

**FORMULATION AND EVALUATION OF  
CARMINATIVE BARS (USING SPICES)  
TO OVERCOME  
DIGESTIVE PROBLEMS**

**By**

**SREEJA PANNEER SELVAM.V**

**(07PN17)**

**A THESIS SUBMITTED TO  
AVINASHILINGAM UNIVERSITY FOR WOMEN  
COIMBATORE-641 043.**

*In partial fulfilment of the requirement for the Degree of*

**MASTER OF SCIENCE IN  
FOOD SCIENCE AND NUTRITION**

**APRIL 2009**

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Certified as a Bonafide Research Work

**Signature of the  
Head of the Department**

**Signature of the Guide**

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## I.INTRODUCTION

*“Who has a body gained may long the gift retain,  
If, food digested well, in measure due he eat again”*

*- (Thirukkural no: 943)*

Good health is not only an indicator of socio-economic status and standard of living of the country, but it also reflects the values and beliefs of the society (Devadas, 2001). The most important gift in life is good health with which debilitating diseases can be avoided and life span can be increased. It is fairly easy to achieve good health, but it involves certain changes in life style that are sometimes difficult to do at first (<http://www.articlegold.com>).

To rescue man from the clutches of disease is a duty, sacred and obligatory, from the immemorial. To achieve this, along with adequate diet, different systems of medicine are been practiced in the world, with its own basis, philosophy and therapeutics, but with one common object-alleviation of disease (Panda, 2004).

As quoted by Bohn, "Nature, Time and Patience are the three great physicians". Plant derived products have been used for medicinal purposes by about 80 per cent of the world population. Herbs and spices are generally considered safe and proved to be effective against certain ailments (Langner et al, 1998).

A well-balanced diet, properly digested and absorbed provides all the nutrients to promote growth and development and also maintains health. Nevertheless a nutritious diet may be less interesting and less enjoyable, if it lacks the flavour appeal. In other words, flavourful foods are catalysts of nutrition. Flavourful foods are, according to the International Standards Organization

(ISO), 'such natural plant or vegetable products or mixtures there of, in whole or ground form, as are used for imparting flavour, taste, and piquancy to and for seasoning food'. Thus, seasoning of food is affected by the addition of flavouring agents such as spices and condiments (Chandrasekhar, 2002).

“Spices are the powerhouse of pleasure and health”, quotes Zak (2006), the author of ‘The magic teaspoon’. Spices are defined as “a strongly flavoured or aromatic substance of vegetable origin, obtained from tropical plants, commonly used as a condiment” (<http://www.spices kerala.com/>).

India is universally known as “The Home of spices” (<http://www.webindia123.com/>). Our spices and spicy products are valued high in the international markets. The diverse agro climatic conditions prevailing in different parts of our country permit cultivation of a variety of spices. They are indispensable in the Indian dietary pattern (Mariammal and Selvi, 2009).

The Indian cuisine is as diverse as its culture. The cuisine varies according to the geographical location and the climate of the region. The Indian culinary skill lies in the perfect blending of the various spices available in the markets (<http://www.indianmirror.com>). The flavours of Indian foods are alluring and fragrant and it is this total mastery over seasonings, spices and combinations of flavours that makes Indian foods quite unique and special (<http://www.indianembassy.ru/>).

Spices constitute an important group of agricultural commodities which are virtually indispensable in the culinary art. In India, spices are important commercial crops from the point of view of both domestic consumption and export. Besides, huge quantities of spices are also being consumed within the country for flavouring foods and are also used in medicine, pharmaceutical, perfumery, food industry, dyeing industry, cosmetics and several other industries. (<http://www.webindia123.com>)

It is estimated that Indian consumption of various herbal spices is around 200 metric tonnes/year. Out of which 64 metric tonnes are produced in India and the rest is imported and out of that 22 metric tonnes are used for culinary purposes and the rest of them are used for medicinal and cosmetic purposes (Abubacker, 2008).

The use of spices as food additives is been practiced widely since ancient times(Platel and Srinivasan, 2004).Food and Agricultural Organization(FAO) and World Health Organization(WHO) defined food additives as 'non-nutritive substances added intentionally to food, generally in small quantities, to improve its appearance, flavour,texture or storage properties(Khetarpaul,2005).

Apart from enhancing the taste and flavour of food, spices have been widely believed to exert digestive stimulant action. A few medicinal properties of spices such as tonic, carminative, stomachic, diuretic and anti-spasmodic have long been recognised.Those attributes, largely empirical, nevertheless efficacious, have earned as digestive stimulants and to relieve digestive disorders (Nadkarni,2002) and evidence exists for their use in functional gastrointestinal symptoms to warrant further investigation(Lipman,2005).

Several preparations available to correct digestive problems contain specific spices besides other plant substances. Spices such as garlic, ginger, ajowan, cumin seed, aniseed, coriander, and so on are the usual ingredients of digestive stimulants, both commercial as well as home remedies (Platel and Srinivasan,2004).

Digestive disorders are one among the most common problems in health care. Digestive problems are some of the most common medical complaints, with 41 per cent of individuals in one recent survey reporting one or more adverse

digestive symptoms (Grabitske and Slavin, 2008). Dietary habits and specific food types play a significant role in the onset, treatment and prevention of many gastrointestinal disorders. In many cases, foods also play a role in improving patient's sense of well-being (Srilakshmi, 2006).

The Statistics used for prevalence/incidence of digestive disorders are typically based on United States or United Kingdom statistics since the statistics are not available for India. But medical studies and experts expressed that Gastro-Intestinal disorders are increasing in India (Curtis, 2008).The extrapolated calculations are automated and do not take into account any genetic, cultural, environmental, social, and racial or other differences across the various countries and regions (<http://www.cureresearch.com/>).

In India, among 234,942,036 people, 1,065,070,607 people suffer from digestive disorders. Similarly, in United States of America, 64,776,924 people out of 293,655,405 people suffer from digestive disorders (extrapolated statistics) (US Census Bureau, 2004).

The digestive system is susceptible to a number of disorders, some of which are mildly uncomfortable and temporary and others which are more serious and chronic(Taylor,2003).One of the most common stomach problems is pain in the abdomen and perhaps the most common cause of this, is the formation of gas. This is due to many factors related to irregularity in taking meals, having foods that form gas and the like. There are certain disorders or symptoms related to digestion. Such ailments can either be said as a disorder itself or a symptom related to digestive disorder. Such problems include flatulence, constipation, Dyspepsia, belching, bloating, etc (Kumar, 2002).

Constipation is defined as having a bowel movement fewer than three times per week. With constipation, stools are usually hard, dry, small in size, and difficult to eliminate. Some people who are constipated find it painful to have a

bowel movement and often experience straining, bloating, and the sensation of a full bowel. Constipation is a symptom and not a disease which needs simple correction in dietary habits, sleep and relaxation (<http://digestive.niddk.nih.gov/>).

Dyspepsia(Indigestion) refers to symptoms thought to originate in the upper gastro intestinal tract(GI tract).It encompasses a variety of symptoms like pain, discomfort,bloating,early satiety,nausea,anorexia,heartburn and belching(Tripathi and Kulkarni, 2002) and the symptoms of prolonged dyspepsia may be related to underlying problems like gastro esophageal reflux disease, gastritis, peptic ulcer, delayed gastric emptying, gall bladder disease or cancer (Robinson,2001).

The ability to belch is almost universal. Belching, also known as burping is the act of expelling gas from the stomach out through the mouth. The usual cause of belching is a distended (inflated) stomach caused by swallowed air. The distention of the stomach causes abdominal discomfort, and the belching expels the air and relieves the discomfort. The common reasons for swallowing large amounts of air (aerophagia) are gulping food or drink too rapidly, anxiety, carbonated beverages, improper food intake, inadequate food intake and stress. (<http://www.medicinenet.com>)

Bloating is the subjective sensation (feeling) that the abdomen is larger than normal. Thus, bloating is a symptom similar to the symptom of discomfort. In contrast, distention is the objective determination (physical finding) that the abdomen is actually larger than normal. Chronic stomach bloating can be a sign of more serious health problems, especially Irritable Bowel Syndrome or IBS. (<http://www.medicinenet.com.htm> and <http://www.healthinfoarticles.com>).

Accumulation of wind/gas in the stomach and the resultant distension is known as flatulence. The wind or gas is generated both in the intestines and

stomach because of dyspepsia and constipation. It may even lead to fluttering in the heart (Mahan and Stump, 2004 and Chauhan, 2006).

Flatulence is a common problem and is associated either with pathology or be simply related to an inappropriate diet. Where muscular cramping in the gut or anxiety and tension are involved, the carminative and anti-spasmodic herbs and spices should be considered for the effective elimination of the problem (<http://www.healthy.net>).

Flatulence and related problems can be relieved with carminative and anti-spasmodic drugs since, an anti-spasmodic is a substance that will relieve or prevent spasms, usually of the smooth muscles and a carminative is an agent that relieves gas and flatulence (Blake, 2004). They are often mixtures of edible oils and herbal spices with a tradition in folk medicine for this use. Although the carminative action is directly upon the intestinal tract, this leads to a more generalized effect on body systems (<http://en.wikipedia.org>).

Herbal Carminatives and carminative spices are Ajowan(*Trachyspermum ammi*), Aniseed(*Pimpinella anisum*), Asafoetida(*Ferula assa-foetida*), Balm, Basil, Cardamom(*Elettaria cardamomum*), Celery Seed, Cinnamon(*Cinnamomum zeylanicum*), Chamomile, Coriander(*Coriandrum sativum*), Cloves(*Syzygium aromaticum*), Cumin seed(*Cuminum cyminum*), Dill(*Anethum graveolens*), Eucalyptus, Fennel, Fenugreek(*Trigonella foenum-graecum*), Garlic(*Allium sativum*), Ginger(*Zingiber officinale*), Hops, Mace(*Myristica fragrans*), Mint(*Lobelia cardinalis*), Mustard(*Brassica nigra*), Nutmeg(*Myristica fragrans*), Parsley, Pepper (*Piper Nigrum*) Peppermint(*Mentha piperita*), Saffron(*Elaeodendron croceum*), Tamarind(*Tamarindus indica*), Thyme(*Acinos arvensis*), Turmeric(*Curcuma longa*), and so on. (<http://www.healthy.net/> and <http://b-and-t-world-seeds.com/>)

Since spices are totally natural they can be used to create new health foods, which help to cure several diseases of 8-10 per cent of general patients of all over country as well as many patients of the world suffering from various physical ailments and digestive problems (Garg and Gupta, 2006).

Against such a backdrop, the present study on “Formulation and evaluation of carminative bars (using spices) to overcome digestive problems” has been undertaken with the following specific objectives to:

- Identify commonly used culinary spices with carminative properties, through household, hospital and market surveys,
- Formulate and evaluate carminative bars using different combinations of carminative spices for acceptability,
- Estimate the nutrient content and cost effectiveness of the selected carminative bar,
- Administer and evaluate the effectiveness of the carminative bar on health status of the selected subjects with digestive problems and
- Evaluate the effect of the educational package developed, on nutritional knowledge of the selected subjects.

## II. REVIEW OF LITERATURE

The literature pertaining to the study on “Formulation and evaluation of carminative bars (using spices) to overcome digestive problems” is reviewed under the following headings:

- F. Spices-The powerhouse of health and pleasure
- G. Properties and culinary uses of spices
- H. General functions of spices
- I. Digestion and related problems and
- J. Role of carminative spices in treatment of digestive problems

### **A. Spices-The powerhouse of health and pleasure**

#### **1. Definition**

India is known as the '**The home of spices**'. There is no other country in the world that produces as many kinds of spices as India since the climate of the country is suitable for cultivation of almost all kinds of spices (<http://www.webindia123.com/>) and the flavour that is attracting people from all nations is Indian cuisine (Akbar, 2008).

India enjoys a wide range of agronomic and climatic conditions, which enable us to grow a number of spices. While India produces high valued saffron on temperate zone of Kashmir in the North, the black pepper, ‘the king of spices’ and cardamom, ‘the queen of spices’ and other plantation spices are grown in down south of the tropical zone in, the ‘God’s own country’ Kerala (<http://www.mgutheses.org/>).

Spices constitute an important group of agricultural commodities which are virtually indispensable in the culinary art. In India, spices are important commercial crops from the point of view of both domestic consumption and export. Besides, huge quantities of spices are also being consumed within the

country for flavouring foods and are also used in medicine, pharmaceutical, perfumery, cosmetics and several other industries (Gopi and Radha, 2006).

According to the International Organization for Standardization, there is no clear-cut division between spices and condiments and so they are clubbed together. The term spice or condiment applies to “such natural plant or vegetable products or mixtures thereof, in whole or ground form, as are used for imparting flavour, aroma and piquancy to and for seasoning food” (Manay and Shadaksharaswamy, 2007).

According to Spices Board of India, Spices are defined as "a strongly flavored or aromatic substance of vegetable origin, obtained from tropical plants, commonly used as a condiment"(http://www.spiceskerala.com).

Department of Food and Drug Administration (United States) opined that “Spices are aromatic vegetable substances, in the whole, broken, or ground form, whose significant function in food is seasoning rather than nutrition” (http://www.fda.gov)

According to Gupta and Garg (2006), “Spices are various plant body parts of different aromatic plants, herbs, shrubs and grasses having an inherent peculiar flavour”.

International Spice Group suggested that the “Spices are any of the flavoured or aromatic substances of vegetable origin obtained from tropical or other plants commonly used as condiments or employed for other purposes on account of their fragrance, preservative or medicinal qualities” (http://www.mgutheses.org/).

