLE - IV

COMPOSITION OF INSTANT SOUP MIX FOR OBESITY

INGREDIENTS	VARIATION – 1 (%)	VARIATION – 2 (%)	VARIATION – 3 (%)
CAPSICUM/ HORSE GRAM/ CHIA SEEDS/ GREEN GRAM	30	40	50
PEPPER POWDER	5	5	5
ONION POWDER	10	10	10
TOMATO POWDER	5	5	5
SALT	10	10	10
CORN FLOUR	40	30	20
TOTAL (%)	100	100	100

Horse gram, green gram, capsicum and chia seeds were selected for the formulation of Instant Soup mix for obese individuals based on its functional property and its role in preventing fat accumulation in the body. Horse gram and other ingredients like salt, onion powder, tomato powder, corn flour and pepper were used in the formulation of Instant horse gram Soup mix in different proportions like 30 percent, 40 percent and 50 percent. Similarly, green gram along with other ingredients was used in the formulation of Instant green gram Soup mix. Capsicum and other ingredients were combined to formulate Instant capsicum Soup mix. Chia seeds and other ingredients were used in the formulation of Instant chia seed Soup mix. Three different proportions like 30 percent, 40 percent and 50 percent were formulated in each Soup mixes to check the acceptability of the soup mix and were labelled as V1, V2 and V3.

Figure – II presents the Formulation and Preparation of Soup mixes.

FIGURE – II

FORMULATION AND PREPARATION OF INSTANT SOUP MIXES







Capsicum/ Bitter gourd/ Horse gram/ Green gram/ Soy beans/ Chia seeds/ Fenugreek leaves/ Garlic/ Broccoli/ Lentils/ Onion/

↓

Pre-preparations such as cleaning, washing, peeling and chopping

↓

Dehydration of ingredients

↓

Formulation of soup mix in three proportions as 30%, 40% and 50% variations of main ingredient

↓

Addition of other ingredients like salt, pepper, onion powder, corn flour and tomato powder

↓

Preparation of soups using 170 ml of water to the dried soup powder and boiled for 5 minutes

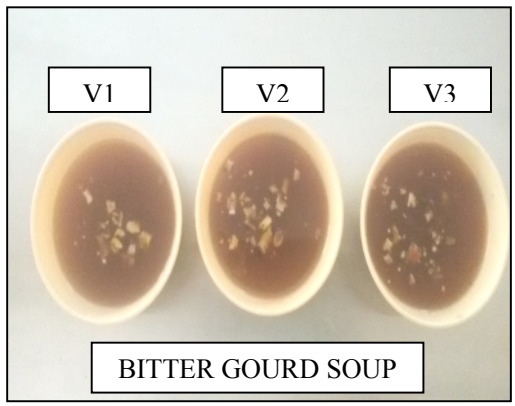
↓

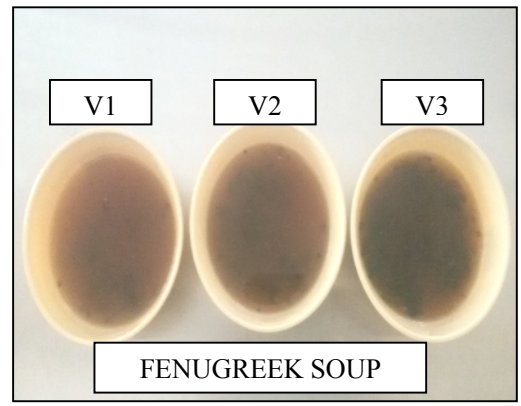
Organoleptic evaluation of prepared soups by 10 semi-trained panel members

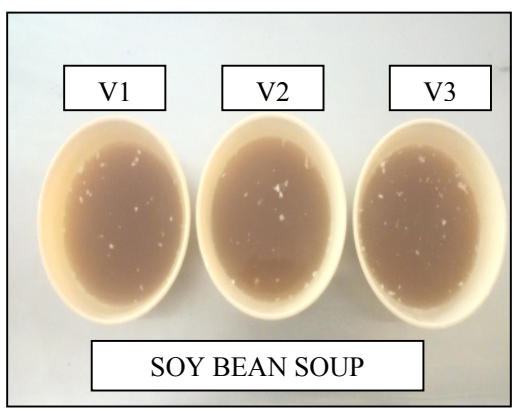
Plate – III presents the formulation of soups using Bitter gourd, Fenugreek leaves, Soy bean and Lentil Instant Soup Mixes.

Plate – IV presents the formulation of soups using Broccoli, Garlic, Cabbage and Onion Instant Soup Mixes.

Plate – V presents the formulation of soups using Capsicum, Green gram, Horse gram and Chia seed Instant Soup Mixes.







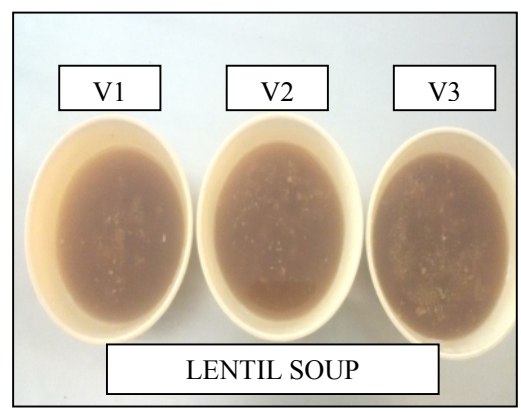
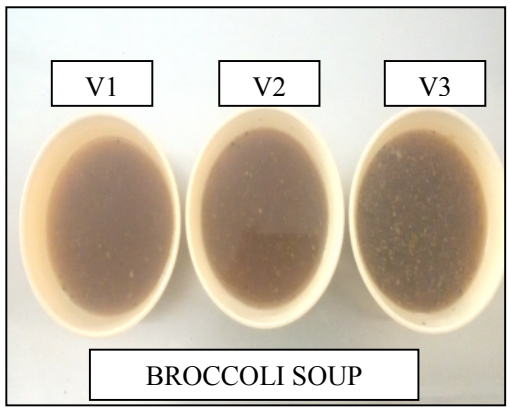
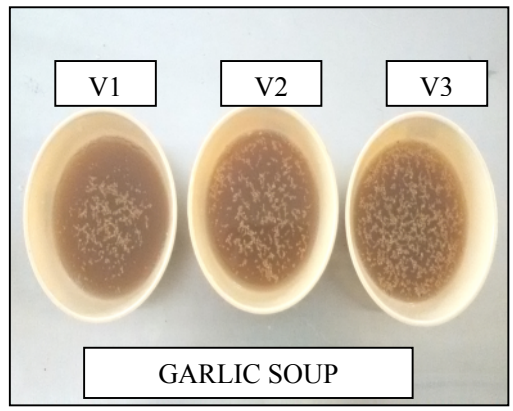
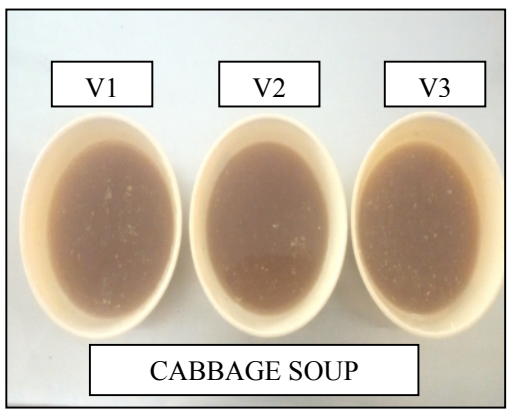


PLATE - III

PREPARATION OF SOUPS USING BITTER GOURD, FENUGREEK LEAVES, SOY BEAN AND LENTIL INSTANT SOUP MIXES







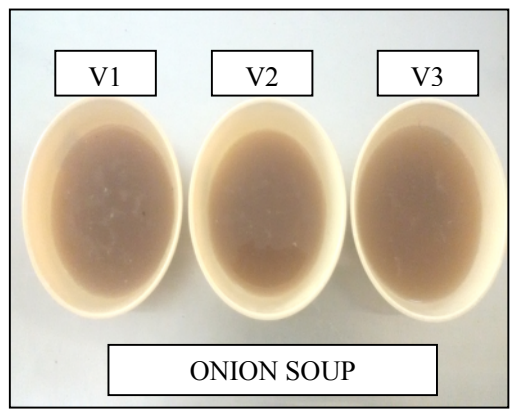
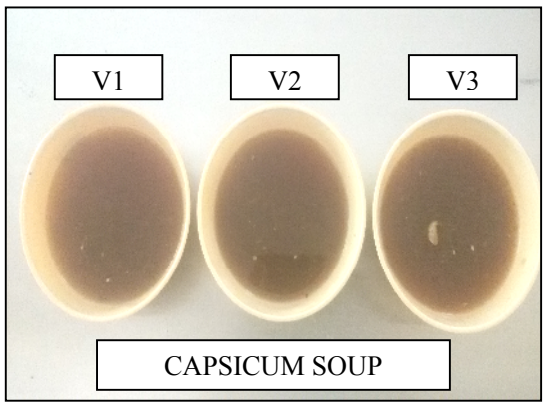
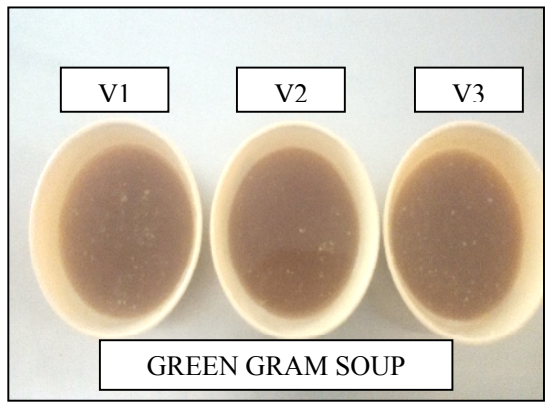
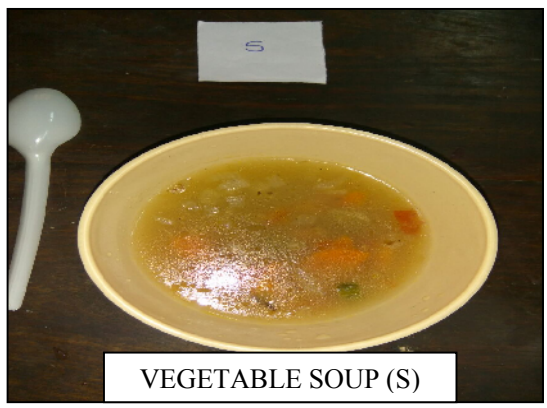


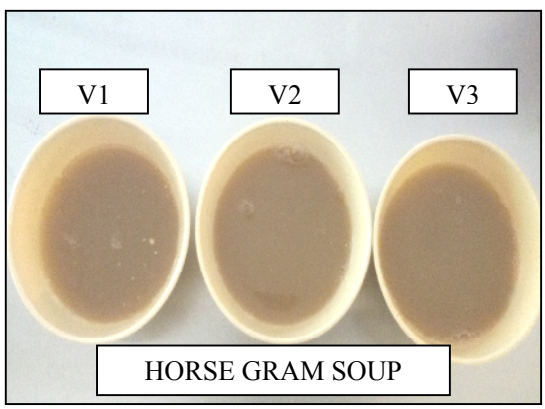
PLATE – IV

PREPARATION OF SOUPS USING BROCCOLI, GARLIC, CABBAGE AND ONION INSTANT SOUP MIXES









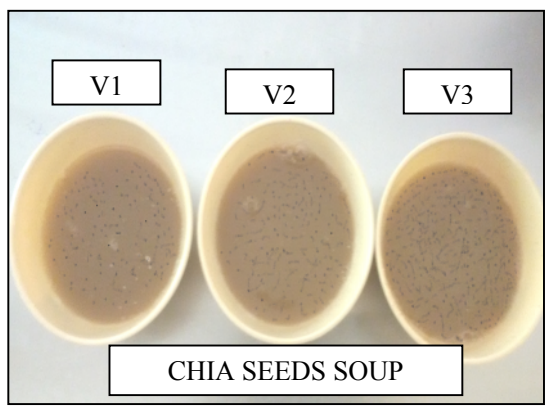


PLATE – V

PREPARATION OF SOUPS USING CAPSICUM, GREEN GRAM, HORSE GRAM AND CHIA SEED INSTANT SOUP MIXES

C. Organoleptic evaluation of the developed Instant Soup mixes

Sensory characterization is one of the most powerful, sophisticated and extensively applied tools in sensory science, which aims at providing a complete description of the sensory characteristics of food products. Sensory characterization plays a key role in defining specifications or quality standards for the sensory characteristics of food products as well as for establishing specifications for physicochemical properties that are related to specific sensory characteristics (Visakh and Laura, 2013).

Sensory evaluation is a valuable tool in solving problems involving food acceptability. It is useful in product improvement, quality maintenance and more important in new product development (Singh-Ackbarali and Maharaj 2014).

The Institute of Food Technologies (IFT) defines sensory evaluation as "The Scientific disciple used to evoke measure, analyze and interpret human reactions to those characteristics of foods and beverages as they are perceived by the senses of sight, smell, taste, touch and healing (Murano, 2003).

Quality of food has been defined as the degree of excellence and includes things such as appearance, taste and nutritional content. Quality is the composite of characteristics that have significance and make for acceptability. Although the nutrient content of fruits and vegetables are similar, the price can be expensive in case of good quality food products.

HEDONIC RATING SCALE

The most widely used scale for measuring food acceptability is the 9-point hedonic scale. David Peryam and colleagues developed the scale at the Quartermaster Food and Container Institute of the U.S. Armed Forces, for the purpose of measuring the food preferences of soldiers. The scale was quickly adopted by the food industry, and now is used not just for measuring the acceptability of foods and beverages, but also for personal care products, household products, and cosmetics.

The hedonic evaluation test involves asking consumers to rate their preference from 1 (I dislike extremely) to 9 (I like very much) for 3 to 4 sensory attributes specific to the test product. The overall preference is ascertained at the beginning of the questionnaire in order not to influence the consumer and be closer to typical conditions of consumption (Juyun Lim, 2011).