Spices and herbs are natural vegetable products used for adding flavour and aroma to foods. They are also used for their medicinal nature and health benefits rather than nutritional significance (DeMan, 2007).

## **2. History Of Spices**

Spices have played an important role in the history of civilization, exploration and commerce as these had a universal acceptance as condiments and flavours in human diet as well as in treatment of ailments.

There are evidences of plant derived aromatic compounds especially spices being used by almost all ancient civilizations. A notable use of spices and herbs in very early times were in medicine in the making of holy oils and unguents and as aphrodisiacs (<http://www.mgutheses.org/>).

The history of Indian spices dates back to the beginning of the human civilization. There are references about Indian spices and their uses in the Vedas (6000 BC), by 'Manu', the lawgiver in 4000 BC, by the Babylonians and Assyrians (around 3000 BC), and in the Old Testament (1000 BC) of the Bible. Traditionally India was known as the legendary land of spices, and the West coast of India, known in history as Malabar Coast, was maintaining very active trade relation with Western world, starting from the ancient Egypt, Greek and Roman times (Ravindran, 2000) and spices and herbs have played a dramatic role in the development and multi-dimensional growth of many civilizations (<http://www.spiceadvice.com>).

Spices, now has reached the moon, as seasoning of the Apollo Astronaut's food, entering a new dimension of progression (<http://www.indiamike.com/india>).

## **3. Classification of Spices**

India is endowed with a rich wealth of medicinal plants and spices. These plants and spices have made a good contribution to the development of ancient Indian materia medica (Meshram et al, 2006).

The total number of spices cultivated in the world is perhaps a disputed question. Based on data collected from Bureau of Indian Standards, 63 spices are grown in India. But the Spices Board (Government of India) has listed only 52 spices. However International Organization for Standardization (ISO) has approved 70 spices and condiments. (Spices Board of India, 2000).

Classification and presentation of spices in a particular sequence or plan becomes rather difficult because of their heterogeneity. Spices could perhaps be classified or grouped according to different systems of classifications like, classification based on economic and commercial importance, physiological classification, organoleptic classification, botanical/ taxonomic classification, agronomic classification and classification based on the morphology of the parts used. But some of the widely followed classification systems are as follows: (<http://www.mgutheses.org>)

**(i) Classification based on economic and commercial importance**

This method is the most popular system of classification because of its convenience and simplicity and the classification is indicated in Table I.

**Table I  
CLASSIFICATION BASED ON ECONOMIC AND COMMERCIAL  
IMPORTANCE**

<b>S.No</b>	<b>Category</b>	<b>Name of the spices</b>	
1.	Major spices	Black pepper, Cardamom, Chillies, Ginger and Turmeric	
2.	Minor spices	Bulb spices	Garlic, Onion
		Seed spices	Aniseed, Fenugreek
		Aromatic tree spices	Clove, Nutmeg
		Acidulent tree spices	Tamarind, Kokam
		Leafy or herb spices	Basil, Curry leaves, Rosemary
		Miscellaneous spices	Saffron, Asafoetida, Vanilla

**(iii) Organoleptic classification**

This type of classification is based on the sensory attributes which in turn, are related to the prime aromatic constituents or in some cases the non-volatile components (NIIR Board, 2004) and the classification is as given in Table II.

**Table II**  
**ORGANOLEPTIC CLASSIFICATION OF SPICES**

S.No	Sensory attributes	Name of the spices
1	Pungent spices	Capsicum, Ginger, Pepper, Mustard
2	Aromatic fruits or seeds	Nutmeg, Mace, Cardamom, Fenugreek, Anise, Fennel, Dill, Cumin, Coriander
3	Aromatic bark spices	Cassia, Cinnamon
4	Phenolic spices	Clove bud, Allspice, Bay leaves
5	Coloured spices	Paprika, Saffron, Turmeric

**(iii) Classification based on the morphology of the parts used**

This type of classification is based on the part of the plant which is used as spices and the classification is depicted in Table III.

**Table III**  
**CLASSIFICATION BASED ON THE MORPHOLOGY OF THE PARTS USED**

S.No	Morphology of the useful part	Name of the spices
1	Berry	Pepper, All spice
2	Seeds	Aniseed, Coriander, Fenugreek
3	Fruit	Cardamom
4	Aril	Mace
5	Kernel	Nutmeg
6	Rhizome	Ginger, Turmeric
7	Leaf	Basil, Bay leaves
8	Bark	Cinnamon
9	Bulb	Garlic, Onion
10	Rind	Garcinia, Kokam
11	Stigma	Saffron
12	Pod	Vanilla
13	Flower bud	Clove
14	Oleogum resin	Asafoetida
15	Root	Caper
16	Fruit pulp	Tamarind

(<http://www.mgutheses.org/>).

*(iv) Physiological classification*

This type of classification is based on the traditional and widespread use of natural plant materials. Many of which have been effective and potent remedies for generations in alternative medicine (NIIR Board, 2004).

#### **4. Production ,Consumption and Export of Spices**

Spices and condiments play an important role in national economics of several spice-producing, exporting and importing countries of the world (Pruthi, 1999).

Spices Board of India is also exploring the nutraceutical properties of spices and boosts its marketing and also reveals that medicinal plant related trade in India is estimated to be around Rs.550 crores per year (Anonymous, 2008).

Table IV, points out the production, consumption, export and value of spices available in the markets.

**Table IV**  
**YEAR-WISE PRODUCTION, CONSUMPTION, EXPORT AND MARKET VALUE OF SPICES**

<b>Year</b>	<b>Production*</b>	<b>Consumption*</b>	<b>Export *</b>	<b>Market value**</b>
1990-1991	2286.15	2060.29	225.86	17869
1995-1996	2772.52	2489.62	282.90	21232
2000-2001	3220.30	2871.50	348.80	24304
2005-2006	3620.40	3230.20	390.20	27861

Source: (Spices Board of India, 2006) \*000 tonnes; \*\*Million rupees

#### **B. Properties and culinary uses of spices**

Spices are storehouses of many chemically active compounds that impart flavour, fragrance and piquancy. Most spices owe their flavouring properties to volatile oils and in some cases, to fixed oils and small amounts of resin, which are known as oleoresins.

Phytochemicals in spices are secondary metabolites, which are originated for the protection from herbivorous insects, vertebrates, fungi, pathogen, and parasites. No single component is responsible for flavours. But a

blend of different compounds such as alcohols, phenols, esters, terpenes, organic acids, resins, alkaloids, and sulphur containing compounds in various proportions produce the flavours. Besides, these flavouring compounds, every spice contain the usual components such as protein, carbohydrate, fiber, minerals, tannins or polyphenols (<http://www.mgutheses.org/>).

Spices form an integral part of Indian kitchen. The variety can be attributed to the diverse tastes of Indian people across the length of the country. North Indians prefer flamboyant use of spices in their meals whereas South Indians prefer just a hint of it (<http://www.srinternational.co.in/>).

### **C. General functions of spices**

Spices are also used for their medicinal properties and have been used in traditional medicines from the time immemorial (Peter, 2004).

Krishnaswamy (2008) has revealed that, current biomedical efforts are focused on their scientific merits, to provide science-based evidence for the traditional uses of spices and to develop either functional foods or nutraceuticals out of spices.

Kochhar (2008) elicited that, the spices have a diverse array of natural phytochemicals that have complementary and overlapping actions, including antioxidant effects, modulation of detoxification enzymes, stimulation of immune system, reduction of inflammation, modulation of steroid metabolism and antibacterial and antiviral effects. They also have role in neuromodulation, immunomodulation, anti inflammatory, antioxidant, anti-carcinogenic, antimutagenic and psychoactive phenomenon.

Yadav and Bhatnagar (2007) have proved the radical scavenging activity and the ferric reducing /antioxidant power (FRAP) in spices, which have beneficial effects on human health. As revealed by Tapsell (2008), research has

shown that, at usual consumption levels, the anti-oxidant capacity of spices is comparable with that of fruits.

Aggarwal et al (2008) reviewed that, active components of some of the major spices, through their mechanisms of action have proved their potential in cancer prevention.

A recent study conducted at Tehran University of Medical Sciences (2008) quoted that certain spices like saffron, might also offer an antidote to premenstrual syndrome (PMS).

Srinivasan (2006) quoted that spices also possess, hypercholesterolemic, antilithogenic, antimicrobial, digestive stimulant action and also other beneficial and physiological functions.

Yadav and Ritika (2006) and Bawa et al (2008) have expressed that spices can be used as an alternative approach to the preservation and enhancement of shelf-life of food because of their extremely anti-microbial and anti-insecticide properties. Hareyan (2008) revealed the fact that, the researchers are exploring the potential of spices to boost metabolism, promote satiety, aid weight management and enhance the overall quality of the diet.

According to, Jose and Joy(2001), spices, in general possess, anti-viral, anti-microbial, anti-fungal, anti-bacterial, anti-oxidant, anti-cancerous, anti-obese, anti-diabetic, carminative, insecticidal, embalm, mummification, lachromatory, aphrodisiac, preservative, brain stimulant, body cooling, anti-spasmodic, mutagenic, teratogenic and necrotic properties which help in coping with many health needs.

#### **D. Digestion and related problems**

According to Christopher (2006) and Chatterjee (2002), digestion can be defined as a process that involves chemical breakdown of complex food

materials into simpler molecules which can be readily used by the individual, through absorption and assimilation (<http://www.thefreedictionary.com>)

The intestinal tract, especially the small intestine, the site of digestion and absorption of nutrients, play an important role in maintaining general health and problems of this tract results in poor utilization of ingested foods and problems in digestion are often related to dietary intake (Brown, 2002 and Veer, 2005)

According to Gibney et al (2005), the majorities of the disorders of gastro-intestinal (GI) tract are not fatal but are significant causes of poor health, since the physiological functioning and disorders of some of its parts reflect both physical and psychological conditions that guides a man's well-being. The disorders of GI tract are classified as functional or organic in nature. Functional diseases involve no alterations in the structure. In organic diseases, on the other hand, pathologic lesions can be seen in tissue, as in ulcers or carcinoma (Paul, 2007).

According to Grabitske and Slavin (2008) lifestyle such as diet intake, drugs consumption, physical activity and stress and personal factors like age, digestive enzymes/food intolerances, gastrointestinal pathology, sex, genetics, micro flora and personality, alter bowel functions and cause digestive complaints which includes, abdominal discomfort, abdominal distension, abdominal pain, acid reflux, bloating, belching, burping, chest pain, colic pain, diarrhea, distension, faecal incontinence, flatulence, heartburn, loose stools, nausea and rumbling in the gut etc. According to Chauhan (2006), pain in abdomen is quite a common ailment and there are several causes leading to this pain especially indigestion and flatulence.

Veer (2007) pointed out the intestinal gases which include nitrogen, oxygen, carbon-di-oxide, hydrogen and in some individuals, methane. Gases called

flatus can enter the GI tract from three sources: (i) Swallowed air (aerophagia),(ii)Gases formed in the gut as a result of bacterial action (fermentation) and (iii)Gases that diffuse from blood into the GI tract. The amount of gases entering or forming in the GI tract each day averages 7-10litres, whereas the average amount expelled through the anus is usually only about 0.6 litres (Guyton and Hall, 2006).

According to National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) (2007), most foods that contain carbohydrates can cause gas, and fats and proteins cause little gas.

Guyton and Hall (2006) attributed that that spasm of a portion of the gut or any other hollow viscus can cause pain and this type of cramping pain frequently occurs in many of the digestive problems.

Bloating is that "too-full" feeling that you get after a meal when you eat too much. But a bloated stomach can also be caused in a number of other ways, and may sometimes be a symptom of a serious stomach problem or disease. (<http://www.healthinfoarticles.com/stomach-bloating.html>).

Belching, of course, is actually the act of expelling built up stomach gas through the mouth (<http://www.healthinfoarticles.com/>).

Sour stomach is a common catchall term for what is also known as indigestion. It is the most common form of stomach discomfort, accounting for about 70 percent of all gastrointestinal complaints.

According to Johns Hopkins University, about one fourth of Americans are suffering some form of sour stomach or indigestion at any given time. Another name for this type of indigestion is dyspepsia, which includes a variety of upper abdominal "disturbances:" bloating, burping, belching, and sometimes, nagging pain and discomfort (<http://www.healthinfoarticles.com>).

Acid reflux, which is known medically as gastro esophageal reflux disease or GERD and is often called "heartburn" by the general public, occurs when liquid content of the stomach back up into the esophagus. This liquid contains stomach acid which can irritate and inflame the tissue of the esophagus, causing a burning sensation in the esophagus in the chest area near the heart: thus the name "heartburn"(<http://www.healthinfoarticles.com>).

Constipation can be acute or chronic depending on the symptoms. Acute constipation could be a sign of a more serious underlying problem, which might require immediate medical attention particularly if accompanied by bleeding and abdominal cramps, while chronic constipation might be remedied with simple measures that help relieve the discomfort. According to health portal [medicinenet.com](http://www.medicinenet.com) (2008), a vast majority of adults have bowel movements between three to 21 times a week and this range is considered normal.

Diarrhoea -loose, watery stools occurring more than three times in one day -is a common problem that usually lasts a day or two and goes away on its own without any special treatment. However, prolonged diarrhoea can be a sign of other problems. Diarrhoea can cause dehydration, which means the body lacks enough fluid to function properly (Australian Government, 2008).

A recent study says that digestive problems could signal diabetic nerve pain and inversely damage of the autonomic nerve affects the digestive system (<http://diabetes.webmd.com>)

According to Nix (2005), nutrition management of digestive disorders is based on the degree of interference in the normal process of ingestion, digestion, absorption and metabolism that the disease causes.

Digestive problems can wreak havoc on your daily life and well being. Indigestion, stomach cramps, bloating, diarrhoea and constipation can make a

bright day turn sour in a matter of seconds and with a few simple alterations to daily diet and lifestyle, digestive disorders can be prevented and digestive health can be maintained. (<http://www.ehow.com/>).

### **E. Role of carminative spices in treatment of digestive problems**

According to Graimes (1999), spices have long been recognised for their medicinal qualities for curing flatulence and certain other digestive problems.

A carminative, also known as carminativum (plural carminativa), is a medicinal drug with antispasmodic activity that is used against cramps of the digestive tract in combination with flatulence. They are often mixtures of herbal spices with a tradition in folk medicine for this use (<http://en.wikipedia.org/>) and these carminatives are used orally for dyspepsia (Chaudry and Moghe, 1996).

Bennet and Brown (2005) have elicited that anti-spasmodics can be provided for abdominal pain and there are two main classes of anti-spasmodics namely, the anti-muscuranic drugs and drugs which are direct smooth muscle relaxants. The spices which are carminative and anti-spasmodic in nature can be used in treating or overcoming problems related to digestion especially flatulence, says Bennet and Brown (2003) and these spices work by either inhibiting the offending bacteria, or neutralizing the offending gases or by helping in the easy expulsion of gases. (<http://oneearthherbs.squarespace.com>).

According to Platel and Srinivasan (2004), several spices are also employed in medicinal preparations against digestive disorders in Indian systems of medicine. The digestive stimulant action of spices seems to be mediated through two possible modes: (i) by stimulating; the liver to secrete bile rich in bile acids, components that are vital for fat digestion and absorption, and (ii) by a stimulation of enzyme activities that are responsible for digestion. Spices are well recognized to stimulate gastric function. They are believed to intensify salivary

flow and gastric juice secretion, and help in digestion. Such spices with carminative, digestive stimulant and anti-spasmodic properties are as follows:

***i. Ajowan***

Ajowan or bishop's weed (*Trachyspermum ammi*) is one among the minor spices of India. (Manay and Shadaksharaswamy, 2007) Ajowan seeds, are more known as adjuncts used in small quantities for flavouring numerous foods, as antioxidants, preservatives, or in medicine or for the manufacture of essential oils for ultimate use in perfumery, essences, medicine, etc. they are reported to be useful in flatulence, atonic dyspepsia, diarrhoea, cholera, hysteria, and spasms of the bowels (NIIR Board, 2002).

***ii. Aniseed***

Aniseed (*Pimpinella anisum*) is a sweet, aromatic spice, which is used for flavouring food, confectionery, bakery products and beverages. It is reported to be used as an aromatic carminative to relieve flatulence and as an ingredient of cough syrups. It is a mild expectorant and is used as an antiseptic (NIIR Board, 2002).

***iii. Asafoetida***

Asafoetida (*Ferula assafoetida*) is the dried latex of several species of *Ferula* (<http://www.indianspices.com/>) Asafoetida has certain medicinal uses and most commonly is used as a digestive aid. It is reputed to lessen flatulence. It is used as a digestive aid, in food as a condiment and in pickles (<http://en.wikipedia.org/>).

***iv. Cardamom***

Cardamom (*Elettaria cardamomum*) is the "Queen of spices", and is indigenous to south India (Punitha, 2007). It has a very pleasant aroma and taste (<http://www.indianspices.com/>) as cooking spices and as a medicine to

treat infections in teeth and gums, to prevent and treat throat troubles, congestion of the lungs and pulmonary tuberculosis, inflammation of eyelids and also digestive disorders (<http://en.wikipedia.org/>).

**v. Cinnamon**

Cinnamon (*Cinnamomum Zeylanicum*) bark is a popular spice with a delicate fragrance and has a very warm and agreeable taste (<http://www.indianspices.com/>). It is high in antioxidant activity. The essential oil of cinnamon also has antimicrobial properties ([http://en.wikipedia.org](http://en.wikipedia.org/)). Cinnamon has recently been proved for its benefits in improving glycemic and lipid profiles (Tang et al, 2008) and extracts of cinnamon have proved to act on immune responses (Cao et al, 2008).

**vi. Cloves**

Clove (*Syzygium aromaticum*) is a valuable spice of the orient which is used mainly for culinary purposes and as a flavouring agent in food industry ([http://www.indianspices.com](http://www.indianspices.com/)). Cloves are used as a carminative, to increase hydrochloric acid in the stomach and to improve peristalsis. Cloves are also said to be a natural antihelminthic ([http://en.wikipedia.org](http://en.wikipedia.org/)).

**vii. Coriander seeds**

Coriander (*Coriandrum sativum*) is an important spices having prime position in flavouring food, as foliage and seed. The dried seeds are, pleasantly aromatic spice extensively used in Indian foods (Vigneshwari and Devi, 2009) and in medicines it is used as a carminative, anti-spasmodic, diuretic, refrigerant and aphrodisiac agent (<http://www.indianspices.com/>) In Germany coriander is approved for the treatment of dyspeptic complaints, GI upsets and flatulence (Craig, 2008).

**viii. Cumin seeds**

Cumin seed (*Cuminum cyminum*) is an ingredient in curry powders and also used in seasonings. They have an aromatic odour and bitter taste.

In medicine, it is used as a stimulant, carminative, stomachic and astringent (<http://www.indianspices.com/>). Cumin seeds are good sources of iron and also have anti-carcinogenic properties. Research has shown that cumin seeds may stimulate the secretion of pancreatic enzymes, compounds necessary for proper digestion and nutrient assimilation. (<http://en.wikipedia.org/>).

**ix. Fenugreek**

Fenugreek (*Trigonella foenum-graecum*), as a spice, adds not only to the flavour but also to the nutritive value of foods (Manay and Shadaksharaswamy, 2007). The seeds are used in colic flatulence, dysentery, diarrhoea, dyspepsia, chronic cough and enlargement of liver and spleen, rickets, gout and diabetes. It is also used as a carminative, tonic, and aphrodisiac. (<http://www.indianspices.com>) Fenugreek is used as a digestive aid and is widely used as a galactagogue (<http://en.wikipedia.org/>) and also has anti-diabetic properties (Saxena and Shalem 2004).

**x. Garlic**

Garlic (*Allium Sativum*), is a herbal wonder which has got scientifically proven medicinal properties (Reshmi, 2006). Garlic is used in pickles, curry powders, meat preparations etc. The other properties of garlic are anti-bacterial, fungicidal and insecticidal (Lakshmanan, 2007). Fermented garlic has anti-oxidant properties (Sato et al, 2006) Garlic cloves are used as a remedy for infections, digestive problems and fungal infections (<http://en.wikipedia.org/>). Garlic reduces the incidence of stomach cancer (Thangarathi, 2008) and it tops the American National Cancer Institute's list as a potential cancer-preventive food and has immune-enhancing Allium compounds which help in treating AIDS (Logamadevi, 2007).

**xi. Ginger**

Ginger (*Zingiber Officinale*), is used in the form of dry ginger, fresh ginger and oil in cooking and food processing. In medicine, it is used as carminative and stimulant and has wider applications in indigenous medicines. (<http://www.indianspices.com/>).Ginger can kill ovarian cancer cells (Vinayagamoorthy and Thirupathi, 2007 and Venkataraman, 2006) and green/fresh ginger is extremely valuable in dyspepsia, flatulence and indigestion and this is due to the presence of the active component of ginger.

Dried ginger is used as a carminative in indigestion, gas pains, stomach cramping(Chandra et al, 2009)heart burn, belching, gastritis, and is used to cure cough, diarrhoea, headache, peptic ulcer and anaemia (Gopi and Radha, 2006).

**xii. *Pepper***

Black pepper (*Piper Nigrum*) is an important component of culinary seasoning of universal use and is an essential ingredient of numerous commercial foodstuffs and is the “King of spices” (Muthu, 2006). It is an essential ingredient in Indian system of medicine. The major functional properties of pepper are analgesic, anti-pyretic, anti-oxidant and anti-microbial (<http://www.indianspices.com/>).It is also used to relieve headaches, rhinitis and heaviness of head (Ramesh, 2005).

**xiii. *Star anise***

Star anise (*Illicium verum*) is one of the masterpiece flavours of Chinese cooking. It is used to flavour vegetables, meat and confectionaries. It is anti-bacterial, carminative, diuretic and stomachic. It is useful in prevention of flatulence and spasmodic (<http://www.indianspices.com/>). It reduces the effect of rheumatism and even serious neurological effects (<http://en.wikipedia.org>).

**xiv. *Tamarind***

Tamarind (*Tamarindus indica*) is used in numerous culinary preparations, in textile, confectionary, cosmetics, pharmaceutical, dyeing and

tanning industries (<http://www.indianspices.com/>).The pulp, leaves, and bark also have medical applications. It is used as a medicine for gastric and/or digestion problems, and has cardioprotective activity (<http://en.wikipedia.org>).

**xv. Turmeric**

Turmeric (*Curcuma longa*) is an Indian spice, which is used for its colour, flavour and digestive properties (Jain et al, 2006 and Tamaraikannan et al, 2008) It is the oldest of all spices and is called as “Indian saffron”(Basha and Banu, 2007). Turmeric is stomachic, carminative, tonic, blood purifier and an antiseptic. It is used in cosmetics and has biopesticidal properties. (<http://www.indianspices.com>).The active component of turmeric, curcumin is used in treatment for cancers, myeloma and Alzheimer's disease (<http://en.wikipedia.org/>).

Taste plays a very important role in any food and among the four basic tastes sweet, bitter, salty and sour, sweetness is the most preferred taste (Roday, 2007).

**i. Honey**

Honey is made from the nectar, a sugary fluid secreted by the nectar glands present on the bases of flowers of trees, shrubs and herbs (Elanchezhyan and Pandi, 2006) It is a sweet viscous liquid produced by honey bees (Indira, 2007).The main uses of honey are in cooking, baking and as a sweetener in commercial beverages. It has anti-bacterial and anti-septic properties which aid in healing sore throats and laryngitis (<http://en.wikipedia.org/>).

**ii. Jaggery**

Jaggery is a traditional unrefined non-centrifugal sugar which is made for direct consumption. It is used as a sweetener in many Indian sweet preparations. Jaggery is a rich source of iron and is considered as a healthier form of sugar than refined white sugar (<http://en.wikipedia.org/>).



### **III.METHODOLOGY**

The methodology pertaining to the study on “Formulation and evaluation of carminative bars (using spices) to overcome digestive problems” involved the following seven phases:

**PHASE I. Identification of Spices for Formulation of Carminative bar**

- F. Selection of the Locale
- G. Selection of the Subjects
- H. Formulation of the Tools
- I. Conduct of Surveys
- J. Identification of Carminative Spices

**PHASE II. Formulation and Development of Carminative Bar**

**PHASE III. Sensory Evaluation of the Carminative Bars**

- A. Selection of Taste Panel Members
- B. Development of Score Card
- C. Conduct of Acceptability Trials
- D. Selection of Carminative Bar for Administration

**PHASE IV. Estimation of Nutrient content and Cost of the Carminative Bars**

**PHASE V. Administration and Evaluation of Carminative Bar**

- A. Screening and Selection of Subjects with Digestion Related Problems
- B. Administration and Evaluation of Carminative Bar

**PHASE VI. Evaluation of Effect of Educational Package**

- A. Development of Educational package
- B. Creation of Awareness on Culinary uses and Health benefits of Spices and Carminative bar
- C. Formulation of the Schedule
- D. Evaluation of the Effect of the Educational Package

**PHASE VII. Analysis and Interpretation of Data**

## **Phase I. Identification of Spices for Formulation of Carminative Bar**

Identification of spices for formulation of carminative bars was done by conducting household, market and hospital surveys, since surveys in general are conducted for collecting general information of any population, institution or phenomena without any hypothesis (Gupta, 2005).

### **A. Selection of the Locale**

The area chosen for the conduct of the study was in and around Coimbatore city, in TamilNadu state, due to the familiarity of the investigator with these areas.

For the purpose of the household survey, to elicit information on socio-economic and dietary pattern, spices consumption pattern, health status and digestive health of the members of the selected families, prominent residential areas of Coimbatore city namely, Thudiyalur, Periyanaickenpalayam, Rathinapuri, Ramalingam colony, Idayarpalayam, Pothanur, R.S.Puram, Vadavalli, Saibaba colony, Jothipuram, Peelamedu, Kalapatty, Sowripalayam, Kattur, Saibaba colony, Pappampatty pirivu, Kavundampalayam, and Pattanam were selected by the investigator owing to its proximity and easy accessibility.

For the hospital survey, to gather information from healthcare professionals, on carminative spices used in treating selective digestive disorders, hospitals, healthcare and research institutions in Coimbatore city namely, Kovai Medical Center and Hospital, G.Kuppuswamy Naidu memorial hospital, Kottakal Arya Vaidya Sala, Arya Vaidya Chikitsalayam and Research Institute, Kumaran Siddha Hospital, Ayur World, Sri Gayathri Nature Cure Hospital, Parthiban Hospital, R.K.Nature Cure Home, Nanas Homeo Medical Centre, RPT Homeopathy Clinic, Pavithra Nature and Yoga Hospital, PSG Institute of Medical Sciences and Research and hospitals and Ashwini Homeo Clinic, were selected by

the investigator. Prior permission was obtained from authorities of the hospitals and institutions to conduct the survey.