Sensory attributes like appearance, flavour, colour, texture and taste of the product plays an important role in consumer acceptance of the developed product. The developed instant soup mix was evaluated with 10 semi-trained panel members. The score cards were prepared based on 9-point hedonic rating scale and were distributed to the panel members in order to evaluate the developed instant soup mix. The sensory attributes are discussed below:

APPEARANCE

The appearance of a food or beverage influences crave ability and acceptance, before the product ever touches the mouth. The appearance of a food includes its size, shape, colour, structure, transparency or turbidity, dullness or gloss and degree of wholesomeness or damage (Kantha Shelke, 2013).

Surface characteristics of food products contribute to the appearance. Appearance also encompasses the positive and negative aspects of properly moulded foods. In addition to size, shape and wholeness, pattering or tapping can be an important appearance factor. Appearance factors also include different forms of damage, gloss, transparency, colour and consistency (Norman Potter, 2007).

FLAVOUR

Flavour is an important attribute of a food. It involves the complex integration of sensations from the olfactory center in the nasal cavity, the taste buds on the tongue, tactile receptors in the mouth and the perception of pungency, heat, cooling, and so on when a food is placed in the mouth. However, flavour is commonly known as blending of taste and aroma.

Flavour is defined as “the sensation produced by a material taken in the mouth, perceived principally by the senses of taste and smell and also by the general pain, tactile and temperature receptors in the mouth. Flavour also denotes the sum of the characteristics of the material which produce that sensation”. Although flavour is composed mainly of taste and odour, other qualities contribute to the overall sensation (John M. Deman, 2007).

TEXTURE

Texture is defined as, "All the mechanical, geometrical and surface attributes of a product which are perceptible by means of mechanical, visual and auditory receptors". Texture is the term used to describe the characteristics of a finished food product. The order in which the ingredients are added, the way of mixing and the method of cooking affect the resulting product.

Primary textural aspects such as hardness, cohesiveness, viscosity and elasticity, secondary characteristics such as brittleness, chewiness and gumminess, all contribute to food acceptability and taste (Shakuntala Manay, 2008).

COLOUR

Colour and other aspects of appearance influence food appreciation and quality, especially by the consumer. Man has subjective standards for the acceptable range and preferred optima for these qualities for almost every food (EOLSS, 2012).

Food colour not only helps to determines quality, but also emphasize on many things. It is commonly known as an index of ripeness or spoilage. Colour plays a major role in acceptability of the product. In addition, it may provide an indication of chemical changes in a food product such as browning and caramelization (John M. Deman, 2007).

TASTE

Taste is one of the five traditional senses that belong to the sensory system. Taste is the sensation in the mouth that reacts chemically with taste receptor cells located on taste buds in the oral cavity, mostly on the tongue. The sensation of taste includes five basic tastes that include sweetness, sourness, saltiness, bitterness and umami (Joseph A. Schroeder and Ellen Flannery-Schroeder, 2005).

Appendix – II presents the organoleptic evaluation form with 9-Hedonic Rating scale.

IV. Nutrient analysis of the Instant Soup mixes

Analysis of nutrient content is an important aspect in standardizing and developing a new product and evaluating a new process for making food products and identifying the sources of problem with unacceptable problem.

Adequate analytical methods for nutrients in foods, food ingredients, and food products are the basic first step in determining the nutritional adequacy of a food supply (Jonathan, 2006).

Nutrient analysis was carried out for the soup - mix powders. The nutrients that were analyzed in these samples include the proximate nutrients such as Carbohydrate, Energy, Protein, Fat, Fiber, Sodium, Potassium and Moisture.

Determination of energy

Bomb calorimeter is based on the fact that a known weight of the sample completely burnt in the apparatus permits the heat developed by the combustion to be absorbed by a definite weight of water. By determining the rise in temperature, it is possible to calculate within close limits, the number of heat units liberated (AOAC, 2004).

Determination of carbohydrate

Carbohydrates are hydrolyzed into simple sugar using dilute hydrochloric acid. In hot acidic medium glucose is dehydrated to hydroxyl methyl furfural. This compound forms with anthrone, a green colour with an absorption maximum at 630nm (AOAC, 2004).

Determination of protein

The most widely used method for protein determination is by Kjeldhal method for nitrogen determination. Since nitrogen is the characteristic element in protein, by its accurate determination, protein concentration can be calculated. This method involves two steps. In the first step protein is digested using sulphuric acid in the presence of a catalyst. In step two, the organic material is oxidized except nitrogen, the reduced form of which is retained in digest as ammonium sulphate. Then ammonia is distilled and collected in boric acid and titrated against standard acid (FSSAI, 2012).

Determination of fat

Fat content of the sample were determined by soxhlet extraction method. The extraction of the crude fat is carried out using petroleum ether in a soxhelt unit

followed by volatilization of solvent after extraction and determination of mass of the residue (AOAC, 2004).

Determination of crude fiber

Defatted sample was weighed and digested in sulphuric acid and sodium hydroxide solutions. The residue was then dried in muffle furnace and the dried weight gives the crude fiber content of the food sample (AOAC, 2004).

Determination of sodium and potassium

Sodium and potassium content of the formulated soup mix were calculated using food composition tables. Since sodium and potassium is the main mineral required for maintaining blood pressure, it is calculated in soup mixes formulated for hypertensive individuals.

Determination of moisture

Moisture present in the powdered sample was calculated using moisture balance. The heated plate in moisture balance will remove the moisture in the sample and shows the output in terms of percentage. Moisture was estimated using Shimadzu Moisture balance MOC – 120H.

Plate – VI presents the Nutrient and Microbial Analysis of Instant Soup Mixes.

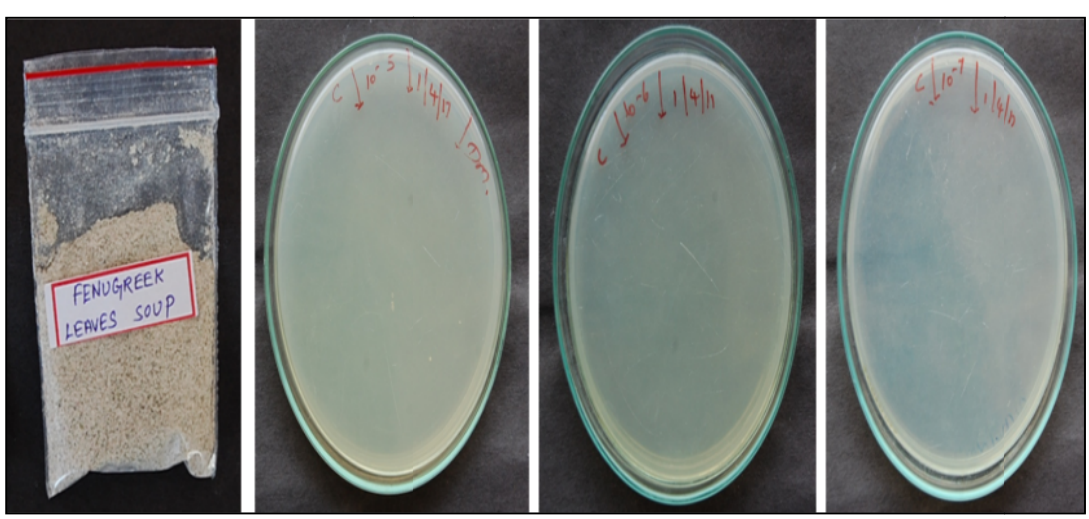


PLATE – VI

NUTRIENT AND MICROBIAL ANALYSIS OF INSTANT SOUP MIXES

IV. Shelf life of Instant Soup powders stored in zip lock covers

Food microbiology focuses on the general biology of micro organisms which are found in foods including their growth, characteristic, identification and pathogenesis (Singh, 2009).

Shelf life is the recommendation of time that products can be stored, during which the defined quality of a specified proportion of the food remains acceptable under expected conditions of storage (Akbar, 2008). Shelf life is influenced by several factors: exposure to light and heat, transmission of gases, humidity, mechanical stress and contamination by microorganism. Microbiological analysis is important to determine the safety and quality of food (Ditty chacko, Emilin renitta and jamila Patterson, 2005).

Water has numerous effects on food stability, palatability, and overall quality. Moisture can affect the physical properties such as caking or clotting in powder or powder product. Water acts as a plasticizer, has an additional effect on the shelf life of low-and intermediate-moisture foodstuffs (Sunyoto and Futiawati, 2012 and Eskin and Rebinson, D.S, 2001).

The manufacturing of Ziploc bags varies among different products. The Ziploc bags are made using 35 percent less plastic than traditional Ziploc bags and are manufactured using wind power, a cleaner renewable energy source. The Ziploc bags are also packaged in recycled paperboard, a technique used to increase the conservation of trees. (Johnson, 2016).

Microbial analysis was carried for the Instant Soup mix powders. These powders (50 g) were stored in zip lock covers. The microbial load of the sample was estimated for the first and second week. The bacterial count was analyzed for the number of colony forming units using Total Plate Count (TLC) method. This helps in determining the storage period of the developed Instant Soup mixes.

Statistical analysis and interpretation of data

The data obtained was consolidated and tabulated in which mean and standard deviation were computed. “T” test was used to calculate the significance.

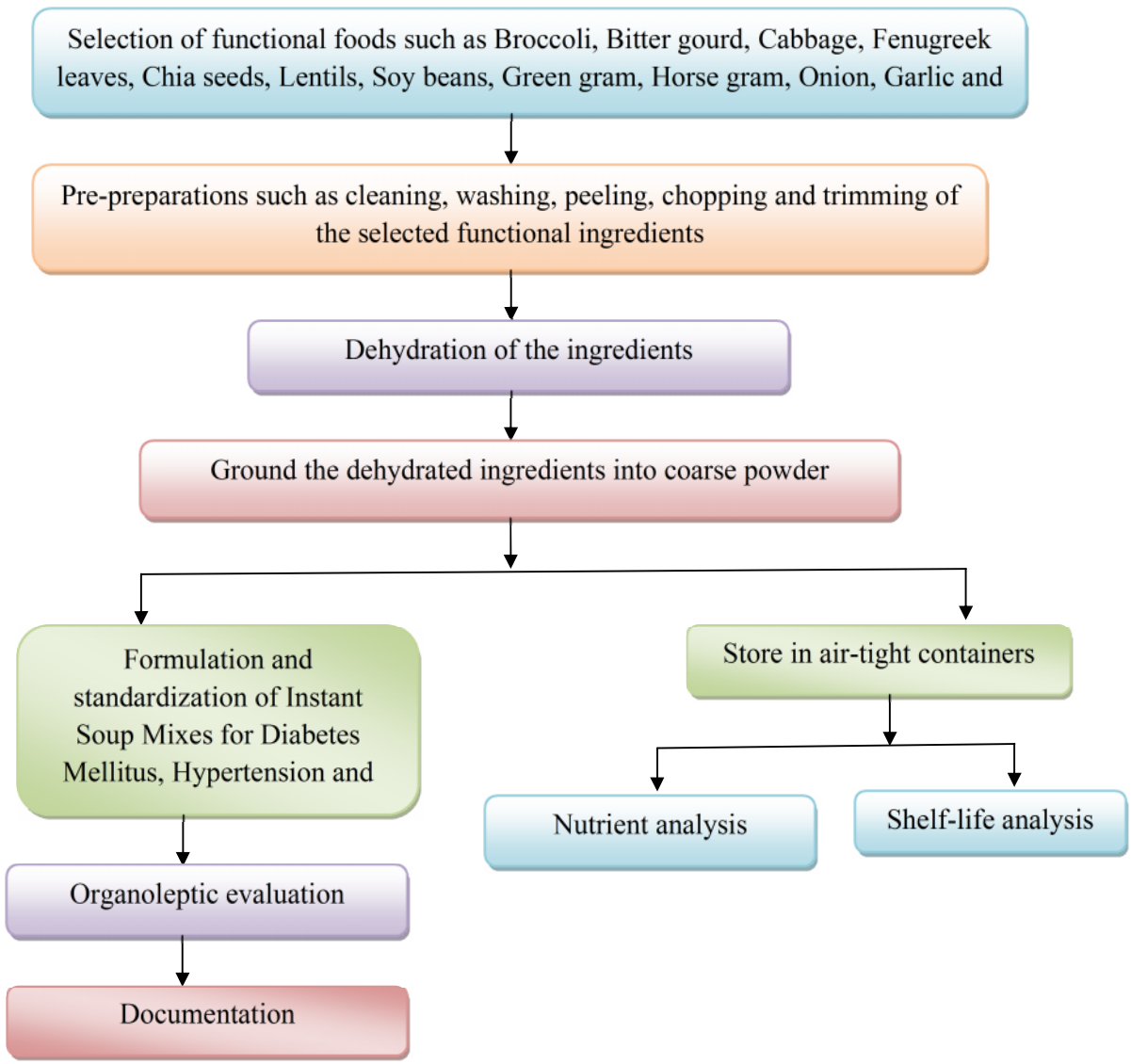
Ethical clearance

The research design and the protocol used in the study were presented for scrutinization and approval in the Institutional Human Ethics Committee. The ethical clearance was obtained and the approval number is IHEC/16-17/FSN-05 is presented in Appendix – I.

Figure – III presents the Research Design of the present study.

FIGURE – III

RESEARCH DESIGN



IV RESULTS AND DISCUSSION

The Results and Discussion pertaining to the topic, "**Formulation and standardization of Instant Soup Mixes using Functional Foods for Lifestyle Disorder**", is presented under the following headings:

A. Selection of ingredients
B. Organoleptic evaluation of the developed soup mixes
C. Nutrient analysis of Instant Soup Mixes
D. Shelf – life of Instant Soup powders stored in zip lock covers

A. Selection of ingredients

Functional foods play an important role in the prevention of diseases and provide positive health benefits beyond its traditional nutrient. Functional foods such as fenugreek leaves, bitter gourd, soy bean, lentil, cabbage, broccoli, garlic, onion, green gram, chia seed, capsicum and horse gram were selected for the study. Many researches focused on these functional foods for its positive health benefits in the human body. These functional foods were selected for its easy availability. The selected ingredients were purchased from the market. The ingredients were processed to the dried form for the development of Instant Soup mixes for lifestyle disorders such as Diabetes, Hypertension and Obesity.