For the conduct of Markey survey on medicinal and health benefits of spices, herbal medicine shops in commercial areas of Coimbatore city were selected. The shops were located at Kavundampalayam, Flower-Market, Ramanathapuram and Saibaba colony. The areas were selected by the investigator owing to the propinquity and easy accessibility of the shops.

## **B. Selection of the Subjects**

According to Trochim (2006), sampling is the process of selecting units (e.g., people, organizations) from a population of interest so that by studying the sample generalization of results back to the population from which they were chose can be done.

Using the systematic random sampling technique (Gupta, 2007), every third house in the target area was chosen for the household survey and the adult women were selected as interviewees since information regarding spices and health status of family members were elicited to a greater extent by them and a total of 100 families were selected to conduct the household survey.

By purposive sampling (International Statistical Institute, 2004), fifty healthcare professionals were selected for hospital survey. Twenty doctors of different fields like Ayurveda, Homeopathy, Siddha, Naturopathy and Allopathy and 30 dietitians of three different hospitals were selected for the conduct of hospital survey.

For the market survey, 10 herbal medicine shops in Coimbatore city, namely, Velmurugan Pooja stores, C.K.stores, Jaison stores, N.Krishnaswamy stores, Natraj Tharagar son pooja stores, Selva Vinayagar stores, Annamalai pooja stores, Shri Manju herbals, Khadhi-Sarvodaya Sangham and V.Natraj Tharagar

and sons, were selected by convenience sampling method (<http://www.statpac.com>).

### **C. Formulation of the Tools**

According to Kothari (2007), an interview schedule is a proforma containing a set of questions. They are generally asked and filled by the investigator, in a face-to-face situation with another person (Gupta, 2007). An interview schedule was developed by the investigator for household survey for the collection of information from the selected 100 families about their socio-economic status, health status, dietary pattern, spices consumption pattern and awareness about the medicinal properties of the spices.

According to Bordens and Abbott (2006), conducting a small pilot study turns up inadequacies in formulation of questionnaire and inadequacies that lead to confusion or misinterpretation. Hence, a pilot study was conducted on a sample of five households to pretest the schedule and necessary modifications were incorporated based on their suggestions. The modified schedule is given in Appendix I.

An interview schedule was developed for hospital survey since an interview schedule contains a set of questions to be answered by the respondent (Medhi, 2006). Interview schedule for hospital survey (Appendix II) was framed and used to elicit information on carminative spices and treatment rendered by health care professionals of the Government and Private hospitals in their own ways for digestive problems.

Interview schedule for market survey (Appendix III) was developed which comprised of the questions pertaining to the availability and medicinal properties of spices and was used to gather information from the selected ten shopkeepers of Coimbatore city.

## CONDUCT OF THE SURVEYS

### CONDUCT OF HOUSEHOLD SURVEY



### CONDUCT OF MARKET SURVEY



### CONDUCT OF HOSPITAL SURVEY



Plate I

#### **D. Conduct of Surveys**

Household survey was conducted among 100 families in Coimbatore city, to gather information on socioeconomic and dietary pattern and also nutritional and health status of the selected subjects and to identify the commonly used spices, the medicinal and culinary benefits of spices at domestic level. The investigator visited the subjects personally and collected information using the interview schedule (Appendix I).

Market survey was conducted by interview cum observation method on spices and herbs available in ten herbal-medicine shops of Coimbatore city, using the interview schedule (Appendix III)

Hospital survey was conducted by the investigator using an interview schedule (Appendix II). Depending upon the convenience and time availability of the healthcare professionals, they were either interviewed directly by the investigator or the forms were distributed and collected after a couple of days.

All the subjects were personally interviewed by the investigator and the relevant data were collected. Maximum reliability of the data was ensured by questioning and cross-questioning the subjects (Plate I).

#### **E. Identification of Carminative Spices**

Carminatives are drugs which benefits patients with digestive problems. They are substances which are held, mainly to assist expulsion of gas from the stomach and intestine (Bennet and Brown, 2005).The carminatives in general, are not preferred to be consumed as drugs and since the spices and herbs which possess this quality were identified. The selection was done based on the culinary benefits, medicinal uses, availability and cost-effectiveness of spices.

Sixteen different spices, which are carminative in nature and used widely for culinary purposes were selected by the investigator for the study. They included three spices which were used in paste form (garlic, ginger and tamarind) and thirteen spices in powdered form (ajowan, aniseed, asafoetida, cardamom, cinnamon, cloves, coriander seeds, cumin seeds, dry-ginger, fenugreek, pepper, star-anise and turmeric) (Plate II)

Taste, is one of the senses used to detect the chemical makeup of ingested food, to establish its palatability and nutritional composition (<http://www.answers.com/>).It provides varying degrees of nourishing strength and sweet is the most nourishing and it is believed that a little sweet taste at the end of the meal stimulates digestion (The Ayurveda Encyclopedia, 1998) and hence sweeteners like honey and jaggery were selected. They also possessed medicinal values and are easily available at an affordable cost.

The prominent factors considered for the formulation of carminative bars were: the ease of availability, taste and flavour of the spices, familiarity and suitability at the household level and individual's tolerance and economic viability.

## **Phase II. Formulation and Development of Carminative Bar**

Nutritional and medicinal bars used to be the stars of the functional food markets and although in a period of transition, the bar market remains healthy and poised for steady growth going forward (Wright, 2008).

A total of ten combinations of carminative bars were formulated and in each combination, five different variations were developed and the details are given in Table V.

# INGREDIENTS USED IN CARMINATIVE BARS

**ASAFOETIDA**



**ANISEED**



**AJOWAN**



**CARDAMOM**



**CINNAMON**



**CLOVES**



**CORIANDER SEEDS**



**CUMIN SEEDS**



**FENUGREEK**



**Plate II**

## INGREDIENTS USED IN CARMINATIVE BARS

**GARLIC**



**GINGER**



**PEPPER**



**STAR-ANISE**



**TAMARIND**



**TURMERIC**



**JAGGERY**



**HONEY**



**Plate II**

# CARMINATIVE BARS



Plate III

**Table V****QUANTITY OF INGREDIENTS USED IN DIFFERENT VARIATIONS OF  
CARMINATIVE BARS**

Combination number	Ingredients	Variations (g)				
		V1	V2	V3	V4	V5
C1	Pepper	0.75	0.50	1.5	-	-
	Ajowan	0.75	0.50	-	1.5	-
	Coriander	3	3	3	3	3
	Turmeric	0.25	0.25	0.25	0.25	0.25
	Honey	0.50	0.50	0.50	0.50	0.50
	Jaggery	2	2	2	2	2
C2	Cinnamon	0.75	0.50	1.5	-	-
	Cloves	0.75	0.50	-	1.5	-
	Cardamom	3	3	3	3	3
	Turmeric	0.25	0.25	0.25	0.25	0.25
	Honey	0.50	0.50	0.50	0.50	0.50
	Jaggery	2	2	2	2	2
C3	Pepper	0.75	0.50	1.5	-	-
	Asafoetida	0.75	0.50	-	1.5	-
	Cumin seeds	3	3	3	3	3
	Turmeric	0.25	0.25	0.25	0.25	0.25
	Honey	0.50	0.50	0.50	0.50	0.50
	Jaggery	2	2	2	2	2
C4	Cardamom	0.75	0.50	1.5	-	-
	Star-anise	0.75	0.50	-	1.5	-
	Aniseed	3	3	3	3	3
	Turmeric	0.25	0.25	0.25	0.25	0.25
	Honey	0.50	0.50	0.50	0.50	0.50
	Jaggery	2	2	2	2	2
C5	Cumin seeds	0.75	0.50	1.5	-	-
	Coriander	0.75	0.50	-	1.5	-
	Dry-ginger	3	3	3	3	3
	Turmeric	0.25	0.25	0.25	0.25	0.25
	Honey	0.50	0.50	0.50	0.50	0.50
	Jaggery	2	2	2	2	2
C6	Dry-ginger	0.75	0.50	1.5	-	-
	Cumin seeds	0.75	0.50	-	1.5	-
	Tamarind	3	3	3	3	3
	Turmeric	0.25	0.25	0.25	0.25	0.25
	Honey	0.50	0.50	0.50	0.50	0.50
	Jaggery	2	2	2	2	2

Combination number	Ingredients	Variations (g)				
		V1	V2	V3	V4	V5
C7	Tamarind	0.75	0.50	1.5	-	-
	Fenugreek	0.75	0.50	-	1.5	-
	Ginger	3	3	3	3	3
	Turmeric	0.25	0.25	0.25	0.25	0.25
	Honey	0.50	0.50	0.50	0.50	0.50
	Jaggery	2	2	2	2	2
C8	Ginger	0.75	0.50	1.5	-	-
	Aniseed	0.75	0.50	-	1.5	-
	Cloves	3	3	3	3	3
	Turmeric	0.25	0.25	0.25	0.25	0.25
	Honey	0.50	0.50	0.50	0.50	0.50
	Jaggery	2	2	2	2	2
C9	Tamarind	0.75	0.50	1.5	-	-
	Dry-ginger	0.75	0.50	-	1.5	-
	Garlic	3	3	3	3	3
	Turmeric	0.25	0.25	0.25	0.25	0.25
	Honey	0.50	0.50	0.50	0.50	0.50
	Jaggery	2	2	2	2	2
C10	Aniseed	0.75	0.50	1.5	-	-
	Garlic	0.75	0.50	-	1.5	-
	Star-anise	3	3	3	3	3
	Turmeric	0.25	0.25	0.25	0.25	0.25
	Honey	0.50	0.50	0.50	0.50	0.50
	Jaggery	2	2	2	2	2

The ingredients used were accurately weighed and were carefully roasted to enhance aroma and texture. They were then finely powdered, mixed with honey and warm jaggery syrup and were made into small bars for sensory evaluation as depicted in Plate III.

### **Phase III. Sensory Evaluation of the Carminative Bars for Selected Digestive Problems**

Sensory evaluation is a part of food science called sensory science, which is dedicated for finding ways to use humans to accurately describe the flavours and other sensory properties of foods (Potter and Hotchkiss, 2007). It has been defined as “A scientific discipline used to evoke, measure, analyze and

interpret reactions to those characteristics of foods and materials as they are perceived by the senses of sight, smell, taste, touch and hearing” (Joshi, 2006).

Quality is the ultimate criterion of the desirability of any food product, and the acceptance of product is dependent upon the quality of the food product, which depends on the nutritional and other hidden attributes of the product, and sensory quality as assessed by means of human sensory organs (Manay and Shadaksharaswamy, 2007). Hence the products developed were decided to be evaluated for its sensory properties.

#### **A. Selection of Taste Panel Members**

Sensory evaluation or ‘taste testing’, consists of judging the quality of food by a panel of judges (Stone and Sidel, 2004). A panel of members of 25 Post-graduate Food-Science and Nutrition students of Avinashilingam University for Women, Coimbatore, were selected for the sensory evaluation of the carminative bars. To avoid errors due to physical, psychological, environmental and individual characteristics, panels of evaluators were used rather than a single assessor.

The panel personnel were selected on the basis of their health, co-operation, willingness and knowledge of sensory analysis and also the ability to discriminate the various criteria for sensory evaluation.

#### **B. Development of Score Card**

Score card is a tool which helps in evaluation through direction and degree of judgements using suitable defined scores (Manay and Shadaksharaswamy, 2007). A four point score card was developed for the purpose of evaluation of the acceptance of colour, taste, texture and flavour and scores were given according to the degrees of acceptance of the carminative bar (Appendix IV).

### **C. Conduct of Acceptability Trials**

As the first step of acceptability trials, five variations in each of the ten combinations were developed. Five bars, which obtained higher scores in sensory evaluation, were selected for further evaluation of its sensory attributes. Three trials were carried out to obtain maximum accuracy of the results.

The sensory evaluation was conducted in suitable time, i.e. around 11am-12.15pm, before the student's lunch time. The results were recorded and analyzed properly.

### **D. Selection of Carminative Bar for Administration**

The carminative bar which obtained the highest acceptability scores through sensory evaluation was considered as the best acceptable product (C5V1) and used for administration and analysis of nutrient content. Table VI shows the quantity of ingredients used in carminative bar selected for administration.

**Table VI**  
**QUANTITY OF INGREDIENTS USED IN CARMINATIVE BAR**  
**SELECTED FOR ADMINISTRATION**

<b>Ingredients</b>	<b>Quantity(g)</b>
Cumin seeds	0.75
Coriander	0.75
Dry-ginger	3.00
Turmeric	0.25
Honey	0.50
Jaggery	2.00

### **Phase IV. Estimation of Nutrient Content and Cost of the Carminative Bars**

According to Roday (2007), nutritional quality and cost factor are the major factors affecting food selection. Analysis of nutrient content is an important aspect in formulating and developing new product and evaluating new processes for making food products and in identifying the source of problems with unacceptable problem (Nielsen, 2006). Hence the best bar selected for further study was analyzed for its nutrient content, using standard procedures. The carminative bar was analyzed for moisture, energy, protein, fat, carbohydrates,

ash, calcium, fiber, phosphorous, iron, ascorbic acid, vitamin A, zinc and Phytin content and the lead content of the bar was also analyzed to know about the presence of toxic substances in the bar using standards suggested by National Institute of Nutrition, Hyderabad.

The nutrient content of the other selected bars were also calculated using values suggested by ICMR(2007).

An important aspect in successful food product development is cost. The cost of the ingredients, the process, and the packaging all must be taken into careful consideration during the food development strategy (<http://www.foodconsultant.biz>) and so the cost of preparation of carminative bar was calculated using current rates of spices in the market. The storage of carminative bar requires only an airtight container which may be indigenous to almost all households.