Fenugreek leaves, bitter gourd, lentils and soy bean are the functional foods selected for Diabetes Mellitus because of its low glycemic index. Broccoli, Cabbage, Onion and Garlic are the functional foods selected for Hypertension due to its low sodium content whereas Capsicum, Horse gram, Green gram and Chia seeds are the functional foods chosen for obesity as they contains low fat and high protein.

The purchased ingredients were cleaned, washed, sorted and dried using cabinet drier and sun drying processes. The dried ingredients were then ground to coarse powdered form and packed in zip lock covers until it was used in the formulation. Thus, the obtained powder was formulated in three variations such as variation 1, variation 2 and variation 3 as 30 percent, 40 percent and 50 percent and was compared with the standard vegetable soup. Sensory evaluation of all the Instant soup mixes were evaluated by 10 semi-trained panel members using 9-point hedonic rating scale and the most acceptable variation was identified in each soup mix.

B. Organoleptic evaluation of the developed soup mixes

Sensory evaluation is a scientific discipline that analyses human responses to the composition of food. Appearance, colour, flavour, taste and texture of the food should be analyzed for the acceptability of the developed food product.

(i) Instant fenugreek leaves soup

Table V shows the mean acceptability scores for Instant fenugreek leaves Soup mix.

TABLE - V

MEAN ACCEPTABILITY SCORES OF INSTANT FENUGREEK LEAVES SOUP MIX

Variation	Appearance Mean±SD	Colour Mean±SD	Flavour Mean±SD	Taste Mean±SD	Texture Mean±SD	Over all Acceptability Mean±SD
Standard	8.28 ± 0.53	8.15 ± 0.57	8.2 ± 0.63	8.31 ± 0.54	8.31 ± 0.57	8.28 ± 0.56
V1	8.5 ± 0.7	8.2 ± 0.78	8.2 ± 0.78	7.9 ± 0.87	8.1 ± 0.87	8.4 ± 0.84
V2	7.8 ± 0.63	7.8 ± 0.63	7.6 ± 0.69	7.4 ± 0.69	7.6 ± 0.84	7.6 ± 0.69
V 3	7.3 ± 0.94	6.9 ± 0.56	6.8 ± 0.63	6.8 ± 0.63	7 ± 0.81	6.9 ± 0.56
T value						
S vs V1	0.748^{ns}	1.464^{ns}	0.361^{ns}	0.382^{ns}	0.802^{ns}	0.345^{ns}
S vs V2	2.098*	0.480^{ns}	0.896^{ns}	0.528^{ns}	0.96^{ns}	1.250^{ns}
S vs V3	1.361^{ns}	1.891*	1.903*	2.905*	2.703*	2.228*

S-Standard, V1-30 percent Variation, V2- 40 percent Variation, V3-50 percent Variation.

* - Significant at 5% level ns – Not Significant

From the table V and figure IV it is evident that the mean scores of the fenugreek leaves soup decreased as the level of variation of the fenugreek leaves increased.

After formulating fenugreek leaves soups with three different variations, the appearance was not acceptable as the variation increased. Majority of the panel members stated that the soup becomes dense with increase in variation. The

appearance of the soup was least acceptable at 40 percent and 50 percent variation. The mean score obtained for appearance of fenugreek leaves soup was 8.5 ± 0.7, 7.8 ± 0.63 and 7.3 ± 0.94 for 30 percent, 40 percent and 50 percent level variations respectively. There was no significant difference between S and V1 (30%) and S and V3 (50%). There was significant difference at five percent ($p<0.05$) between S and V2 (40%).

The intensity of the colour of the fenugreek leaves soup was acceptable at 30 percent variation. The mean score for the colour of the soup was 8.2 ± 0.78, 7.8 ± 0.63 and 6.9 ± 0.56 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%). There was significant difference at five percent ($p<0.05$) between S and V3 (50%).

The soup had a very strong flavour of the fenugreek leaves. Regarding flavour, 30 percent variation was found to be acceptable. Mean scores obtained for flavour of the soup was 8.2 ± 0.78, 7.6 ± 0.69 and 6.8 ± 0.63 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%). There was significant difference at five percent ($p<0.05$) between S and V3 (50%).

The taste of the fenugreek leaves soup was not highly acceptable. It gave a bitter taste when the level of variation increased. 30 percent variation secured the highest score in taste. The mean score for taste was 7.9 ± 0.87, 7.4 ± 0.69 and 6.8 ± 0.63 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%). There was significant difference at five percent ($p<0.05$) between S and V3 (50%).

The texture of the fenugreek leaves soup was very dense and found to lose the consistency of soup. Texture of 30 percent variation was found to be acceptable than the others. The mean score for texture of soup was 8.1 ± 0.87, 7.6 ± 0.84 and 7 ± 0.81 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%). There was significant difference at five percent ($p<0.05$) between S and V3 (50%).

The overall acceptability of standard soup and V1 (i.e.) 30 percent variation were found to be very good. The V2 and V3 (i.e.) 40 percent and 50 percent level of variation were found to be least acceptable. The mean score for soup was 8.4 ± 0.84, 7.6 ± 0.69 and 6.9 ± 0.56 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%). There was significant difference at five percent ($p<0.05$) between S and V3 (50%).

(ii) Instant Bitter gourd Soup Mix

Table VI shows the mean acceptability scores for Instant bitter gourd Soup mix.

TABLE - VI

MEAN ACCEPTABILITY SCORES OF INSTANT BITTER GOURD SOUP MIX

Variation	Appearance Mean±SD	Colour Mean±SD	Flavour Mean±SD	Taste Mean±SD	Texture Mean±SD	Over all Acceptability Mean±SD
Standard	8.28 ± 0.53	8.15 ± 0.57	8.2 ± 0.63	8.31 ± 0.54	8.31 ± 0.57	8.28 ± 0.56
V1	8 ± 0.66	7.9 ± 0.56	7.2 ± 0.63	8 ± 0.81	7.7 ± 0.67	7.8 ± 0.63
V2	7.7 ± 0.67	7.5 ± 0.52	7.5 ± 0.52	7.2 ± 0.42	7.3 ± 0.48	7.2 ± 0.42
V3	7.4 ± 0.96	7.1 ± 0.87	7.1 ± 0.56	7.2 ± 0.78	7.3 ± 0.94	7.2 ± 0.78
T value						
S vs V1	0.964^{ns}	0.318^{ns}	1.000^{ns}	0.964^{ns}	0.809*	1.000^{ns}
S vs V2	0.861^{ns}	0.318^{ns}	1.765^{ns}	1.689^{ns}	1.953*	2.033^{*}
S vs V3	1.354^{ns}	1.078^{ns}	2.333*	1.914*	1.761^{ns}	1.895*

S-Standard, V1-30 percent Variation, V2- 40 percent Variation, V3-50 percent Variation.
* - Significant at 5% level ns – Not Significant

From the table VI and figure V it is evident that the mean scores of the bitter gourd soup decreased as the level of variation of the bitter gourd increased.

After the formulation of bitter gourd soup with three different variations, the appearance was not acceptable for 50 percent variation. Majority of the panel members

stated that the soup becomes dense with 50 percent variation. The mean score obtained for appearance of bitter gourd soup was 8 ± 0.66, 7.7 ± 0.67 and 7.4 ± 0.96 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The intensity of the colour of the bitter gourd soup was acceptable at 30 percent variation and not acceptable at 40 and 50 percent variation. The mean score for the colour of the soup was 7.9 ± 0.56, 7.5 ± 0.52 and 7.1 ± 0.87 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The soup had a very strong flavour of the bitter gourd at 50 percent level of variation. Mean scores obtained for flavour of the soup was 7.2 ± 0.63, 7.5 ± 0.52 and 7.1 ± 0.56 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%). There was significant difference at five percent ($p<0.05$) between S and V3 (50%).

The taste of the bitter gourd soup was acceptable at 30 percent and 40 percent variation and not acceptable at 50 percent variation. It gave a bitter taste when the level of variation increased. The mean score for taste was 8 ± 0.81, 7.2 ± 0.42 and 7.2 ± 0.78for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%). There was significant difference at five percent ($p<0.05$) between S and V3 (50%).

The texture of the bitter gourd soup was very dense at 50 percent variation. The mean score for texture of soup was 7.7 ± 0.67, 7.3 ± 0.48 and 7.3 ± 0.94 for 30 percent, 40 percent and 50 percent level variation respectively. There was significant difference at five percent ($p<0.05$) between S and V1 and S and V2 (40%). There was no significant difference between S and V3 (50%).

The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be good. The V3 (i.e.) 50 percent level of variation were found to be least acceptable. The mean score for soup was 7.8 ± 0.63, 7.2 ± 0.42 and 7.2 ± 0.78 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%). There was significant difference at five percent ($p<0.05$) between S and V2 (40%) and S and V3 (50%).

(iii) Instant Lentil Soup Mix

Table VII shows the mean acceptability scores for Instant lentil Soup mix.

TABLE - VII

MEAN ACCEPTABILITY SCORES OF INSTANT LENTIL SOUP MIX

Variation	Appearance Mean±SD	Colour Mean±SD	Flavour Mean±SD	Taste Mean±SD	Texture Mean±SD	Over all Acceptability Mean±SD
Standard	8.28 ± 0.53	8.15 ± 0.57	8.2 ± 0.63	8.31 ± 0.54	8.31 ± 0.57	8.28 ± 0.56
V1	8.1 ± 0.73	7.8 ± 0.63	7.8 ± 0.78	7.8 ± 0.63	8 ± 0.47	8 ± 0.66
V2	8.2 ± 0.78	8.1 ± 0.73	8.2 ± 0.78	8 ± 0.47	8.1 ± 0.31	8 ± 0.47
V3	8 ± 0.47	7.5 ± 0.52	7.7 ± 0.48	7.5 ± 0.52	7.7 ± 0.48	7.8 ± 0.42
T value						
S vs V1	0.688^{ns}	1.078^{ns}	0.639^{ns}	0.557^{ns}	0.287^{ns}	0.314^{ns}
S vs V2	0.464^{ns}	0.956^{ns}	0.045^{ns}	0.627^{ns}	0.627^{ns}	0.765^{ns}
S vs V3	0.586^{ns}	1.000^{ns}	0.842^{ns}	1.862*	1.228^{ns}	1.535^{ns}

S-Standard, V1- 30 percent Variation, V2- 40 percent Variation, V3- 50 percent Variation.
* - Significant at 5% level ns – Not Significant

From the table VII and figure VI it is evident that the mean scores of the lentil soup decreased as the level of variation of the lentils increased

After the formulation of lentil soup with three different variations, the appearance of the soup was highly acceptable at 30 percent and 40 percent variation. The mean score obtained for appearance of lentil soup was 8.1 ± 0.73, 8.2 ± 0.78 and 8 ± 0.47 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The intensity of the colour of the lentil soup had not showed much difference as the level of variation increased. The mean score for the colour of the soup was 7.8 ± 0.63, 8.1 ± 0.73 and 7.5 ± 0.52 for 30 percent, 40 percent and 50 percent level variation respectively. The colour of the soup remained same for all the level of variation with

minimum variations in colour. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The soup had a pulse flavour in the formulated lentil soup. 40 percent variation scored high in flavour. Mean scores obtained for flavour of the soup was 7.8 ± 0.78, 8.2 ± 0.78 and 7.7 ± 0.48 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The taste of the lentil soup was highly acceptable. It gave a good taste to the soup at 30 and 40 percent variation. The mean score for taste was 7.8 ± 0.63, 8 ± 0.47 and 7.5 ± 0.52 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%). There was significant difference at five percent ($p<0.05$) between S and V3 (50%).

The texture of the lentil soup was very good and gave out a highly acceptable consistency of the soup. 40 percent variation in texture was found to be highly acceptable. The mean score for texture of soup was 8 ± 0.47, 8.1 ± 0.31 and 7.7 ± 0.48 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be very good. The V3 (i.e.) 50 percent level of variation was found to be good. The mean score for soup was 8 ± 0.66, 8 ± 0.47 and 7.8 ± 0.42 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

(iv) Instant Soy Beans Soup Mix

Table VIII shows the mean acceptability scores for Instant soy beans Soup mix

TABLE - VIII

MEAN ACCEPTABILITY SCORES OF INSTANT SOY BEAN SOUP MIX

Variation	Appearance Mean±SD	Colour Mean±SD	Flavour Mean±SD	Taste Mean±SD	Texture Mean±SD	Over all Acceptability Mean±SD
Standard	8.28 ± 0.53	8.15 ± 0.57	8.2 ± 0.63	8.31 ± 0.54	8.31 ± 0.57	8.28 ± 0.56
V1	7.9 ± 0.31	8.2 ± 0.42	8.1 ± 0.31	8.2 ± 0.42	8.4 ± 0.51	8.2 ± 0.63
V2	8.2 ± 0.78	7.8 ± 0.63	8.1 ± 0.87	8.1 ± 0.99	8.2 ± 0.91	8.2 ± 0.91
V3	7.6 ± 0.69	7.9 ± 0.73	7.6 ± 0.69	7.6 ± 0.69	8 ± 0.47	7.9 ± 0.56
T value						
S vs V1	0.518^{ns}	0.218^{ns}	0.612^{ns}	0.689^{ns}	0.177^{ns}	0.627^{ns}
S vs V2	0.909^{ns}	0.896^{ns}	0.765^{ns}	0.449^{ns}	0.462^{ns}	0.452^{ns}
S vs V3	1.012^{ns}	0.921^{ns}	1.051^{ns}	0.936^{ns}	0.714^{ns}	0.914^{ns}

S-Standard, V1- 30 percent Variation, V2- 40 percent Variation, V3- 50 percent Variation.
* - Significant at 5% level ns – Not Significant

From the table VIII and figure VII it is evident that the mean scores of the soy bean soup decreased as the level of variation of the soy bean increased.