#### **Phase V. Administration and Evaluation of Carminative Bar**

The carminative obtained the highest acceptability score was selected for administration to the target groups having digestive problems.

##### **A. Screening and Selection of Subjects with Digestion Related Problems**

From the household survey conducted among 100 families, the health status of 397 subjects was assessed. By Multi-stage sampling technique (Gupta, 2007), 39 subjects having digestive problems were initially screened. Among them, 34 subjects were selected for the in-depth study. The selection depended upon the causes and severity of the digestive problems and willingness and co-operation of the subjects.

##### **B. Administration and Evaluation of Carminative Bar**

The subjects with digestive problems were selected and administered carminative bar to find its effectiveness on digestion related problems. They were

requested to consume the bar, with a dosage of one gram daily for a period of ten days. Care was taken by the investigator for ensuring the consumption of carminative bar and also that the subjects did not suffer from any other health problems during the study period of ten days.

The effectiveness of carminative bar on digestive problems was evaluated in terms of the responses of the subjects by means of an interview schedule, since they are the most common method for assessing digestive health (Grabitske and Slavin, 2008).(Appendix VII).

## **Phase VI. Evaluation of Effect of Awareness Created using Educational Package**

Awareness was created among the selected subjects on importance of spices and its medicinal properties using specially designed booklets.

### **A. Development of Educational Package**

Subjects having digestive problems were educated for the importance and medicinal nature of spices and preparation, storage, shelf-life, dosage and nutritional and health benefits of carminative bar.

A booklet was developed using softwares namely, Adobe Photoshop 7.0, Adobe PageMaker 7.0 and Corel draw 11.0 and is given in Appendix VI.

### **B. Creation of Awareness on Culinary uses and Health benefits of Spices and Carminative bar**

The subjects having digestive problems need to continue with the preparation and consumption of carminative bar, and it is customary for the people to become aware of the nutritional and health benefits of spices. Hence awareness on importance and carminative nature of spices was created among selected families using the educational package developed by the investigator. (Plate IV)

Education on medicinal nature, health benefits, and culinary uses of spices and preparation, storage, dosage and health benefits of carminative bar



was imparted to the selected families of the subjects using booklet and the effect of the educational package was evaluated using a specially designed questionnaire.

### **C. Formulation of the schedule**

An interview schedule was developed to evaluate the effectiveness of educational package (Appendix VII).The investigator personally evaluated and obtained answers from the subjects and so interview schedule was chosen to be the best tool for evaluation of the impact of awareness created (<http://www.ihmctan.edu/>).

### **D. Evaluation of the effect of educational package**

Initially nutritional knowledge of the families on spices and their benefits was assessed using an interview schedule and after imparting education, the same questions were asked to evaluate the effect of education program. The impact of the education imparted was assessed by comparing the results obtained before and after education program.

### **Phase VII. Analysis and Interpretation of Data**

The data collected through interview schedules, score cards and observation methods were organized to obtain the desired results and interpreted scientifically (Kothari, 2007) and the collected data were subjected to statistical analysis. For the analysis of data, percentages were worked out wherever needed and statistical comparisons were made using the mean and ANOVA (Appendix V). The findings with the detailed discussions are presented in the Chapter IV.



## **IV.RESULTS AND DISCUSSION**

The results of the present study entitled “Formulation and evaluation of carminative bars (using spices) to overcome digestive problems” is presented and discussed under the following headings:

- A. Information collected through surveys
- B. Sensory evaluation of the carminative bar
- C. Nutrient content and cost effectiveness of carminative bar
- D. General information about subjects selected for administration of carminative bar
- E. Evaluation of the effectiveness of the carminative bar and
- F. Evaluation of effect of awareness created among selected families of the subjects

### **A. Information collected through surveys**

#### **1. Socio-economic background, dietary pattern and health status of selected families**

##### **a) Socio-economic status of the selected families**

Health and nutritional status of an individual are affected by an unfavourable socio-economic status of the family like poverty, literacy, over work, ineffective health care service etc., and according to Darman and Drewnowski (2008) diet quality is mainly affected by all the conventional indices of socio-economic background of an individual.

Hence it is essential to include the socio-economic profile of the selected 100 families and data gathered through household survey are presented in Table VII.

**Table-VII**  
**SOCIO-ECONOMIC STATUS OF THE SELECTED**  
**FAMILIES**

S.No	Variables	Criteria	Number	Percentage
1.	Type of family*	Joint	16	16
		Nuclear	84	84
		<b>Total</b>	<b>100</b>	<b>100</b>
2.	Family size	≤4	77	77
		>4	23	23
		<b>Total</b>	<b>100</b>	<b>100</b>
3.	Gender	Male	183	46
		Female	214	54
		<b>Total</b>	<b>100</b>	<b>100</b>
4.	Age **	Upto 12 months	2	1
		1-12 years	54	13
		13-19 years	36	9
		20-39 years	141	36
		40-64 years	137	34
		65+ years	27	7
		<b>Total</b>	<b>397</b>	<b>100</b>
5.	Educational status***	Post Graduates and above	53	13
		Graduates	88	22
		Diploma holders	78	20
		High school	75	19
		Middle school	32	8
		Primary school	17	4
		Illiterates	7	2
		Others	47	12
		<b>Total</b>	<b>397</b>	<b>100</b>
6.	Occupation	Full-time home making	79	20
		Self-employment	54	14
		Government/Private	105	26
		employee	109	27
		Student	27	7
		Retired personnel	23	6
		<b>Total</b>	<b>397</b>	<b>100</b>
7.	Monthly income **** (Rs.)	≤4,500	6	6
		4,500-7,500	16	16
		>7,500	78	78
		<b>Total</b>	<b>100</b>	<b>100</b>

[[\\*http://www.sociologyguide.com](http://www.sociologyguide.com) \*\*HUDCO income classification (2004) \*\*\*Timiras (2003) \*\*\*\*Kuppuswamy (2007)]

According to Rani et al (2003), families are important part of social institution. The results of the study indicated that 84 per cent of the families belonged to nuclear type of families and the rest of them were being in traditional joint family system.

Majority of the families (77%) had one to four members highlighting the significance of small family norms and the remaining (23%) families had more than four members. This reveals that nowadays people are more aware of the small family concepts and its benefits.

Seventy eight per cent of families belonged to high income group, with a monthly income of more than Rs.7, 500 and the remaining six and sixteen per cent of families belonged to low-income and middle income groups respectively, based on the income classification suggested by Housing and Urban Development Corporation (2004).

Among the 397 subjects screened for the study, 46 per cent were males and 54 per cent were females, revealing that the number of female population is facing its incline than male population.

Regarding the age of the screened subjects, 13 per cent belonged to age group of 1-12 years, 9 per cent were between 13-19 years, 36 per cent were adults of 20-39 years of age and 34 per cent were of 40-64 years. The remaining individuals (1% and 7%) were less than one year and 65+ years respectively.

From the result of the study, it is evident that 13 per cent of the subjects were post-graduates (and above), 22 per cent of the subjects were graduates and 20 per cent of subjects were diploma holders. Nineteen, eight and four per cent of the subjects had completed high school, middle school and primary school levels of

education respectively and four per cent of the screened subjects were illiterates. This is, in accordance with findings of Pande (2004), that there is a consistent decline of percentage of illiterates in India.

#### b) Dietary pattern of the selected families

Table VIII depicts the details regarding dietary pattern of the selected families.

**Table-VIII**  
**DIETARY PATTERN OF THE SELECTED FAMILIES (N=100)**

S.No	Variables	Criteria	Number	Percentage
1.	Food consumption pattern	Vegetarian	5	5
		Non-vegetarian	75	75
		Ova-vegetarian	5	5
		Lacto-vegetarian	15	15
		<b>Total</b>	<b>100</b>	<b>100</b>
2.	Percentage of income spent for food/month	≤25%	49	49
		≤50%	49	49
		≤75%	2	2
		>75%	Nil	Nil
		<b>Total</b>	<b>100</b>	<b>100</b>

Among 100 families selected nearly ten per cent of families were vegetarians and ova-vegetarians. Seventy five per cent of the families were non-vegetarians and rest of the families were lacto-vegetarians. This shows that majority of the selected subjects were non-vegetarians.

Table VIII indicates that the percentage of income spent for food per month varies in different families. Equal percentage (49 %) of the families spent ≤ 25 per cent of their income for purchasing different types of food every month. Around 2 per cent of families spent ≤75 per cent of their income for food per month and no family was found to spend more than 75% of their total income for food per month. These findings goes on par with statement of Rani et al(2003), that the percentage of income spent on food declines as the total income increases, since most of the families were high income groups.

### c) Methods of cooking

Table IX indicates the methods of cooking adopted by the selected 100 families in different kinds of foods.

**Table-IX**

#### **METHODS OF COOKING ADOPTED BY SELECTED FAMILIES**

S.No	Food groups	Methods of cooking*										
		Pressure cooking	Boiling	Steaming	Deep frying	Shallow frying	Microwave cooking	Pickling	Seasoning	Flavouring	Juicing	Fresh/raw
1.	Cereals & millets	91	80	100	-	-	1	-	-	-	-	-
2.	Pulses & legumes	87	72	23	-	-	3	-	-	-	-	-
3.	Vegetables	2	5	6	55	81	1	-	-	-	1	-
4.	Fruits	-	-	-	-	-	-	-	-	-	19	95
5.	Milk & its products	-	97	-	-	-	-	-	-	3	-	-
6.	Egg, meat & poultry	1	73	-	77	76	-	-	-	-	-	-
7.	Spices& condiments	-	12	1	85	87	-	24	94	-	-	-

\*Multiple response

From Table IX, it is heart warming to note that, all the 100 families adopted steaming and 91 and 87 families followed pressure cooking, for cooking cereals and millets and pulses and legumes respectively for improving palatability and digestability. Eighty one families used the method of shallow frying for vegetables and green leafy vegetables and 95 families consumed fruits in its raw/fresh form and majority (97) of families boiled milk to enhance the cooking quality and to destroy micro-organisms. Seventy seven families followed different types of frying method for cooking egg, meat and poultry and around 94 families used spices and condiments for seasoning, thickening, garnishing and medicinal

purposes. Eighty five families also used spices and condiments for improving digestability and palatability and only 24 families used spices in pickling.

**d) Health status of members of selected families**

Table X indicates the presence of health problems among the 397 members of the selected 100 families.

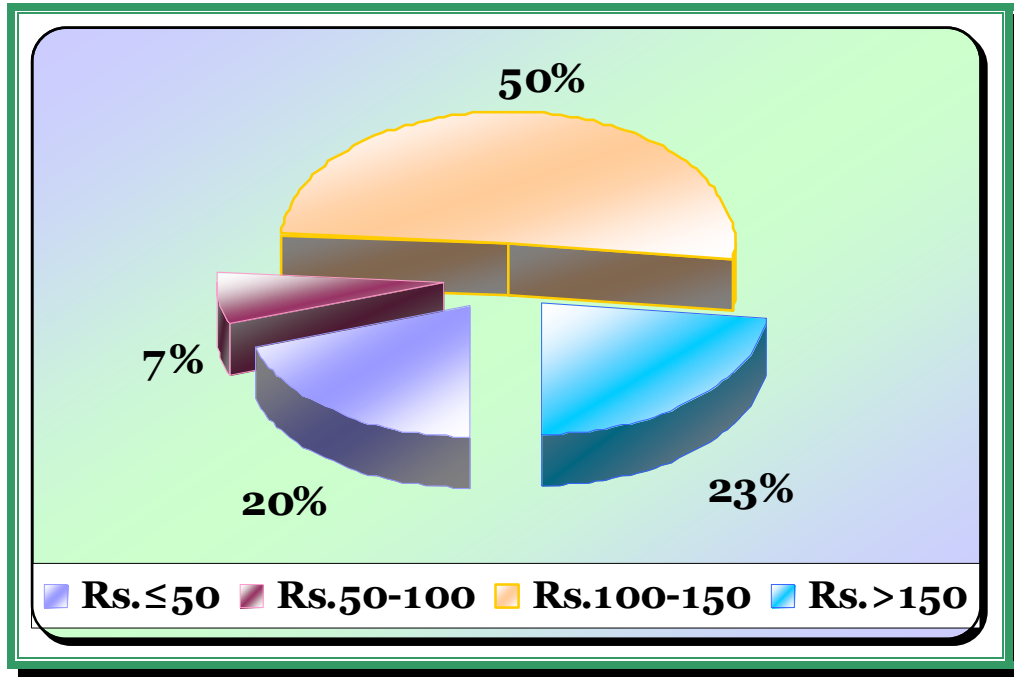
**Table-X**  
**HEALTH STATUS OF MEMBERS OF SELECTED FAMILIES (N=397)**

Criteria	Variable	Number	Percentage	Type of health problem (Multiple response)		
Presence of health problems	Yes	88	22	B.P*-13	Cholesterol-2	O.P**-7
				Diabetes-25	GIT*** problems-39	C.V.P** **_-2
				Thyroid-3	Tumours-1	Others*** **_-4
	Free from health problems	309	78	* Blood pressure; **Ortho problems; ***Gastro Intestinal tract****Cardio-Vascular problems; *****Spinal problems		
<b>Total</b>		<b>397</b>	<b>100</b>			