The appearance of the soy bean soup was acceptable as the variation increased upto 40 percent variation. The appearance of the soup was highly acceptable at 30 percent and 40 percent variation. The mean score obtained for appearance of soy bean soup was 7.9 ± 0.31, 8.2 ± 0.78 and 7.6 ± 0.69 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The intensity of the colour of the soy bean soup was acceptable at 30 percent variation. The mean score for the colour of the soup was 8.2 ± 0.42, 7.8 ± 0.63 and 7.9 ± 0.73 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The soup had the flavour of soy bean at 30 and 40 percent variation. Mean scores obtained for flavour of the soup was 8.1 ± 0.31, 8.1 ± 0.87 and 7.6 ± 0.69 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The taste of the soy bean soup was acceptable at 30 percent and 40 percent level of variation. It gave a good taste at 30 percent level of variation. The mean score for taste was 8.2 ± 0.42, 8.1 ± 0.99 and 7.6 ± 0.69 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The texture of the soy bean soup was good and was highly acceptable. 30 percent variation secured the highest score in texture. The mean score for texture of soup was 8.4 ± 0.51, 8.2 ± 0.91 and 8 ± 0.47 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be very good. The V3 (i.e.) 50 percent level of variation was found to be good. The mean score for soup was 8.2 ± 0.63, 8.2 ± 0.91 and 7.9 ± 0.56 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

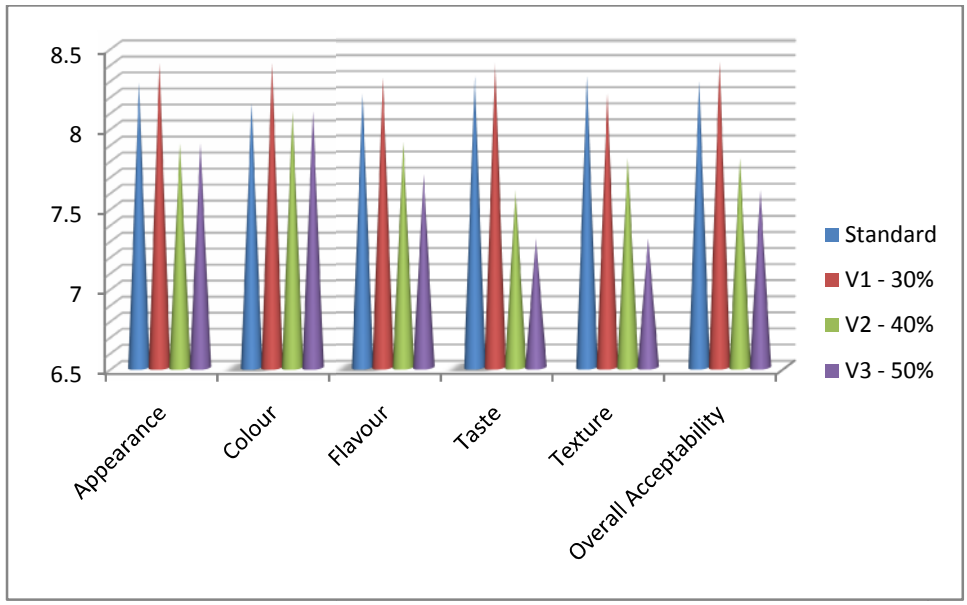


FIGURE – IV

MEAN ACCEPTABILITY SCORES OF INSTANT FENUGREEK LEAVES SOUP MIX

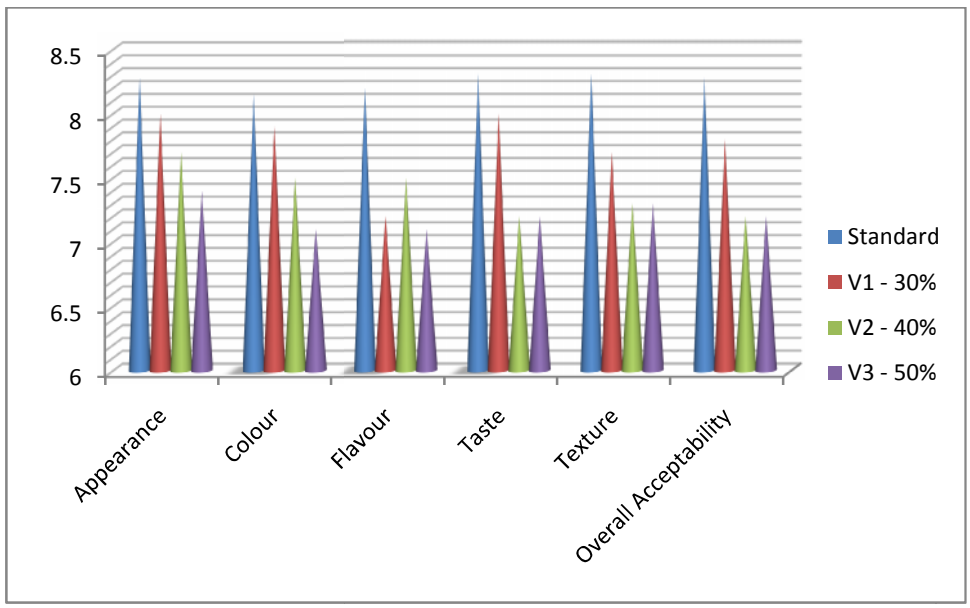


FIGURE – V

MEAN ACCEPTABILITY SCORES OF INSTANT BITTER GOURD SOUP MIX

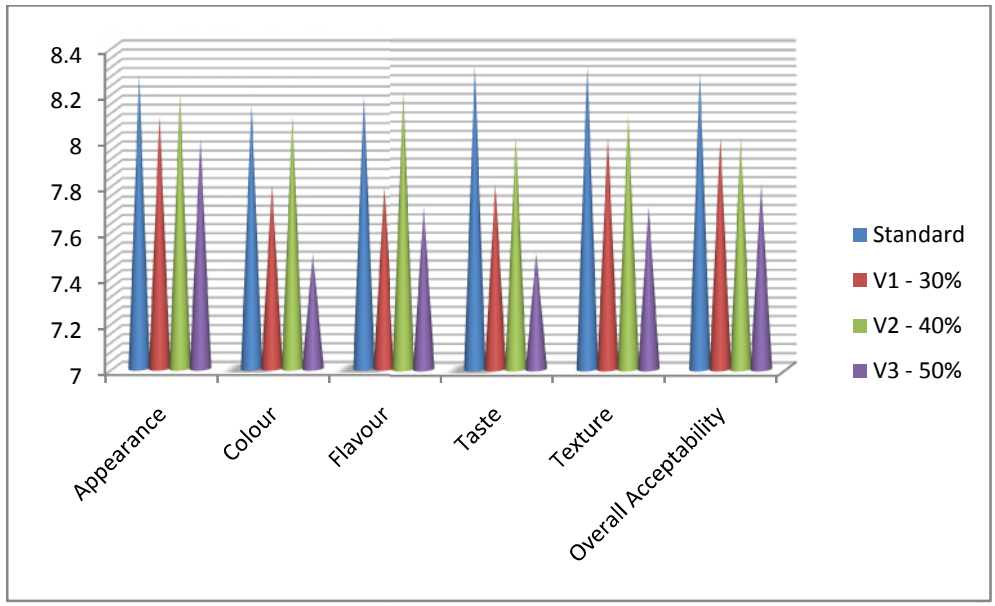


FIGURE – VI

MEAN ACCEPTABILITY SCORES OF INSTANT LENTIL SOUP MIX

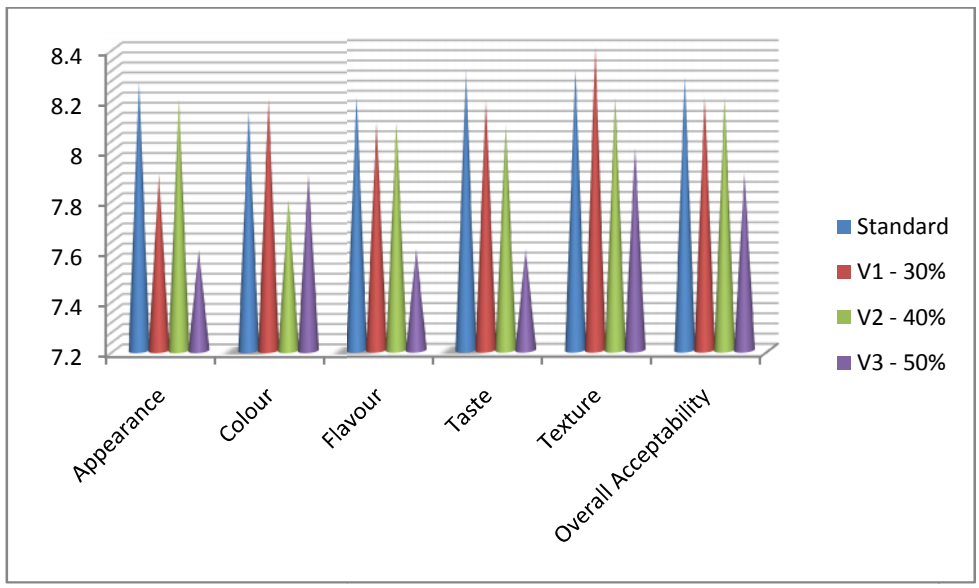


FIGURE – VII

MEAN ACCEPTABILITY SCORES OF INSTANT SOY BEAN SOUP MIX

(v) Instant Broccoli Soup Mix

Table – IX shows the mean acceptability scores for Instant broccoli Soup mix.

TABLE - IX

MEAN ACCEPTABILITY SCORES OF INSTANT BROCCOLI SOUP MIX

Variation	Appearance Mean±SD	Colour Mean±SD	Flavour Mean±SD	Taste Mean±SD	Texture Mean±SD	Over all Acceptability Mean±SD
Standard	8.28 ± 0.53	8.15 ± 0.57	8.2 ± 0.63	8.31 ± 0.54	8.31 ± 0.57	8.28 ± 0.56
V1	8.1 ± 0.73	8 ± 0.81	8 ± 0.81	7.7 ± 0.67	8 ± 0.81	7.9 ± 0.87
V2	7.7 ± 0.67	7.6 ± 0.51	7.6 ± 0.51	7.6 ± 0.69	7.5 ± 0.52	7.4 ± 0.51
V3	7.3 ± 1.41	7.4 ± 1.34	6.9 ± 1.19	6.7 ± 1.05	7.1 ± 1.28	7.1 ± 1.28
T value						
S vs V1	0.309^{ns}	0.318^{ns}	0.177^{ns}	0.752^{ns}	0.464^{ns}	0.167^{ns}
S vs V2	0.829^{ns}	0.449^{ns}	0.689^{ns}	0.743^{ns}	0.973^{ns}	0.373^{ns}
S vs V3	0.832^{ns}	0.961^{ns}	1.987*	1.805*	1.533^{ns}	0.993^{ns}

S-Standard, V1-30 percent Variation, V2- 40 percent Variation, V3-50 percent Variation.
* - Significant at 5% level ns – Not Significant

From the table IX and figure VIII it is evident that the mean scores of the broccoli soup decreased as the level of variation increased.

After the formulation of broccoli soup with three different variations, the appearance was acceptable upto 40 percent variation. Majority of the panel members stated that the soup becomes dense with increase in variation. The appearance of the soup was not acceptable at 50percent variation. The mean score obtained for appearance of broccoli soup was 8.1 ± 0.73, 7.7 ± 0.67 and 7.3 ± 1.41 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The intensity of the colour of the broccoli soup was acceptable at 30 percent variation and had secured the highest score. The mean score for the colour of the soup

was 8 ± 0.81, 7.6 ± 0.51 and 7.4 ± 1.34 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The soup had a very strong flavour of the broccoli at 40 and 50 percent variation, hence they were not acceptable. Mean scores obtained for flavour of the soup was 8 ± 0.81, 7.6 ± 0.51 and 6.9 ± 1.19 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%). There was a significant difference at five percent ($p<0.005$) between S and V3 (50%).

The taste of the broccoli soup was acceptable. It gave a bitter taste when the level of variation increased. The mean score for taste was 7.7 ± 0.67, 7.6 ± 0.69 and 6.7 ± 1.05 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%). There was a significant difference at five percent ($p<0.005$) between S and V3 (50%).

The texture of the broccoli soup was very dense and found to lose the consistency of soup. The texture of 30 percent variation of soup was found to be acceptable. The mean score for texture of soup was 8 ± 0.81, 7.5 ± 0.52 and 7.1 ± 1.28 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be very good. The V3 (i.e.) 50 percent level of variation was not found to be acceptable. The mean score for soup was 7.9 ± 0.87, 7.4 ± 0.51 and 7.1 ± 1.28 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

(vi) Instant Cabbage Soup Mix

Table – X shows the mean acceptability scores for Instant cabbage Soup mix

TABLE - X

MEAN ACCEPTABILITY SCORES OF INSTANT CABBAGE SOUP MIX

Variation	Appearance Mean±SD	Colour Mean±SD	Flavour Mean±SD	Taste Mean±SD	Texture Mean±SD	Over all Acceptability Mean±SD
Standard	8.28 ± 0.53	8.15 ± 0.57	8.2 ± 0.63	8.31 ± 0.54	8.31 ± 0.57	8.28 ± 0.56
V1	7.9 ± 0.73	7.9 ± 0.87	8.1 ± 0.73	7.9 ± 0.73	7.8 ± 0.63	7.9 ± 0.73
V2	7.7 ± 0.48	7.6 ± 0.69	7.4 ± 0.84	7.6 ± 0.69	7.9 ± 0.56	7.7 ± 0.48
V3	7.5 ± 0.7	7.4 ± 0.51	7.6 ± 0.84	7.5 ± 0.97	7.7 ± 0.67	7.5 ± 0.7
T value						
S vs V1	0.627 ^{ns}	0.525^{ns}	0.361 ^{ns}	0.659 ^{ns}	0.250 ^{ns}	0.361 ^{ns}
S vs V2	0.783 ^{ns}	0.806 ^{ns}	0.832 ^{ns}	0.742 ^{ns}	0.236 ^{ns}	0.480 ^{ns}
S vs V3	0.950 ^{ns}	0.861 ^{ns}	0.714 ^{ns}	0.662 ^{ns}	0.280 ^{ns}	0.563 ^{ns}

S-Standard, V1-30 percent Variation, V2- 40 percent Variation, V3-50 percent Variation.

* - Significant at 5% level ns – Not Significant

From the table X and figure IX it is evident that the mean scores of the cabbage soup decreased as the level of variation increased.

After the formulation of cabbage soup with three different variations, the appearance was not acceptable as the variation increased. Majority of the panel members stated that the soup becomes dense with increase in variation. The appearance of the soup was not acceptable at 50 percent variation. The mean score obtained for appearance of cabbage soup was 7.9 ± 0.73, 7.7 ± 0.48 and 7.5 ± 0.7 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The intensity of the colour of the cabbage soup increased as the level of variation increased. 30 and 40 percent variation of colour of the soup was found to be acceptable. The mean score for the colour of the soup was 7.9 ± 0.87, 7.6 ± 0.69 and 7.4 ± 0.51 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The flavour of the soup increased with each successive variation and had a strong flavour of cabbage at 50 percent variation, hence it was not acceptable. The soup had a very strong flavour of cabbage. Mean scores obtained for flavour of the soup was 8.1 ± 0.73, 7.4 ± 0.84 and 7.6 ± 0.84 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The taste of the cabbage soup was highly acceptable and gave a good taste at 30 percent variation. The mean score for taste was 7.9 ± 0.73, 7.6 ± 0.69 and 7.5 ± 0.97 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The texture of the cabbage soup was very dense. Texture of the cabbage soup was acceptable at 30 percent variation and was not acceptable at 40 and 50 percent variation. The mean score for texture of soup was 7.8 ± 0.63, 7.9 ± 0.56 and 7.7 ± 0.67 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be very good. The V3 (i.e.) 50 percent level of variation was found to be least acceptable. The mean score for soup was 7.9 ± 0.73, 7.7 ± 0.48 and 7.5 ± 0.7 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

(vii) Instant Onion Soup Mix

Table – XI shows the mean acceptability scores for Instant onion Soup mix

TABLE - XI

MEAN ACCEPTABILITY SCORES OF INSTANT ONION SOUP MIX

Variation	Appearance Mean±SD	Colour Mean±SD	Flavour Mean±SD	Taste Mean±SD	Texture Mean±SD	Over all Acceptability Mean±SD
Standard	8.28 ± 0.53	8.15 ± 0.57	8.2 ± 0.63	8.31 ± 0.54	8.31 ± 0.57	8.28 ± 0.56
V1	8.2 ± 0.78	8.3 ± 0.67	8.2 ± 0.78	8.2 ± 0.78	8.3 ± 0.67	8.3 ± 0.67
V2	7.9 ± 0.56	7.9 ± 0.56	7.6 ± 0.96	7.9 ± 0.87	7.9 ± 0.73	7.8 ± 0.63
V3	7.5 ± 0.84	7.6 ± 0.84	7.7 ± 0.82	7.5 ± 0.7	7.6 ± 0.69	7.4 ± 0.84
T value						
S vs V1	0.318 ns	0.318 ns	0.184 ns	0.127 ns	0.118 ns	0.250 ns
S vs V2	0.564 ns	0.661 ns	0.516 ns	0.354 ns	0.307 ns	0.453 ns
S vs V3	0.527 ns	0.873 ns	0.383 ns	0.539 ns	0.418 ns	0.482 ns

S-Standard, V1-30 percent Variation, V2- 40 percent Variation, V3-50 percent Variation.

* - Significant at 5% level ns – Not Significant

From the table XI and figure X it is evident that the mean scores of the onion soup decreased as the level of variation of the increased.

After the formulation of onion soup with three different variations, the appearance was not acceptable as the variation increased. The panel members stated that the soup becomes dense with increase in variation. The appearance of the soup was acceptable at 30 percent and 40 percent variation. The mean score obtained for appearance of onion soup was 8.2 ± 0.78, 7.9 ± 0.56 and 7.5 ± 0.84 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The intensity of the colour of the onion soup was found be acceptable at 30 percent variation. The mean score for the colour of the soup was 8.3 ± 0.67, 7.9 ± 0.56 and 7.6 ± 0.84 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The soup had a very strong flavour of onion at 50 percent variation and hence it was not acceptable. Mean scores obtained for flavour of the soup was 8.2 ± 0.78, 7.6 ± 0.96 and 7.7 ± 0.82 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The taste of the onion soup was highly acceptable. It gave a stringent taste when the level of variation increased and hence not acceptable at 50 percent level of variation. The mean score for taste was 8.2 ± 0.78, 7.9 ± 0.87 and 7.5 ± 0.7 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The texture of the onion soup was very dense. The texture of 30 percent variation was found to be acceptable. The mean score for texture of soup was 8.3 ± 0.67, 7.9 ± 0.73 and 7.6 ± 0.69 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be very good. The V3 (i.e.) 50 percent level of variation was not found to be acceptable. The mean score for soup was 8.3 ± 0.67, 7.8 ± 0.63 and 7.4 ± 0.84 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

(viii) Instant Garlic Soup Mix

Table – XII shows the mean acceptability scores for instant garlic soup mix.

TABLE - XII

MEAN ACCEPTABILITY SCORES OF INSTANT GARLIC SOUP MIX

Variation	Appearance Mean±SD	Colour Mean±SD	Flavour Mean±SD	Taste Mean±SD	Texture Mean±SD	Over all Acceptability Mean±SD
Standard	8.28 ± 0.53	8.15 ± 0.57	8.2 ± 0.63	8.31 ± 0.54	8.31 ± 0.57	8.28 ± 0.56
V1	8.4 ± 0.51	8.4 ± 0.69	8.3 ± 0.48	8.4 ± 0.51	8.2 ± 0.42	8.4 ± 0.51
V2	7.9 ± 0.56	8.1 ± 0.73	7.9 ± 0.73	7.6 ± 0.51	7.8 ± 0.63	7.8 ± 0.42
V3	7.9 ± 0.87	8.1 ± 1.1	7.7 ± 1.05	7.3 ± 0.94	7.3 ± 1.05	7.6 ± 0.84
T value						
S vs V1	0.258^{ns}	0.292^{ns}	0.189^{ns}	0.139^{ns}	0.283^{ns}	0.314^{ns}
S vs V2	0.390^{ns}	0.177^{ns}	0.333^{ns}	0.811^{ns}	0.361^{ns}	0.511^{ns}
S vs V3	0.236^{ns}	0.122^{ns}	0.161^{ns}	0.674^{ns}	0.538^{ns}	0.687^{ns}

S-Standard, V1-30 percent Variation, V2- 40 percent Variation, V3-50 percent Variation.

* - Significant at 5% level ns – Not Significant

From the table XII and figure XI it is evident that the mean scores of the garlic soup decreased as the level of variation of the garlic increased.

After the formulation of garlic soup with three different variations, the appearance was not acceptable as the variation increased. The appearance of the soup was not acceptable at 50 percent variation. The mean score obtained for appearance of garlic soup was 8.4 ± 0.51, 7.9 ± 0.56 and 7.9 ± 0.87 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The colour of the soup had very slight difference and was acceptable at 30 percent variation. The mean score for the colour of the soup was 8.4 ± 0.69, 8.1 ± 0.73 and 8.1 ± 1.1 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The soup had a very strong flavour of the garlic at 50 percent variation. Mean scores obtained for flavour of the soup was 8.3 ± 0.48, 7.9 ± 0.73 and 7.7 ± 1.05 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The taste of the garlic soup was not highly acceptable. It gave a spicy taste when the level of variation increased and was least acceptable at 40 and 50 percent variation. The mean score for taste was 8.4 ± 0.51, 7.6 ± 0.51 and 7.3 ± 0.94 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The texture of the garlic soup was found to be good at 30 percent variation. The mean score for texture of soup was 8.2 ± 0.42, 7.8 ± 0.63 and 7.3 ± 1.05 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The overall acceptability of standard soup and V1 (i.e.) 30 percent variation were found to be very good. The V2 and V3 (i.e.) 40 percent and 50 percent level of variation were not found to be acceptable. The mean score for soup was 8.4 ± 0.51, 7.8 ± 0.42 and 7.6 ± 0.84 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

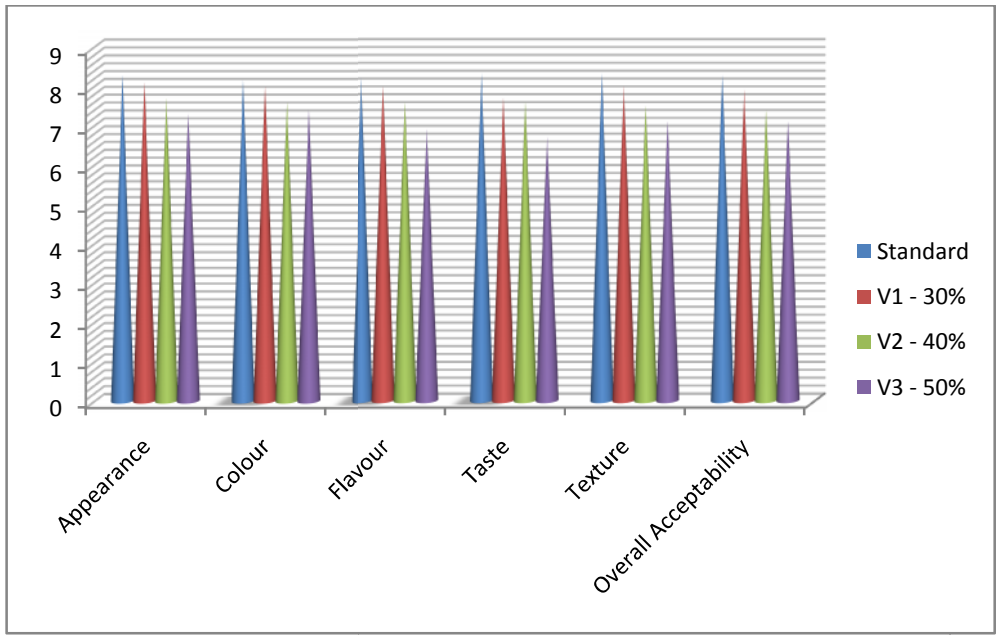


FIGURE - VIII

MEAN ACCEPTABILITY SCORES OF INSTANT BROCCOLI SOUP MIX

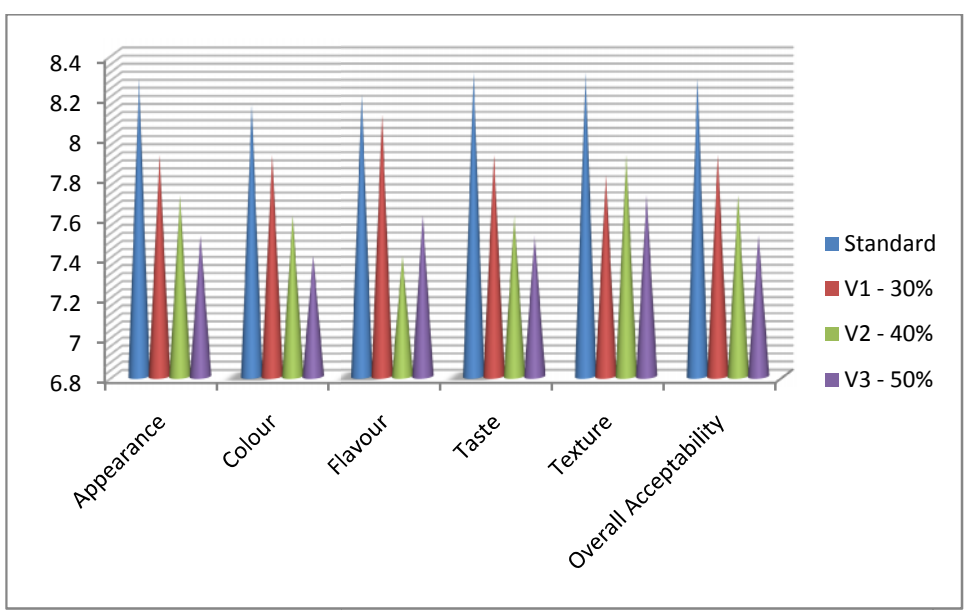


FIGURE – IX

MEAN ACCEPTABILITY SCORES OF INSTANT CABBAGE SOUP MIX

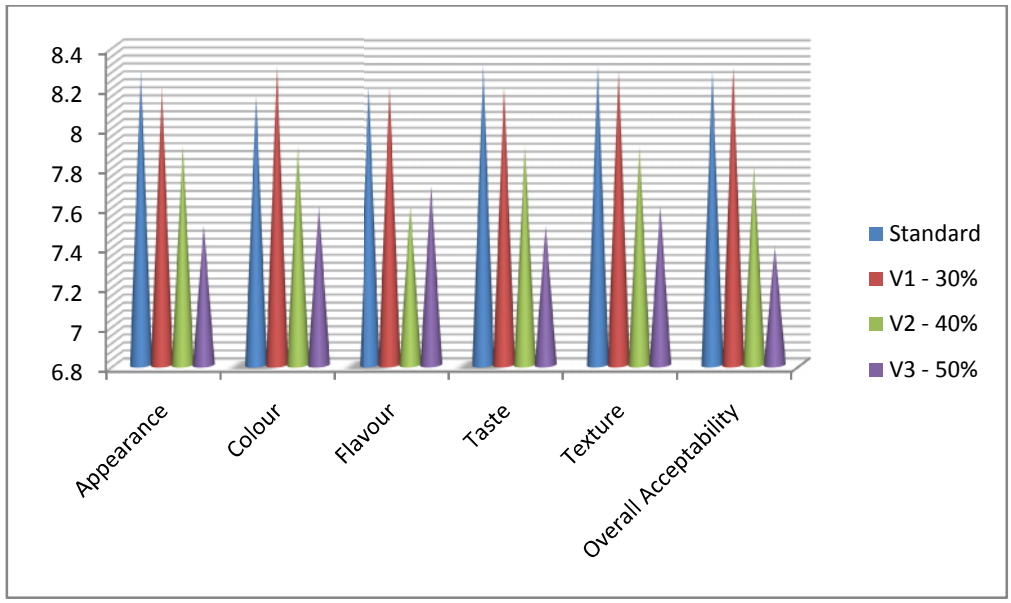


FIGURE – X

MEAN ACCEPTABILITY SCORES OF INSTANT ONION SOUP MIX

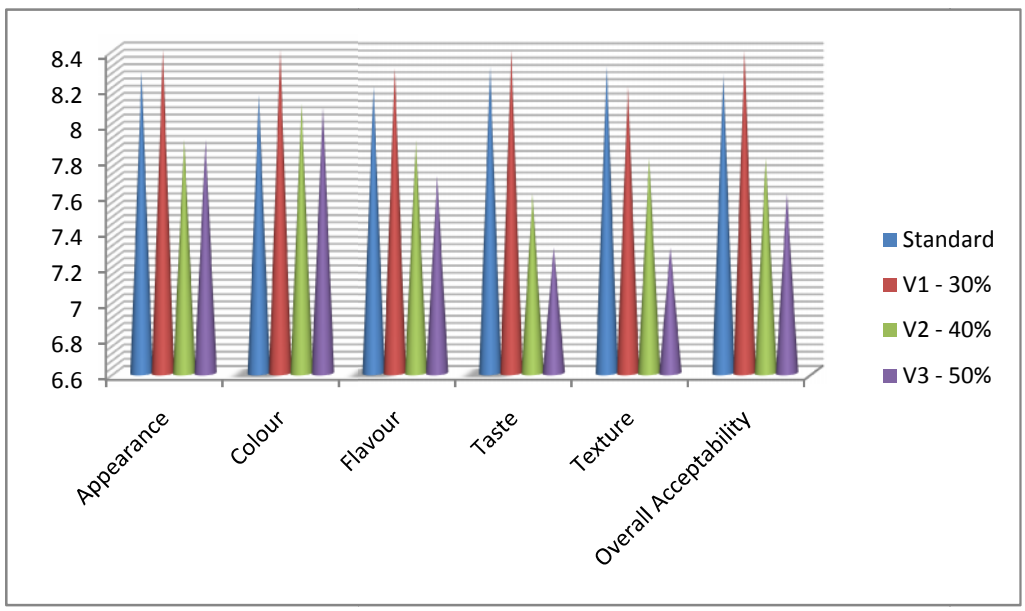


FIGURE – XI

MEAN ACCEPTABILITY SCORES OF INSTANT GARLIC SOUP MIX

(ix) Instant Capsicum Soup Mix

Table – XIII shows the mean acceptability scores for Instant capsicum Soup mix.