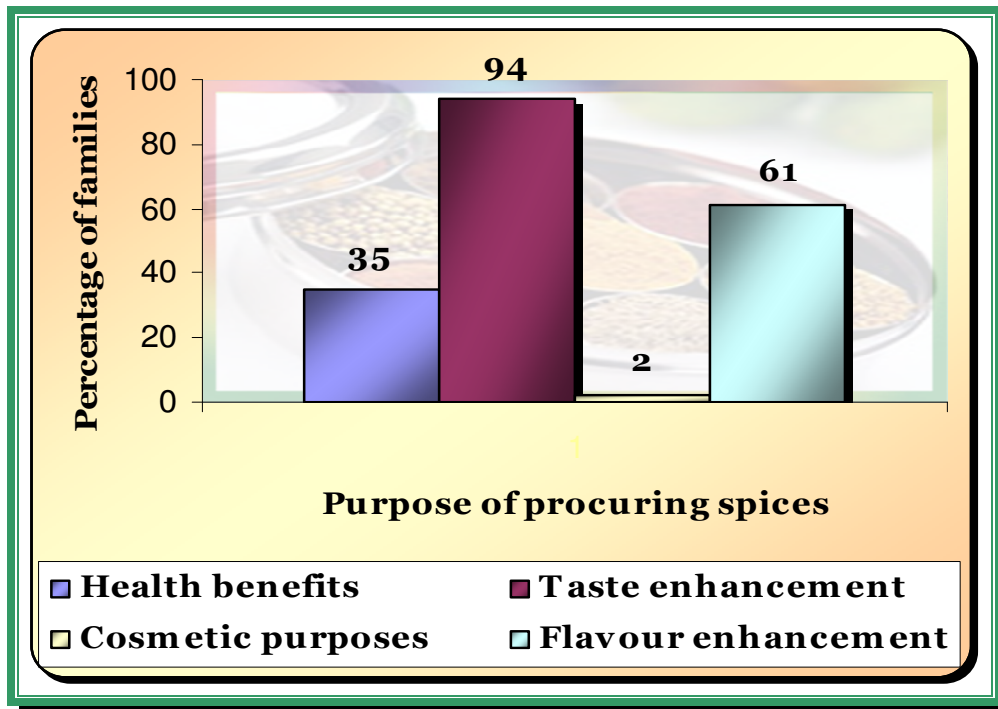
Among the 397 individuals screened, majority (78%) of subjects were healthy and free from health problems and 13 per cent of subjects were suffering from different types of health problems indicated in Table IV. The present study indicated that the most of people were suffering from diabetes (25) and 39 subjects had gastrointestinal tract problems.

**2. Spices consumption pattern of selected families**

Table XI and Figure II indicates the amount spent by selected families for procurement of spices for the culinary uses and other benefits. Figure III indicates the purpose of consuming spices and types of recipes in which spices are included in selected families.



**AMOUNT SPENT BY FAMILIES FOR SPICES PER MONTH**  
**Figure II**



**PURPOSE FOR PROCUREMENT OF SPICES BY THE FAMILIES**  
**Figure III**

**Table-XI**  
**DETAILS REGARDING SPICES CONSUMPTION PATTERN OF SELECTED FAMILIES**

S.No	Variables	Criteria	Number	Percentage
1.	Amount spent for spices/month(Rs.)	≤50	12	12
		50-100	43	4
		100-150	31	31
		>150	14	14
		<b>Total</b>	<b>100</b>	<b>100</b>
1.	Purpose for procuring spices*	Health benefits	35	35
		Taste enhancement	94	94
		Flavour enhancement	61	61
		Cosmetic purposes	2	2
2.	Types of recipes in which spices are included * (Except seasonings)	Non-vegetarian recipes	17	17
		Gravies	23	23
		Selected recipes	23	23
		All recipes in all possible ways	72	72

\*Multiple response

Table XI reveals that 43 per cent of the selected families spent Rs.50-100 for spices per month, followed by 31 per cent of families with an expenditure of Rs.100-150. Among the 100 families, 14 per cent of families spent more than Rs.150 and 12 per cent of families spent less than Rs.50 for spices per month.

Table V also highlights that majority of families (94), bought spices for the purpose enhancing palatability. Only two families utilized spices for cosmetic purposes and rest of them consumed spices for the purpose of flavour enhancements in food preparations and also for their health benefits.

Among 100 families, 72 families included spices in recipes in all possible ways and rest of them included spices either in non-vegetarian recipes or in gravies or in selected recipes like biryani, pulao, sweets and so on.

#### **a) Frequency of consumption of spices among selected families**

Table XII and Figure IV indicates the frequency of consumption and procurement of spices among selected 100 families.

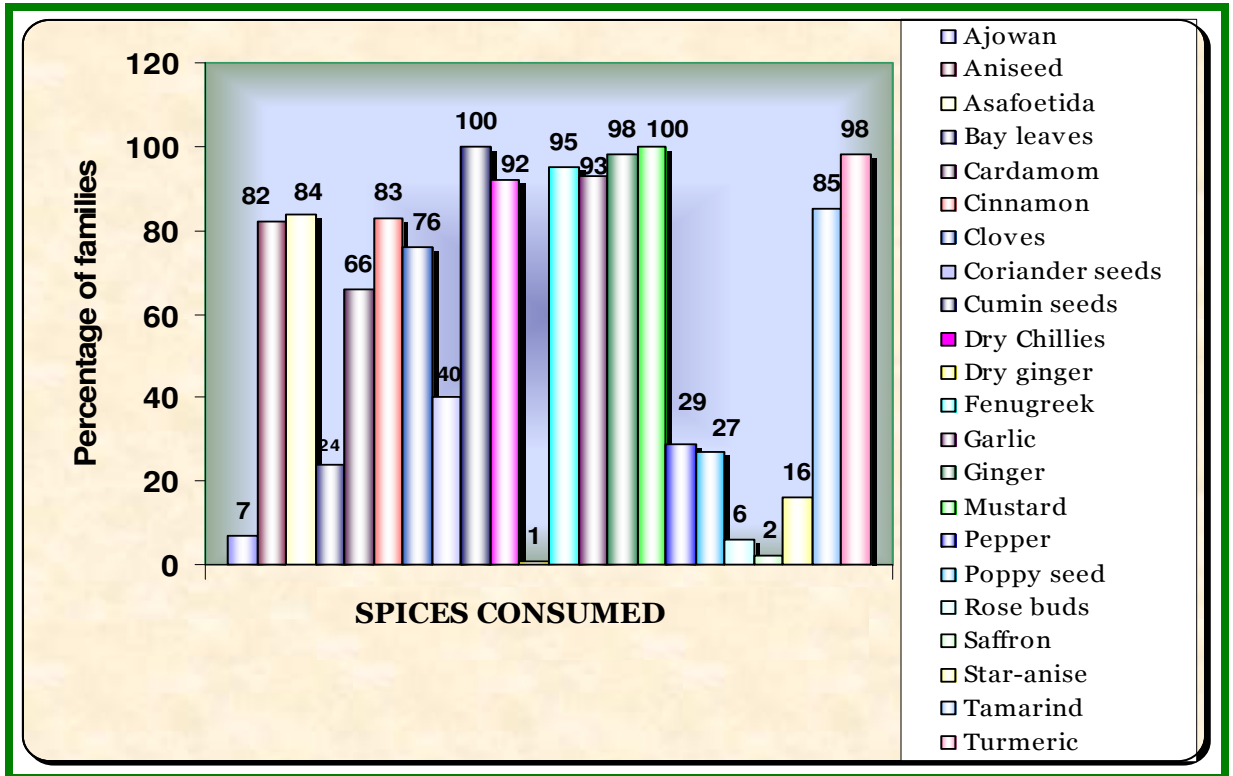
**Table-XII**  
**FREQUENCY AND QUANTITY OF CONSUMPTION OF SPICES**

S.No	Name of the spices*	Frequency						Quantity(g)				
		Whenever needed	Once in a month	Once in fortnight	Once in a year	Once in 6 months	Total	≤5	5-25	25-50	50-100	>100
1	Ajowan	0	7	0	0	0	7	0	0	3	4	0
2	Aniseed	10	58	8	5	1	82	0	12	24	41	5
3	Asafoetida	8	65	5	4	2	84	0	10	21	48	5
4	Bay leaves	0	16	4	4	0	24	3	15	2	3	1
5	Cardamom	6	51	4	4	1	66	100	51	1	1	3
6	Cinnamon	10	58	7	6	2	83	6	69	2	3	3
7	Cloves	7	56	6	6	1	76	9	60	2	2	3
8	Coriander seeds	2	28	3	5	2	40	0	1	3	23	13
9	Cumin seeds	11	75	7	5	2	100	0	10	23	59	8
10	Dry Chillies	10	67	9	4	2	92	0	11	22	53	6
11	Dry ginger	1	0	0	0	0	1	0	0	0	0	1
12	Fenugreek	10	73	6	4	2	95	0	12	25	52	6
13	Garlic	47	13	33	0	0	93	0	11	27	46	9
14	Ginger	54	12	32	0	0	98	0	12	40	41	5
15	Mustard	13	72	8	5	2	100	0	9	31	53	7
16	Pepper	2	17	4	4	2	29	0	5	7	11	6
17	Poppy seed	3	14	6	3	1	27	0	4	15	6	2
18	Rose buds	1	4	0	1	0	6	0	4	1	1	0
19	Saffron	0	1	0	0	1	2	0	1	1	0	0
20	Star-anise	2	9	5	0	0	16	1	14	1	0	0
21	Tamarind	9	65	6	4	1	85	0	5	10	55	15
22	Turmeric	11	72	9	5	1	98		11	30	51	6

\*Multiple response

Table XII reveals that cent per cent of families consumed mustard and cumin seeds and very low number of families consumed dry ginger and saffron regularly in their routine dietary pattern.

Most number of families procured 50-100g of spices every month and a very less number of families procured less than 5 g of spices every month for their regular usage.



**SPICES CONSUMED BY SELECTED FAMILIES**

**Figure IV**

**b) Forms of usage and storage of spices among selected households**

Table XIII indicates the forms of usage and storage of spices among selected 100 families.

**Table-XIII  
FORMS OF USAGE AND STORAGE OF SPICES  
AMONG SELECTED FAMILIES**

S.No	Name of the Spices*	Forms of usage (N=100)			Storage devices (N=100)
		Whole	Powder	Paste	Stainless steel /plastic containers
1	Ajowan	6	6	0	7
2	Aniseed	79	39	2	82
3	Asafoetida	6	84	0	84
4	Bay leaves	24	15	1	24
5	Cardamom	66	23	1	66
6	Cinnamon	80	36	10	83
7	Cloves	74	34	2	77
8	Coriander seeds	35	40	2	40
9	Cumin seeds	96	56	6	100
10	Dry Chillies	80	41	3	92
11	Dry ginger	0	1	0	1
12	Fenugreek	95	0	0	95
13	Garlic	53	0	91	50
14	Ginger	60	0	94	39
15	Mustard	100	0	0	100
16	Pepper	28	27	1	29
17	Poppy seed	27	0	4	27
18	Rose buds	6	3	1	6
19	Saffron	2	0	0	2
20	Star-anise	15	12	1	16
21	Tamarind	7	0	85	85
22	Turmeric	1	97	1	98

\*Multiple response

Table XIII reveals that majority of them preferred to consume spices in its whole form and none of them used oils or other extracts of spices for their cooking purposes. Regarding storage, almost all families stored spices in stainless

steel or plastic container and none of the families stored spices in wooden boxes, which is considered to be the traditional and best way of storing spices. Fifty nine of them stored garlic and ginger in refrigerator.

From the gathered data, it is evident that 96 per cent of families were satisfied with quantity of consumption and methods of preparation of spices for various cooking purposes, especially for enhancing taste and flavour

Majority of families (96) preferred turmeric powder for colouring purpose and also for the following reasons: Medicinal value(68), natural(12), easily available(10), got practiced(12), no side effects(1), healthy(13), cheap(13) and liked by family members(1). Only one family has preferred saffron for enhancing colour of the sweets.

### 3. Digestive problems of the selected subjects

Table XIV represents the number of subjects suffering from digestive problems.

**Table-XIV**  
**NUMBER OF SUBJECTS WITH DIGESTIVE PROBLEMS**

S.No.	Digestion related problems*	Number	Percentage
1.	Flatulence	36	9
2.	Indigestion	12	3
3.	Abdominal pain	7	2
4.	Constipation	3	1
5.	Diarrhoea	1	1
6.	Bloating	7	2
7.	Belching	20	5

\*Multiple response

Among the 397 subjects nearly ten per cent of the selected subjects had one or other digestive problems and the main problems experienced by them were flatulence, belching, and indigestion.

#### a) Details regarding the digestive problems of the individuals

Table XV indicates the details regarding the digestive problems of the 39 subjects who were suffering from some types of digestive problems.

**Table-XV**  
**DIGESTIVE PROBLEMS OF THE SELECTED SUBJECTS**

S.No	Variables	Criteria	Number	Percentage
1.	Cause of the digestion related problem	Side effect of health problem/medical treatment	3	8
		Others	36	92
		<b>Total</b>	<b>39</b>	<b>100</b>
2.	Frequency of occurrence of digestive problem	Always	4	10
		Only before/after food intake	3	8
		Rarely	31	79
		Only after heavy meals	1	3
		<b>Total</b>	<b>39</b>	<b>100</b>
3.	Capacity to tolerate	Tolerable	33	85
		Intolerable	6	15
		<b>Total</b>	<b>39</b>	<b>100</b>
4.	Duration of existence of problem	≤1 year	5	13
		1-5 years	14	36
		5-10 years	14	36
		>10 years	6	15
		<b>Total</b>	<b>39</b>	<b>100</b>
5.	Treatment undertaken for digestive problem	Under treatment	13	33
		Not under any treatment	26	67
		<b>Total</b>	<b>39</b>	<b>100</b>

From Table XV, it is clear that in the case of eight per cent of subjects had digestive problems as a side effect of a chronic peptic ulcer. The remaining 92 per cent of the subjects had digestive problems due to smoking (11%), alcohol consumption (6%), faulty dietary habits (81%), prolonged intake of medicines(14%), lack of proper exercise(3%), psychological disturbances like stress(3%) and post-operational effect(3%) and one of the subjects did not know the cause for having the digestive problem. In the case of one individual the cause was due to unknown reasons. Hence the results revealed that faulty dietary habits are the prime reason for the occurrence of digestive problems.