TABLE - XIII

MEAN ACCEPTABILITY SCORES OF INSTANT CAPSICUM SOUP MIX

Variation	Appearance Mean±SD	Colour Mean±SD	Flavour Mean±SD	Taste Mean±SD	Texture Mean±SD	Over all Acceptability Mean±SD
Standard	8.28 ± 0.53	8.15 ± 0.57	8.2 ± 0.63	8.31 ± 0.54	8.31 ± 0.57	8.28 ± 0.56
V1	7.8 ± 0.63	7.8 ± 0.63	7.8 ± 0.91	7.8 ± 0.78	8 ± 0.66	8.1 ± 0.73
V2	7.9 ± 0.73	7.8 ± 0.63	7.6 ± 0.69	7.7 ± 0.82	7.6 ± 0.69	7.7 ± 0.82
V3	7.4 ± 0.96	7.5 ± 1.08	7.5 ± 1.08	7.3 ± 0.94	7.3 ± 1.15	7.4 ± 1.07
T value						
S vs V1	0.449^{ns}	0.429^{ns}	0.353^{ns}	0.389^{ns}	0.214^{ns}	0.271^{ns}
S vs V2	0.550^{ns}	0.412^{ns}	0.586^{ns}	0.347^{ns}	0.562^{ns}	0.356^{ns}
S vs V3	0.604^{ns}	0.373^{ns}	0.382^{ns}	0.429^{ns}	0.250^{ns}	0.391^{ns}

S-Standard, V1- 30 percent Variation, V2- 40 percent Variation, V3- 50 percent Variation.

* - Significant at 5% level ns – Not Significant

From the table XIII and figure XII it is evident that the mean scores of the capsicum soup decreased as the level of variation increased.

After the formulation of capsicum soup with three different variations, the appearance was acceptable as the variation increased. The appearance of the soup was acceptable at 30 percent, 40 percent and 50 percent variation. The mean score obtained for appearance of capsicum soup was 7.8 ± 0.63, 7.9 ± 0.73 and 7.4 ± 0.96 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The colour of capsicum soup has scored the same for 30 and 40 percent variation. Hence, the colour was acceptable at both 30 and 40 percent variation. The mean score for the colour of the soup was 7.8 ± 0.63, 7.8 ± 0.63 and 7.5 ± 1.08 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The soup had a strong flavour of the capsicum at 50 percent variation. The flavour of the soup was found to be acceptable at 30 percent variation. Mean scores obtained for flavour of the soup was 7.8 ± 0.91, 7.6 ± 0.69 and 7.5 ± 1.08 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The taste of the capsicum soup was highly acceptable. It gave a good taste at 30 and 40 percent variation. The mean score for taste was 7.8 ± 0.78, 7.7 ± 0.82 and 7.3 ± 0.94 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The texture of the capsicum soup was found to good at 30 percent variation. The mean score for texture of soup was 8 ± 0.66, 7.6 ± 0.69 and 7.3 ± 1.15 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be very good. The V3 (i.e.) 50 percent level of variation was found to be good. The mean score for soup was 8.1 ± 0.73, 7.7 ± 0.82 and 7.4 ± 1.07 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

(x) Instant Green Gram Soup Mix

Table – XIV shows the mean acceptability scores for Instant green gram Soup mix.

TABLE - XIV

MEAN ACCEPTABILITY SCORES OF INSTANT GREEN GRAM SOUP MIX

Variation	Appearance Mean±SD	Colour Mean±SD	Flavour Mean±SD	Taste Mean±SD	Texture Mean±SD	Over all Acceptability Mean±SD
Standard	8.28 ± 0.53	8.15 ± 0.57	8.2 ± 0.63	8.31 ± 0.54	8.31 ± 0.57	8.28 ± 0.56
V1	7.9 ± 0.31	7.6 ± 0.51	8.2 ± 0.91	7.7 ± 0.48	7.8 ± 0.42	7.8 ± 0.42
V2	8.5 ± 0.52	8.3 ± 0.94	8.4 ± 0.69	8.3 ± 0.48	8.4 ± 0.69	8.5 ± 0.52
V3	8.4 ± 0.84	7.8 ± 0.78	7.9 ± 0.56	7.6 ± 0.69	7.4 ± 0.69	8 ± 0.47
T value						
S vs V1	0.309^{ns}	0.818^{ns}	0.159^{ns}	0.689^{ns}	0.554^{ns}	0.450^{ns}
S vs V2	0.218^{ns}	0.502^{ns}	0.312^{ns}	0.422^{ns}	0.185^{ns}	0.318^{ns}
S vs V3	0.268^{ns}	0.746^{ns}	0.378^{ns}	0.741^{ns}	0.832^{ns}	0.309^{ns}

S-Standard, V1-30 percent Variation, V2- 40 percent Variation, V3-50 percent Variation

* - Significant at 5% level ns – Not Significant

From the table XIV and figure XIII it is evident that the mean scores of the green gram soup decreased as the level of variation of the increased.

After the formulation of green gram soup with three different variations, the appearance was acceptable as the variation increased upto 40 percent. The appearance of the soup was acceptable at 30 percent, 40 percent and 50 percent variation. The mean score obtained for appearance of green gram soup was 7.9 ± 0.31, 8.5 ± 0.52 and 8.4 ± 0.84 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The colour of green gram soup at 40 percent variation was found to be acceptable. The mean score for the colour of the soup was 7.6 ± 0.51, 8.3 ± 0.94 and 7.8 ± 0.78 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The soup had a very good flavour of green gram at 50 percent variation and hence it was not acceptable. Mean scores obtained for flavour of the soup was 8.2 ± 0.91, 8.4 ± 0.69 and 7.9 ± 0.56 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The taste of the green gram soup was highly acceptable. It gave a good taste at 30 and 40 percent variation. The mean score for taste was 7.7 ± 0.48, 8.3 ± 0.48 and 7.6 ± 0.69 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The texture of the green gram soup was found to be good at 40 percent variation. The mean score for texture of soup was 7.8 ± 0.42, 8.4 ± 0.69 and 7.4 ± 0.69 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be very good. The V3 (i.e.) 50 percent level of variation was found to be good. The mean score for soup was 7.8 ± 0.42, 8.5 ± 0.52 and 8 ± 0.47 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

(xi) Instant Horse Gram Soup Mix

Table – XV shows the mean scores for Instant horse gram Soup mix.

TABLE - XV

MEAN ACCEPTABILITY SCORES OF INSTANT HORSE GRAM SOUP MIX

Variation	Appearance Mean±SD	Colour Mean±SD	Flavour Mean±SD	Taste Mean±SD	Texture Mean±SD	Over all Acceptability Mean±SD
Standard	8.28 ± 0.53	8.15 ± 0.57	8.2 ± 0.63	8.31 ± 0.54	8.31 ± 0.57	8.28 ± 0.56
V1	8 ± 0.47	7.8 ± 0.42	7.8 ± 0.63	8.1 ± 0.56	7.9 ± 0.56	8 ± 0.66
V2	7.2 ± 0.63	7.5 ± 0.7	7.5 ± 0.7	7.4 ± 0.69	7.3 ± 0.67	7.4 ± 0.69
V3	7 ± 0.81	7.4 ± 0.96	7.1 ± 0.73	6.9 ± 0.73	7.1 ± 0.87	7.1 ± 0.73
T value						
S vs V1	0.215^{ns}	0.361^{ns}	0.309^{ns}	0.250^{ns}	0.809^{ns}	0.543^{ns}
S vs V2	0.688^{ns}	0.514^{ns}	0.427^{ns}	0.449^{ns}	1.406^{ns}	1.045^{ns}
S vs V3	0.449^{ns}	0.500^{ns}	0.861^{ns}	1.857*	1.689^{ns}	1.714^{ns}

S-Standard, V1-30 percent Variation, V2- 40 percent Variation, V3-50 percent Variation.
* - Significant at 5% level ns – Not Significant

From the table XV and figure XIV it is evident that the mean scores of the horse gram soup decreased as the level of variation of the increased.

After the formulation of horse gram soup with three different variations, the appearance was not acceptable as the variation increased. The appearance of the soup was not acceptable at 50 percent variation. The mean score obtained for appearance of horse gram soup was 8 ± 0.47, 7.2 ± 0.63 and 7 ± 0.81 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The intensity of the colour of the horse gram soup has a slight difference as the level of variation increased. The colour of the soup was acceptable at 30 percent variation. The mean score for the colour of the soup was 7.8 ± 0.42, 7.5 ± 0.7 and 7.4 ± 0.96 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The soup had a very strong flavour of horse gram at 50 percent variation and hence it is not acceptable. Mean scores obtained for flavour of the soup was 7.8 ± 0.63, 7.5 ± 0.7 and 7.1 ± 0.73 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The taste of the horse gram soup was highly acceptable. Taste was not acceptable as the level of variation increased. The mean score for taste was 8.1 ± 0.56, 7.4 ± 0.69 and 6.9 ± 0.73 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%). There was significant difference at five percent ($p<0.05$) between S and V3 (50%).

The texture of the horse gram soup was found to be dense and lost the consistency of the soup. Texture was acceptable at 30 percent variation than the others. The mean score for texture of soup was 7.9 ± 0.56, 7.3 ± 0.67 and 7.1 ± 0.87 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The overall acceptability of standard soup and V1 (i.e.) 30 percent variation were found to be very good. The V2 and V3 (i.e.) 40 percent and 50 percent level of variation was found not to be acceptable. The mean score for soup was 8 ± 0.66, 7.4 ± 0.69 and 7.1 ± 0.73 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

(xii) Instant Chia Seed Soup Mix

Table – XVI shows the mean acceptability scores for Instant chia seed Soup mix.

TABLE - XVI

MEAN ACCEPTABILITY SCORES OF INSTANT CHIA SEED SOUP MIX

Variation	Appearance Mean±SD	Colour Mean±SD	Flavour Mean±SD	Taste Mean±SD	Texture Mean±SD	Over all Acceptability Mean±SD
Standard	8.28 ± 0.53	8.15 ± 0.57	8.2 ± 0.63	8.31 ± 0.54	8.31 ± 0.57	8.28 ± 0.56
V 1	8 ± 0.47	7.9 ± 0.56	7.4 ± 0.51	7.7 ± 0.67	7.8 ± 0.63	7.7 ± 0.67
V2	7.8 ± 0.42	7.7 ± 0.48	7.3 ± 0.48	7.4 ± 0.51	7.5 ± 0.52	7.6 ± 0.51
V3	7 ± 0.81	6.9 ± 0.73	6.7 ± 0.67	6.7 ± 0.48	7 ± 0.81	7.1 ± 0.73
T value						
S vs V1	0.261^{ns}	0.152^{ns}	1.057^{ns}	0.528^{ns}	0.456^{ns}	0.671^{ns}
S vs V2	0.557^{ns}	0.429^{ns}	1.105^{ns}	0.949^{ns}	0.742^{ns}	0.882^{ns}
S vs V3	1.207^{ns}	1.334^{ns}	1.986*	1.928*	1.238^{ns}	1.345^{ns}

S-Standard, V1-30 percent Variation, V2- 40 percent Variation, V3-50 percent Variation.

* - Significant at 5% level ns – Not Significant

From the table XVI and figure XV it is evident that the mean scores of the chia seed soup decreased as the level of variation of the increased.

After the formulation of chia seed soup with three different variations, the appearance was acceptable as the variation increased. The appearance of the soup was acceptable at 30 percent and not acceptable at 40 percent and 50 percent variation. The mean score obtained for appearance of chia seed soup was 8 ± 0.47, 7.8 ± 0.42 and 7 ± 0.81 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The intensity of the colour of chia seed soup had less difference as the level of variation increased. The mean score for the colour of the soup was 7.9 ± 0.56, 7.7 ± 0.48 and 6.9 ± 0.73 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The flavour of the soup had less difference with each successive variation and found to be acceptable at 30 percent variation. Mean scores obtained for flavour of the soup was 7.4 ± 0.51, 7.3 ± 0.48 and 6.7 ± 0.67 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%). There was significant difference at five percent ($p<0.05$) between S and V3 (50%).

The taste of the chia seed soup was acceptable to some extent. It gave a good taste at 30 percent variation. The mean score for taste was 7.7 ± 0.67, 7.4 ± 0.51 and 6.7 ± 0.48 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%). There was significant difference at five percent ($p<0.05$) between S and V3 (50%).

The texture of the chia seed soup was found to be good. 40 and 50 percent variation makes the soup becomes denser and was not acceptable. The mean score for texture of soup was 7.8 ± 0.63, 7.5 ± 0.52 and 7 ± 0.81 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

The overall acceptability of standard soup and V1 (i.e.) 30 percent variation was found to be very good. The V2 and V3 (i.e.) 40 percent and 50 percent level of variation was found not to be acceptable. The mean score for soup was 7.7 ± 0.67, 7.6 ± 0.51 and 7.1 ± 0.73 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

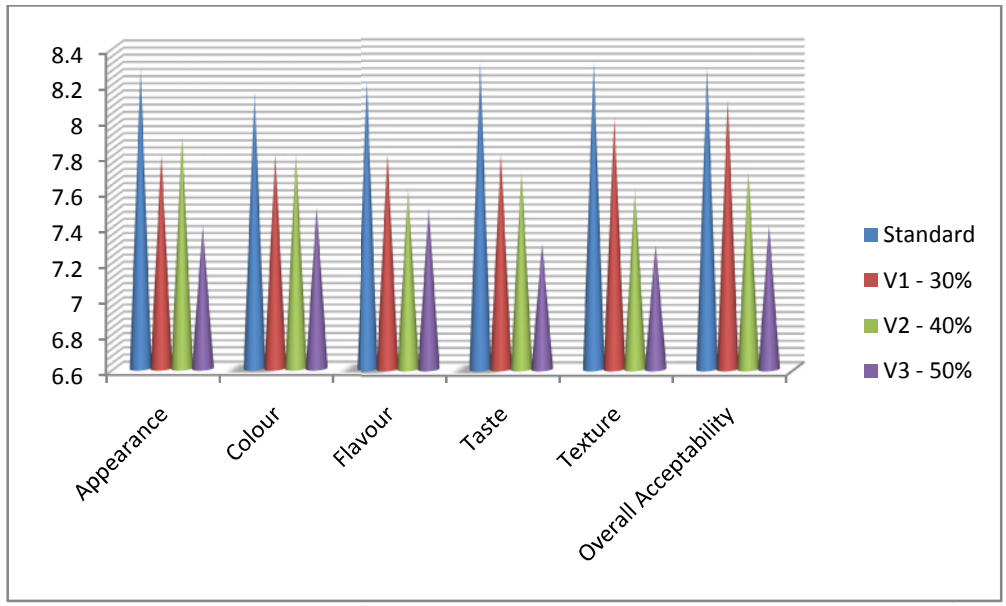


FIGURE - XII

MEAN ACCEPTABILITY SCORES OF INSTANT CAPSICUM SOUP MIX

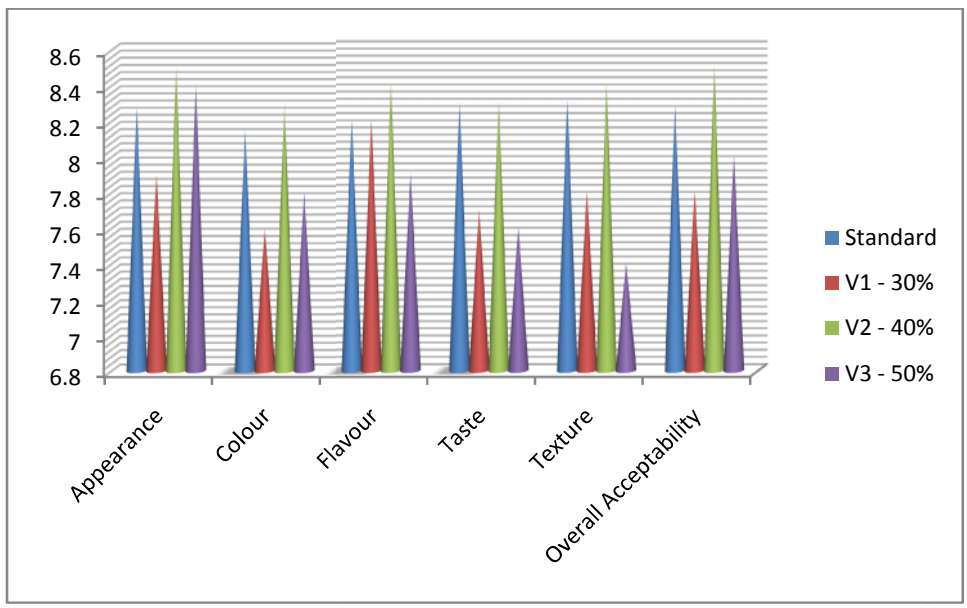


FIGURE – XIII

MEAN ACCEPTABILITY SCORES OF INSTANT GREEN GRAM SOUP MIX

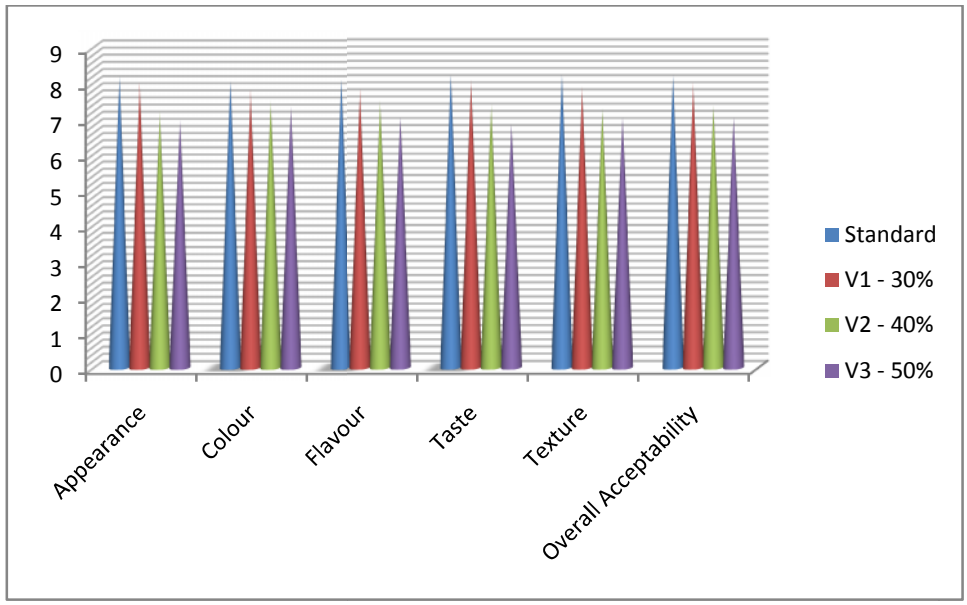


FIGURE – XIV

MEAN ACCEPTABILITY SCORES OF INSTANT HORSE GRAM SOUP MIX

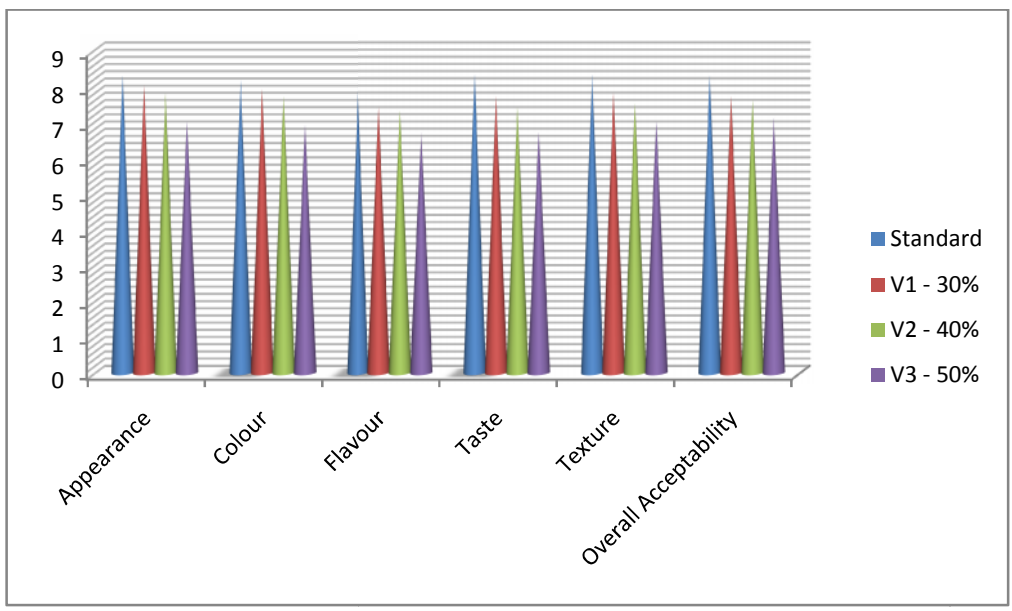


FIGURE – XV

MEAN ACCEPTABILITY SCORES OF INSTANT CHIA SEED SOUP MIX

C. **Nutrient analysis of Instant Soup Mixes**

Analysis of nutrient content is an important aspect in the development of a new product. Nutrient content of the developed food product were analyzed based on AOAC method, 2004. There are adequate analytical methods available for the analysis of nutrients like carbohydrate, protein, crude fiber, fat and energy present in the food product. Since the products were developed for the lifestyle disorders, selected nutrients were analyzed for Obesity, Diabetes Mellitus and Hypertension. For Obesity and Diabetes, nutrients such as energy, carbohydrate, fat, crude fiber, protein and moisture were analyzed. For hypertension, moisture and fat were analyzed and sodium and potassium were calculated using Indian food composition tables.

Nutrients present in Instant fenugreek leaves, bitter gourd, soy beans, lentils, broccoli, cabbage, onion, garlic, capsicum, green gram, horse gram and chia seed soup mixes are presented in the following tables.

Table – XVII presents the nutrients present in Instant Soup mix for Diabetes Mellitus

TABLE - XVII

NUTRIENT ANALYSIS OF INSTANT SOUP MIX FOR DIABETES MELLITUS

S.NO	NUTRIENTS	FENUGREEK LEAVES SOUP MIX (per 100 g)	BITTER GOURD SOUP MIX (per 100 g)	SOY BEANS SOUP MIX (per 100 g)	LENTILS SOUP MIX (per 100 g)
1.	Energy (kcal)	172.7	165.5	287.6	295.2
2.	Carbohydrate (g)	30.6	31.5	35	50
3.	Fat (g)	1	1.5	3	1.5
4.	Crude Fiber (g)	12.5	10	12.5	5
5.	Protein (g)	7	6	17	13
6.	Moisture (%)	9.6	13.3	11.9	10.5

From the table, it is evident that the ingredients selected for the study have adequate nutrients that enable to maintain the blood glucose level in the diabetic

individuals. The ingredients selected for the formulation of Instant Soup mix for Diabetes Mellitus was according to the principles of diabetic diet, such as low carbohydrate, low fat, high fiber and moderate protein. Lentil and soy bean soup mix have high energy content of 295.2 and 287.6 kcals/100 g, whereas fenugreek leaves and bitter gourd soup mix had a lesser amount of calories (i.e) 172.7 and 165.5 kcals/100 g. The carbohydrate content of lentil soup mix was 50 g/100 g, whereas soy bean, bitter gourd and fenugreek leaves soup mix contains 35, 31.5 and 30.6 g/100 g respectively. Soy bean soup mix had highest fat content of 3 g/100 g when compared to other soup mixes. Lentil and bitter gourd soup mix had fat content of 1.5 g/100 g, whereas fenugreek leaves soup mix had a negligible amount of fat (i.e) one gram only. Fenugreek leaves and soy bean soup mix had the highest amount of fiber of 12.5 g/100 g when compared to bitter gourd and lentil soup mix which contains 10 g and 5 g/100 g. Soy bean and lentil soup mix have more protein (i.e) 17 and 13 g/100 g, whereas bitter gourd and fenugreek leaves soup mix had only 6 and 7 g/100 g. Bitter gourd and soy bean soup mix had highest moisture content of 13.3 percent and 11.9 percent, when compared to lentil and fenugreek leaves soup mix which contains 10.5 percent and 9.6 percent of moisture. Hence, it can be concluded that lentil soup mix had the highest calorific value and carbohydrate content. Soy bean soup mix had high fat and protein content. Fenugreek leaves and soy bean soup mix had high fiber content and bitter gourd soup mix had high moisture content.

Table – XVIII presents the nutrients present in Instant Soup Mix for Hypertension

TABLE - XVIII

NUTRIENT ANALYSIS OF INSTANT SOUP MIX FOR HYPERTENSION

S.NO	NUTRIENTS	BROCCOLI SOUP MIX (per 100 g)	CABBAGE SOUP MIX (per 100 g)	ONION SOUP MIX (per 100 g)	GARLIC SOUP MIX (per 100 g)
1.	Sodium (mg)	11.9	7.40	8.60	7.40
2.	Potassium (mg)	237.3	134.4	172.5	134.4
3.	Fat (g)	1	1.20	1	1.50
4.	Moisture (%)	10.2	12.3	11.7	11.9

From the table, it is evident that the selected ingredients have adequate nutrients to maintain the blood pressure within 120/80 mm Hg. The soup mixes were analyzed for the sodium, potassium, fat and fiber levels. The ingredients selected for the study for the formulation of Instant Soup Mixes for hypertensive individuals was according to the principles of diet, such as low carbohydrate, low fat, low sodium and normal protein. Broccoli soup mix had highest sodium content of 11.9 mg/100g whereas other soup mixes such as onion, cabbage and garlic soup mix contains 8.60, 7.40 and 7.40 mg/100 g respectively. Broccoli soup mix had highest potassium content of 237.3 mg/100 g, whereas onion, cabbage and garlic soup mix contains 172.5 and 134.4 mg/100 g. Garlic had the highest fat content of 1.50 g/100 g followed by cabbage soup mix which contains 1.20 g/100g of fat. Onion and broccoli soup mixes had very negligible amount of fat (i.e) one gram/100 g. Regarding moisture, cabbage soup mix had the highest moisture of 12.3 percent when compared to other soup mixes. Garlic, onion and broccoli soup mix had a moisture content of 11.9, 11.7 and 10.2 percent/100 g respectively. Hence, it can be concluded that broccoli soup mix had high content of sodium, while garlic soup mix was high in fat content and cabbage in moisture content.