Regarding the frequency of suffering from the problem, 79 per cent of subjects suffered very rarely out of problems related to digestion and only one per cent of subjects suffered immediately after consumption of heavy meals.

Majority of the subjects (85%) were able to tolerate the severity of the digestive problems whereas, fifteen per cent were not able to tolerate the severity of the problems and expressed their pain.

Pertaining to the duration of the problems, equal percentage (36%) of the subjects suffered from the digestive problem for the past 1-5 or 5-10 years. The remaining 13 and 15 per cent of subjects suffered for past few months and more than ten years respectively.

With respect to the treatment underwent for digestive problems, 33 per cent were following different types of treatments like, Allopathy (10), Homeopathy (1) and Ayurveda (2), and nearly 14 per cent of the subjects were adopting some kinds of home remedies in certain conditions like body hotness, flatulence, constipation and stomach upsets.

Regarding allergies or side effects due to consumption of spices, only one per cent among the selected subjects of 397, suffered from allergic responses due to consumption of spices like, cinnamon, turmeric, chillies are consumed and so reason can be considered as individual's sensitivity and not the nature of spices.

#### **4. Informations elicited from hospital and market survey**

##### **a) Informations elicited from health-care professionals through hospital survey**

The health-care professionals, who were surveyed, belonged to different fields like homeopathic (6%), Ayurvedic (22%), Allopathic (2%), Siddha (2%) and Naturopathic (8%) doctors and dietitians (60%) were surveyed and the findings are discussed below:

The findings revealed that 98 per cent of the health-care professionals prescribed diet for ill-health or diseased conditions like diabetes (19), digestive

problems(32), cough and cold (5), viral fever (17), pediatric diseases (1), geriatric diseases (1), renal diseases(1), cardio-vascular problems(4), cancer(2) and cholesteremic disorders(4), where as only two per cent of health-care professionals did not prescribe diet for diseased conditions.

Fifty per cent of health-care professionals only suggested spices or drugs made of spices for treatment of certain diseases. The conditions in which spices were suggested in meager quantity include digestive problems except ulcer, ascites, urinary infections, cold and cough, neurological disorders, respiratory infections, diabetes, dyslipidemia, and dental problems.

It was also found that 94 per cent of health-care professionals advised their patients to avoid spices in certain diseased conditions like ulcer, post-operational period, jaundice, hypertension, allergies and intestinal problems and three per cent of health-care professionals have opinioned that there are no such conditions where spices should be avoided in their modified dietary pattern.

It was heart warming to note that, cent per cent of health care professionals unanimously accepted that spices have the ability to act as digestive stimulants and twenty per cent of them have indicated that spices can be provided in treatment of digestive problems.

Regarding chances of presence of toxicity in certain spices, 82 per cent of health-care professionals had come out with a fact that spices, in general are not toxic, whereas, 18 per cent of them expressed that some spices like red chillies, long pepper and cinnamon turned to be toxic depending upon individual's levels of tolerance and quantity used.

Ninety per cent of health-care professionals opined that there was no history of patient who has suffered from allergic responses due to consumption of spices. However, 10 per cent of health-care professionals expressed that they have

come across very few cases with such problems, when selected spices like chillies, pepper, cinnamon, cloves and turmeric were been consumed in larger quantity.

Majority of the health-care professionals (52%) expressed that public were aware of the medicinal and therapeutic uses of spices and rest of them expressed that public were not aware of the medicinal and therapeutic uses of spices.

The usage of spices in routine dietary pattern, varied from person to person and ninety eight per cent of health-care professionals have opinioned taste preferences to be the reason for the variation and 96, 92 and 84 per cent of health-care professionals expressed the reasons to be food preparation methods, individual likes/dislikes and cultural taboos.

The remedial measures suggested by the health-care professionals in their own ways and types of treatment are different in terms of preparation and forms methods but, spices are been used in almost all types of treatment for flatulence and other digestive problems.

Seventy eight per cent of health-care professionals reported that flatulence lead to many other complications like gastritis, ulcer, muscular cramps, GI complications and respiratory complaints.

Majority of the health-care professional suggested that the best forms in which spices were provided for the treatments are, in the form of powders, as extracts and as mixtures with honey.

#### **b) Informations elicited from herbal-medicine shopkeepers through market survey**

The herbal-medicine shopkeepers of different status namely shop-owners (70%) and staff (30%) were surveyed and the findings are discussed as follows: From the responses of the shop-keepers, it was found that, turmeric was available in all the shops in Coimbatore city, followed by cumin seeds, pepper and

dry ginger (80%),cloves and cardamom (50%), nutmeg (40%), asafoetida and ajowan (30%), cinnamon, star-anise (20%) and finally mustard (10%). Regarding the medicinal benefits of the spices cent per cent of interviewees of market survey reported that spices have medicinal benefits, particularly, pepper, turmeric, cumin seeds, dry ginger, cloves, cinnamon, aniseed and asafoetida.

From the survey, it was evident that majority of the shopkeepers preferred consuming spices in powdered form and they had suggested spices like cumin seeds, dry ginger, pepper, aniseed, cardamom, turmeric, ajowan, asafoetida and fenugreek with honey for relief from digestive problems, particularly after meals.

Regarding the spice which is been sold in a large quantity and is fast moving, pepper stood first, followed by, turmeric, dry ginger, long pepper, cumin seeds, asafoetida, cardamom, mustard, aniseed and cloves.

Around 80 per cent of shopkeepers reported that there were no seasonal variations regarding the sales of spices, whereas 20 per cent of them reported that particularly in winter the sales of spices was in large quantum because of the seasonal problems like cough, cold, and so on.

Seventy per cent of the shopkeepers revealed that all kinds of people preferred to consume spices for medicinal purposes and rest of shopkeepers have revealed that only elderly population, people belonging to low income and middle income group preferred to consume spices for their medicinal purposes.

Spices consumption pattern varies from person to person. Cent per cent of interviewees expressed that difference in food preparation methods and taste preferences are the reasons for the variation. Whereas, 90 per cent have responded the reason to be individual's likes and dislikes and 80 per cent of shop keepers reported the reason to be cultural taboos.

Ninety per cent of respondents revealed that spices related confectionaries are commercially available in the market and the rest of them were not aware of the availability of such confectionaries.

They also pointed out that the spices like dry ginger, cumin seeds and cardamom are available as commercial confectionaries.

## **B.Sensory evaluation scores of the carminative bar**

### **1. Mean Acceptability scores of ten combinations of carminative bars**

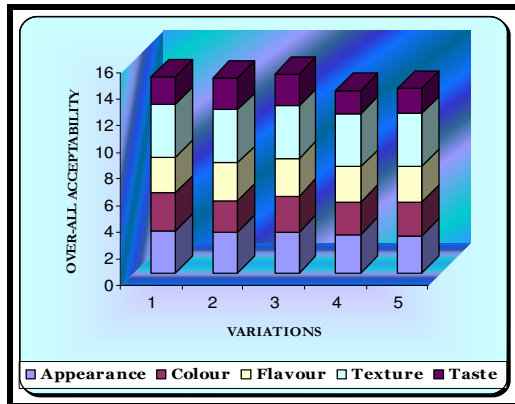
Sensory evaluation of different combinations of carminative bar was conducted in different trials by a panel of judges and the scores were recorded. Table XVI and Figure V indicates the mean acceptability scores of ten combinations of carminative bars and its variations.

**Table-XVI**  
**MEAN ACCEPTABILITY SCORES OF**  
**DIFFERENT COMBINATIONS OF CARMINATIVE BARS**

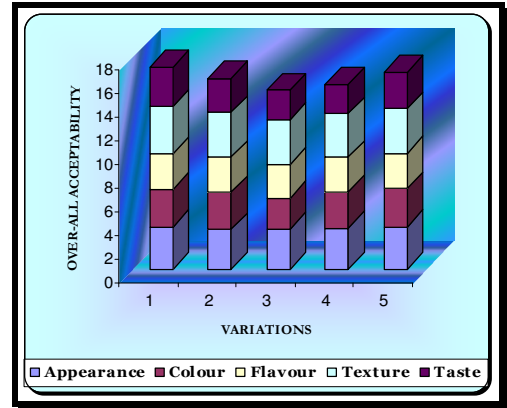
Combination Number	Attributes	Variations (Maximum score-4)				
		V1	V2	V3	V4	V5
<b>C1</b>	Appearance	3.60	3.36	3.44	3.48	3.60
	Colour	3.16	3.16	2.60	3.08	3.24
	Flavour	3.04	2.96	2.88	2.92	3.00
	Texture	4.00	3.8	3.76	3.68	3.76
	Taste	3.36	2.88	2.48	2.48	3.12
	<b>Mean acceptability score</b>	<b>3.38</b>	<b>3.23</b>	<b>3.03</b>	<b>3.13</b>	<b>3.37</b>
<b>C2</b>	Appearance	3.12	3.04	3.08	2.88	2.8
	Colour	2.88	2.36	2.68	2.4	2.48
	Flavour	2.68	2.84	2.8	2.68	2.72
	Texture	4.0	4.0	3.96	3.96	3.96
	Taste	2.04	2.36	2.4	1.8	1.92
	<b>Mean acceptability score</b>	<b>2.94</b>	<b>2.92</b>	<b>2.98</b>	<b>2.74</b>	<b>2.77</b>
<b>C3</b>	Appearance	2.72	2.76	2.76	2.6	2.48
	Colour	3.028	3.44	3.12	3.44	3.36
	Flavour	2.092	2.6	2.8	2.56	2.76
	Texture	3.076	3.8	3.76	3.64	3.84
	Taste	3.04	2.64	3.2	2.68	3.16
	<b>Mean acceptability score</b>	<b>3.14</b>	<b>3.05</b>	<b>3.13</b>	<b>2.98</b>	<b>3.12</b>

Combination Number	Attributes	Variations (Maximum score-4)				
		V1	V2	V3	V4	V5
C4	Appearance	3.2	3.24	3.24	3.28	3.32
	Colour	2.52	2.52	2.48	2.24	2.56
	Flavour	2.96	3.20	3.08	3.04	3
	Texture	3.8	3.80	3.76	3.84	3.8
	Taste	3.6	3.68	3.64	3.4	3.32
	<b>Mean acceptability score</b>	<b>3.2</b>	<b>3.28</b>	<b>3.24</b>	<b>3.16</b>	<b>3.2</b>
C5	Appearance	3.40	3.28	3.16	3.28	3.36
	Colour	3.52	3.28	3.2	3.44	3.28
	Flavour	3.20	3.12	2.72	2.84	3.04
	Texture	3.68	3.6	3.4	3.56	3.48
	Taste	2.56	2.4	2.32	2.52	2.72
	<b>Mean acceptability score</b>	<b>3.27</b>	<b>3.14</b>	<b>2.96</b>	<b>3.12</b>	<b>3.17</b>
C6	Appearance	3.32	3.16	3.20	3.20	3.28
	Colour	3.76	3.72	3.76	3.76	3.76
	Flavour	3.44	2.84	3.04	3.16	2.72
	Texture	3.68	3.60	3.68	3.68	3.60
	Taste	3.65	3.40	3.24	3.40	3.44
	<b>Mean acceptability score</b>	<b>3.57</b>	<b>3.34</b>	<b>3.38</b>	<b>3.44</b>	<b>3.36</b>
C7	Appearance	2.32	2.28	2.20	2.24	2.32
	Colour	3.32	3.12	3.88	2.52	2.44
	Flavour	2.32	2.28	2.32	2.28	2.08
	Texture	3.56	3.56	3.72	3.76	3.76
	Taste	1.76	1.76	1.68	1.84	1.60
	<b>Mean acceptability score</b>	<b>2.66</b>	<b>2.6</b>	<b>2.76</b>	<b>2.53</b>	<b>2.44</b>
C8	Appearance	2.72	2.76	2.68	2.68	2.68
	Colour	3.92	3.76	3.76	3.64	3.64
	Flavour	2.08	1.96	2.08	2.08	1.96
	Texture	4.00	4.00	3.88	3.84	3.84
	Taste	1.56	1.60	1.44	1.40	1.32
	<b>Mean acceptability score</b>	<b>2.86</b>	<b>2.81</b>	<b>2.77</b>	<b>2.73</b>	<b>2.69</b>
C9	Appearance	2.60	2.88	2.32	2.40	2.60
	Colour	2.96	3.00	2.72	3.04	2.88
	Flavour	2.68	2.52	2.16	2.28	2.36
	Texture	4.00	4.00	3.68	3.44	3.16
	Taste	2.48	1.64	2.60	1.68	1.60
	<b>Mean acceptability score</b>	<b>2.94</b>	<b>2.81</b>	<b>2.70</b>	<b>2.57</b>	<b>2.52</b>
C10	Appearance	2.84	2.24	2.36	2.36	2.36
	Colour	3.76	3.64	3.64	3.56	3.60
	Flavour	2.84	2.48	2.00	2.52	2.24
	Texture	3.72	3.72	3.36	3.72	3.56
	Taste	2.72	2.84	2.52	2.24	2.60
	<b>Mean acceptability score</b>	<b>3.18</b>	<b>2.98</b>	<b>2.78</b>	<b>2.88</b>	<b>2.87</b>