Table – XIX presents the nutrients present in Instant Soup Mix for Obesity

TABLE - XIX

NUTRIENT ANALYSIS OF INSTANT SOUP MIX FOR OBESITY

S.NO	NUTRIENTS	CAPSICUM SOUP MIX (per 100 g)	GREEN GRAM SOUP MIX (per 100 g)	HORSE GRAM SOUP MIX (per 100 g)	CHIA SEED SOUP MIX (per 100 g)
1.	Energy (kcal)	163.4	257.4	254.3	162
2.	Fat (g)	1	1.5	1.5	1
3.	Crude Fiber (g)	5	5	7.5	15
4.	Carbohydrate (g)	30	43	39	33
5.	Protein (g)	6	12	10	13
6.	Moisture (%)	13.2	11.7	11.1	9.5

From the table it is evident that the selected ingredients have adequate nutrients to maintain the optimal body weight of the individual. The ingredients selected for the study for the formulation of Instant Soup Mixes for obese individuals was according to the principles of diet such as low carbohydrate, low fat, moderate protein, liberal vitamins and minerals. Green gram and horse gram soup mix had highest calorific content of 257.4 and 254.3 kcals/100 g, whereas capsicum and chia seed soup mix contains 163.4 and 162 kcals/100 g. Green gram and horse gram soup mix had fat content of 1.5 g/100 g while capsicum and chia seed soup mix has negligible amount of fat (i.e) one gram/100 g. Chia seed soup mix had highest fiber content of 15 g/100 g followed by horse gram, green gram and capsicum soup mix which contains 7.5 g and 5g /100 g. Regarding carbohydrates, green gram soup had highest content of 43 g/100 g, whereas Horse gram, chia seed and capsicum soup mixes contains 39, 33 and 30 g/100 g respectively. Chia seed and green gram soup mixes had high protein content of 13 and 12 g/100 g, while horse gram and capsicum soup mix has 10 and 6 g/100 g of protein. Capsicum soup mix had highest moisture content of 13.2 percent/100 g when compared to other soup mixes. Green gram, horse gram and chia seed soup mix has 11.7, 11.1 and 9.5 percent of moisture content. Hence it can be concluded that green gram soup mix had highest calorific value. Green gram and horse gram soup mix had high fat content and chia seed soup mix had highest fiber and protein content. Green gram soup mix had highest carbohydrate content and capsicum soup mix had highest moisture content.

D. Shelf-Life of powders in Zip-Lock covers

Table XX presents the microbial analysis of Instant Soup mixes packed in zip lock covers.

TABLE – XX

MICROBIAL ANALYSIS OF INSTANT SOUP MIXES

S.No	Instant soup mixes	Microbial Plate Count (cfu/ml)	
		Week – I	Week – II
1.	Fenugreek leaves	$1 * 10^5$	$2 * 10^5$
2.	Bitter gourd	$1 * 10^6$	$2 * 10^5$
3.	Lentil	Nil	$1 * 10^5$
4.	Soy bean	Nil	$1 * 10^6$
5.	Broccoli	$1 * 10^6$	$3 * 10^5$
6.	Cabbage	$3 * 10^5$	$4 * 10^5$
7.	Onion	$2 * 10^6$	$4 * 10^6$
8.	Garlic	$1 * 10^6$	$2 * 10^6$
9.	Capsicum	Nil	$1 * 10^5$
10.	Green gram	$1 * 10^6$	$3 * 10^6$
11.	Horse gram	Nil	$1 * 10^5$
12.	Chia seed	$1 * 10^6$	$9 * 10^7$

Fifty gram of soup mixes were packed and stored in zip lock covers for two weeks and then analyzed for the microbial count. Total plate count method otherwise known as spread plate method was adopted to determine the bacterial count of the soup mixes. Soup mixes such as lentil, soy bean, capsicum and horse gram was found to have no bacteria in the first week of storage period. Then the bacterial colonies were found to be increased in the second week of storage. Soup mixes such as fenugreek leaves, bitter gourd, broccoli, cabbage, onion, garlic, green gram and chia seed were found to have bacteria even at the first week of storage period. Hence, it can be concluded that the Instant Soup Mixes was at acceptable level for first two weeks of storage and found to have less microbial load.

.V SUMMARY AND CONCLUSION

The present study on "**Formulation and Standardization of Instant Soup Mixes using Functional Foods for Lifestyle Disorder"** was undertaken to formulate Instant Soup Mixes for lifestyle disorders such as Diabetes Mellitus, Hypertension and Obesity using Functional foods.

The Institute of Medicine's Food and Nutrition Board (IOM/FNB, 1994) defined functional foods as "any food or food ingredient that may provide a health benefit beyond the traditional nutrients it contains". The concept of functional foods, nutraceuticals and other bioactive components in human diet leads to promotion of healthy life and prevention of various age and lifestyle related chronic diseases. The prevalence of Lifestyle Disorders such as Hypertension was about 6.8 percent, Obesity accounts to one in six adults globally and Diabetes Mellitus was 20 percent of global population.

Convenience food or tertiary processed food is commercially prepared food for ease of consumption. Soups are one of the convenience food mostly used for consumption and are classified as appetizer or warm food given during cold or sick. It is made by combining ingredients such as meat or vegetable stock, juice, water or any other liquid. Instant soup mix can become an alternative food for breakfast because it could fulfill the adequacy of energy and nutrient requirement by the body.

Instant Soup Mixes were formulated for three lifestyle disorder such as Diabetes Mellitus, Hypertension and Obesity. Functional foods like bitter gourd, fenugreek leaves, soy bean, lentil, broccoli, cabbage, onion, garlic, capsicum, horse gram, green gram and chia seed were selected for the study. The selected ingredients were processed and dried using cabinet drying and sun drying methods. The dried ingredients were combined in different proportion for the formulation of Instant Soup Mixes. The dried ingredients were then packed in zip lock covers for microbial analysis to determine the shelf – life of the product.

Soups were formulated using Instant Soup Mixes by boiling the content with 175 ml of water and organoleptic evaluation was done by 10 semi-trained panel members. Rating of the product was done by using 9-Hedonic rating scale. The acceptability of the

product was obtained for nutrient and microbial analysis of the developed Instant Soup Mixes. The mean acceptability scores were obtained for all the soups as follows:

Fenugreek leaves soup - The overall acceptability of standard soup and V1 (i.e.) 30 percent variation were found to be very good. The V2 and V3 (i.e.) 40 percent and 50 percent level of variation were found to be least acceptable. The mean score for soup was 8.4 ± 0.84, 7.6 ± 0.69 and 6.9 ± 0.56 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%). There was significant difference at five percent ($p<0.05$) between S and V3 (50%).

Bitter gourd soup - The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be good. The V3 (i.e.) 50 percent level of variation were found to be least acceptable. The mean score for soup was 7.8 ± 0.63, 7.2 ± 0.42 and 7.2 ± 0.78 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%). There was significant difference at five percent ($p<0.05$) between S and V2 (40%) and S and V3 (50%).

Lentil soup - The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be very good. The V3 (i.e.) 50 percent level of variation was found to be good. The mean score for soup was 8 ± 0.66, 8 ± 0.47 and 7.8 ± 0.42 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

Soy bean soup - The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be very good. The V3 (i.e.) 50 percent level of variation was found to be good. The mean score for soup was 8.2 ± 0.63, 8.2 ± 0.91 and 7.9 ± 0.56 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

Broccoli soup - The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be very good. The V3 (i.e.) 50 percent level of variation was not found to be acceptable. The mean score for soup

was 7.9 ± 0.87, 7.4 ± 0.51 and 7.1 ± 1.28 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

Cabbage soup - The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be very good. The V3 (i.e.) 50 percent level of variation was found to be least acceptable. The mean score for soup was 7.9 ± 0.73, 7.7 ± 0.48 and 7.5 ± 0.7 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

Onion soup - The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be very good. The V3 (i.e.) 50 percent level of variation was not found to be acceptable. The mean score for soup was 8.3 ± 0.67, 7.8 ± 0.63 and 7.4 ± 0.84 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

Garlic soup - The overall acceptability of standard soup and V1 (i.e.) 30 percent variation were found to be very good. The V2 and V3 (i.e.) 40 percent and 50 percent level of variation were not found to be acceptable. The mean score for soup was 8.4 ± 0.51, 7.8 ± 0.42 and 7.6 ± 0.84 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

Capsicum soup - The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be very good. The V3 (i.e.) 50 percent level of variation was found to be good. The mean score for soup was 8.1 ± 0.73, 7.7 ± 0.82 and 7.4 ± 1.07 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

Green gram soup - The overall acceptability of standard soup and V1 and V2 (i.e.) 30 percent and 40 percent variation were found to be very good. The V3 (i.e.) 50 percent level of variation was found to be good. The mean score for soup was 7.8 ±

0.42, 8.5 ± 0.52 and 8 ± 0.47 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

Horse gram soup - The overall acceptability of standard soup and V1 (i.e.) 30 percent variation were found to be very good. The V2 and V3 (i.e.) 40 percent and 50 percent level of variation was found not to be acceptable. The mean score for soup was 8 ± 0.66, 7.4 ± 0.69 and 7.1 ± 0.73 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%). There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

Chia seed soup - The overall acceptability of standard soup and V1 (i.e.) 30 percent variation was found to be very good. The V2 and V3 (i.e.) 40 percent and 50 percent level of variation was found not to be acceptable. The mean score for soup was 7.7 ± 0.67, 7.6 ± 0.51 and 7.1 ± 0.73 for 30 percent, 40 percent and 50 percent level variation respectively. There was no significant difference between S and V1 (30%) and S and V2 (40%) and S and V3 (50%).

Instant Soup mixes formulated for **Diabetes Mellitus** was analyzed for its nutrient content. Lentil soup mix had the highest calorific value of 295.2 kcals/100 g and carbohydrate content of 50 g/100 g. Soy bean soup mix had high fat and protein content of 3 and 17 g/100 g. Fenugreek leaves and soy bean soup mix had high fiber content of 12.5 g/100 g and bitter gourd soup mix had high moisture content of 13.3 percent/100 g.

Instant Soup mixes formulated for **Hypertension** was analyzed for its nutrient content. Broccoli soup mix had high sodium content of 11.9 mg/100 g, while garlic soup mix was high in fat content of 1.50 g/100 g and cabbage with high moisture content of 12.3 percent/100 g.

Instant Soup mixes formulated for **Obesity** was analyzed for its nutrient content. Green gram soup mix had highest calorific value and carbohydrate content of 257.4 kcals and 43g/100 g. Green gram and horse gram soup mix had high fat content of 1.5 g/100 g and chia seed soup mix had highest fiber and protein content of 15 and 13g/100 g. Capsicum soup mix had highest moisture content of 13.2 percent/100 g.

Formulated Instant Soup mixes were analyzed for its microbial load. Soup mixes such as lentil, soy bean, capsicum and horse gram was found to have no bacteria in the first week of storage period. Then the bacterial colonies were found to be increased in the second week of storage. Soup mixes such as fenugreek leaves, bitter gourd, broccoli, cabbage, onion, garlic, green gram and chia seed were found to have bacteria even at the first week of storage period. Hence, it was found that the Instant Soup Mixes was at acceptable level for first two weeks of storage and found to have less microbial load.

CONCLUSION

In this era, functional foods and convenience foods gain popularity among the population globally. Soups are known as traditional food and act as an appetizer or warm food which can be given during disease condition or sick. Now a day's soups are commercially available as Ready-To-Eat Foods that are preferred by all age group. Instant Soup Mixes being one of the convenience food, it is widely used for consumption at any time. Hence, the study was focused on the formulation and standardization of Instant Soup Mixes using Functional Foods. Instant soup mixes acts as an excellent vehicle for the incorporation of functional foods. The soups were formulated for three lifestyle disorder such as Diabetes Mellitus, Hypertension and Obesity. Many studies have focused on the formulation of soup mixes using functional foods but there are very few researches focused on the formulation of soups that are disease oriented. In future, commercial sectors can develop Instant Soup Mixes for lifestyle disorders.

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APPENDIX - I

ETHICAL COMMITTEE CERTIFICATE

INSTITUTIONAL HUMAN ETHICS COMMITTEE

Avinashilingam
Institute for Home Science and Higher Education for Women
University
(Estd. u/s 3 of UGC Act 1956)

3rd February 2017

To
Ms. Preethi S
Department of Food Science Nutrition
Avinashilingam Institute for Home Science and
Higher Education for Women
Coimbatore – 641 043

Dear Madam,

Ref: Your proposal No. IHEC/16-17/FSN-05 entitled "Formulation and standardization of instant soup mixes using functional foods for lifestyle disorder" submitted for approval of the IHEC

The Institutional Human Ethics Committee of our University hereby grants approval to your research proposal No. IHEC/16-17/FSN-05 entitled "Formulation and standardization of instant soup mixes using functional foods for lifestyle disorder" submitted by you. The Approval number for the same is AUW/IHEC/FSN-16-17/XMT-05.

We wish you all the best in your research endeavours.

Regards,
3/2/17
Dr.P.R.Padma
Member Secretary

Institutional Human Ethics Committee

APPENDIX - II

ORGANOLEPTIC EVALUATION OF INSTANT SOUP MIXES

(SCORE CARD)

Soup:

Name:

Class:

Date:

9	Like extremely
8	Like very much
7	Like moderately
6	Like slightly
5	Neither like nor dislike
4	Dislike slightly
3	Dislike moderately
2	Dislike very much
1	Dislike extremely

S.no	Product	Appearance	Colour	Flavour	Taste	Texture	Over all acceptability
1.	Standard						
2.	Test sample (A)						
3.	Test sample (B)						
4.	Test sample (C)						

COMMENTS

Signature

APPENDIX - III

RECIPE FOR STANDARD VEGETABLE SOUP

INGREDIENTS

- Beans – 10 g
- Carrot – 20 g
- Tomato – 20 g
- Onion – 30 g
- Pepper – 1 g
- Oil – 1 tsp
- Salt – 2 g
- Corn flour – 17 g

METHOD OF PREPARATION

- Heat oil in a pan.
- Add onion and saute till it turns translucent.
- Add tomato, beans and carrot and saute the mixture until it is half cooked.
- Add corn flour to the mixture and mix the ingredients.
- Then add 350 ml of water to the contents.
- Add pepper and salt and boil the contents for 10 minutes.
- Serve the soup hot by garnishing it with coriander leaves.