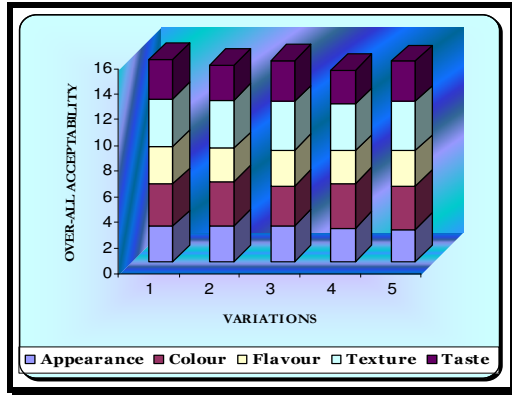
**COMBINATION I (C1)**



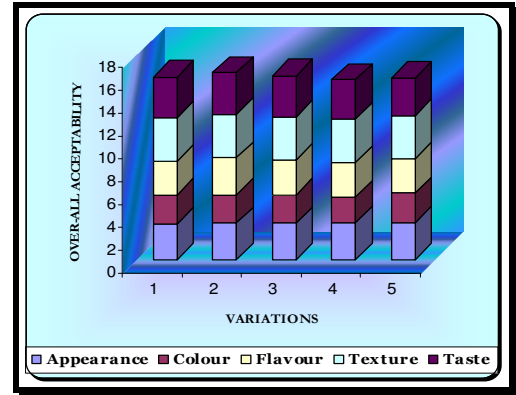
**COMBINATION II (C2)**



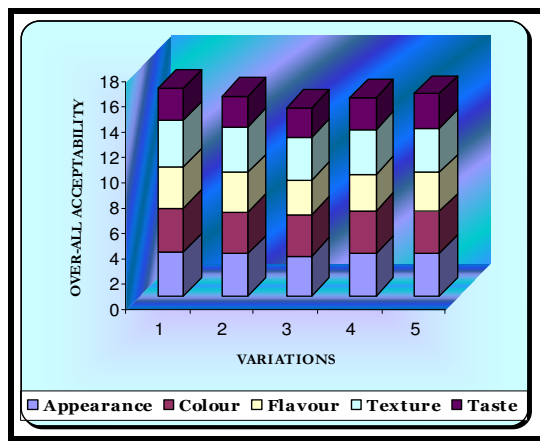
**COMBINATION III (C3)**



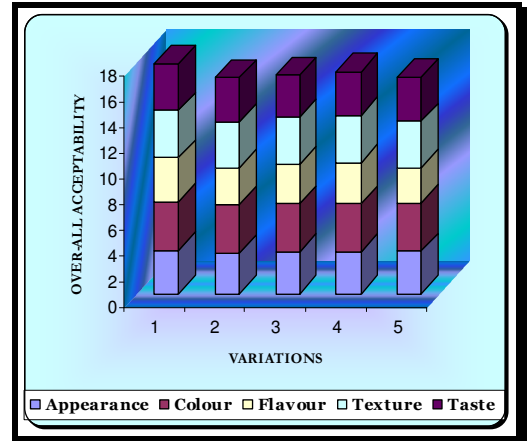
**COMBINATION IV (C4)**



**COMBINATION V (C5)**



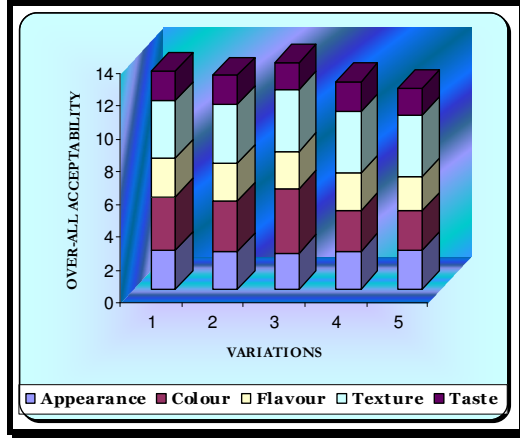
**COMBINATION VI (C6)**



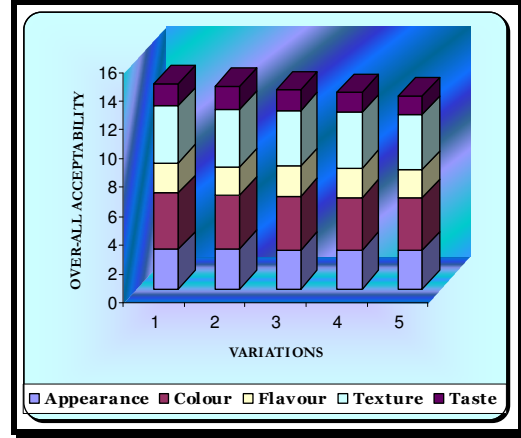
**MEAN ACCEPTABILITY SCORES OF DIFFERENT COMBINATIONS OF CARMINATIVE BARS AND ITS VARIATIONS**

**Figure V**

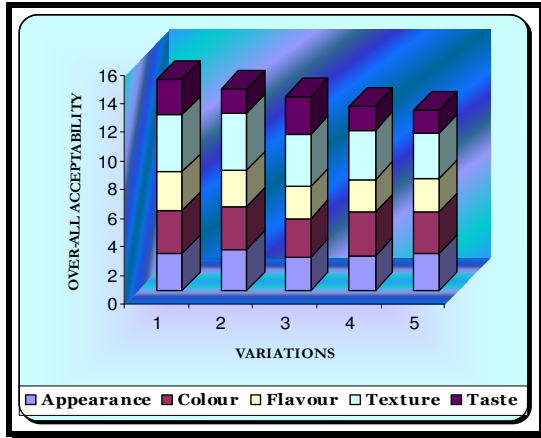
**COMBINATION VII (C7)**



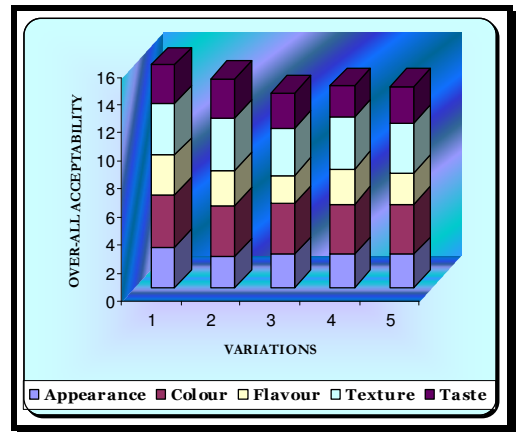
**COMBINATION VIII (C8)**



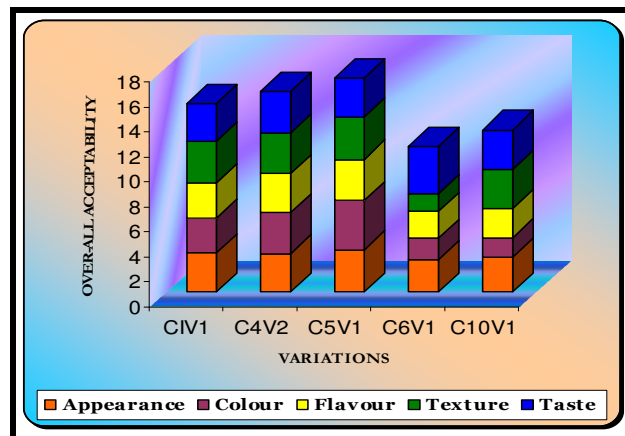
**COMBINATION XI (C9)**



**COMBINATION X (C10)**



**Figure V**



**MEAN ACCEPTABILITY SCORES OF SELECTED FIVE CARMINATIVE BARS IN THREE TRIALS**

**Figure VI**

The acceptance response was derived mainly from quantity of consumption and expression of taste panel members. Development of any side effects like irritation in the throat, burning sensation in the stomach and abdominal discomforts were also recorded for selection of the carminative bar as a suitable product for administration. The scores of the five sensory attributes namely, appearance, colour, flavour, texture and taste were clearly indicated in the table. Among the 50 bars (10 combinations\*5 variations) developed, five bars which obtained top scores were selected as follows: (C1V1), (C4V2), (C5V1), (C6V1) and (C10V1).

## 2. Mean Acceptability scores of selected five combinations of carminative bars

Table XVII and Figure VI specifies the mean acceptability scores of selected five combinations of carminative bars.

**Table-XVII**  
**MEAN ACCEPTABILITY SCORES OF SELECTED FIVE COMBINATIONS OF**  
**CARMINATIVE BARS**

<b>Attributes</b>	<b>C1V1</b>	<b>C4V2</b>	<b>C5V1</b>	<b>C6V1</b>	<b>C10V1</b>
Appearance	3.13	3.11	3.44	2.65	2.80
Colour	2.83	3.28	3.91	1.68	1.61
Flavour	2.80	3.15	3.33	2.20	2.35
Texture	3.37	3.28	3.39	1.43	3.08
Taste	3.00	3.32	3.15	3.71	3.21
<b>Mean acceptability scores</b>	<b>3.03</b>	<b>3.23</b>	<b>3.54</b>	<b>2.33</b>	<b>2.61</b>
<b>F-ratio</b>	<b>3.33**</b>				

\*Maximum score-4 \*\*Significant at five per cent level

Table X indicates the scores obtained by the selected five carminative bars in three trials of sensory evaluation.

Statistically, the calculated F value of 3.33 was greater than table value and hence that null hypothesis that there is no significant difference between the five samples of carminative bar, gets rejected. In other words, there is significant difference between the five samples of carminative bar at 5 per cent level of

significance. From the Table it is clear that, C5V1 obtained the maximum acceptability scores amongst all other bars developed and hence it was chosen for the further administration study.

### C. Nutrient content and cost effectiveness of carminative bar

According to Roday (2007), nutritional quality and cost factor are the major factors affecting food selection. Table XVIII indicates the calculated nutrient content and cost of the selected five carminative bars.

**Table-XVIII**  
**NUTRIENT CONTENT AND COST OF THE SELECTED**  
**CARMINATIVE BARS**

<b>Nutrients</b>	<b>C1V1</b>	<b>C4V2</b>	<b>C5V1</b>	<b>C6V1</b>	<b>C10V1</b>
Moisture	0.743	0.560	0.682	0.930	0.756
Energy (Kcal)	7	14	9	14	6
Protein (g)	1.4	0.6	0.3	0.3	0.2
Fat (g)	0.8	0.6	0.3	0.1	0.1
Carbohydrates (g)	3.8	4.2	3.3	4.9	3.1
Fibre (g)	1.3	0.5	0.4	0.3	0
Calcium (mg)	35	2.7	15.4	15.4	2.23
Phosphorous (mg)	18	16	10	9	7
Iron (mg)	0.61	1.36	0.47	0.85	1.14
Vitamin C(mg)	0	0	0.2	0.2	0.1
β Carotene(μg)	37	0.1	12	6	0.1
Zinc (mg)	0.15	0.02	0.11	0.03	0
<b>Cost (Rs.)</b>	<b>0.63 p</b>	<b>0.58 p</b>	<b>1.13</b>	<b>0.77 p</b>	<b>0.65 p</b>

Table XI gives the nutrient content of the different combinations of carminative bars. The energy content was found to be high in second combination whereas other nutrients were found to be high in the first combination of carminative bar.

Regarding the cost, C5V1 was estimated to have higher cost of Rs.1.13 whereas, the other combinations were found to have comparatively less costly.

The nutrient content of the 5<sup>th</sup> combination of carminative bar, which was analysed experimentally, is indicated in Table XIX.

**Table-XIX**  
**ESTIMATED NUTRIENT CONTENT OF THE SELECTED**  
**CARMINATIVE BAR (7 grams)**

<b>Nutrients</b>	<b>C5V1</b>
Moisture	0.59
Ash	0.26
Energy (Kcal)	22.67
Protein (g)	0.67
Fat (g)	0.23
Carbohydrates (g)	4.76
Fibre (g)	0.41
Calcium (mg)	1.38
Phosphorous (mg)	49
Iron (mg)	0.08
Vitamin C(mg)	11.29
$\beta$ Carotene( $\mu$ g)	10.13
Zinc (mg)	0.19
Lead (mg)	0.56
Phytin (mg)	9.24

From Table XIX, it is clear that there is a minimum difference between the calculated and experimentally estimated nutrient content of the carminative bar, since there are no losses of cooking.

Regarding the toxicity, only 0.56 mg of lead is present in one carminative bar, which means the intake depending on the frequency and quantity will be even lower and hence there is no presence of toxicity in carminative bar.

## D. General information about subjects selected for administration

### 1. Socio-economic profile and dietary pattern of selected subjects

Table XX indicates the socio-economic background and dietary pattern of selected subjects.

**Table-XX**  
**SOCIO-ECONOMIC PROFILE AND DIETARY PATTERN OF**  
**SELECTED SUBJECTS (N=34)**

S.No	Variables	Criteria	Number	Percentage
1.	Type of family	Joint	8	24
		Nuclear	26	76
		<b>Total</b>	<b>34</b>	<b>100</b>
2.	Size of family	≤4	24	71
		>4	10	29
		<b>Total</b>	<b>34</b>	<b>100</b>
3.	Monthly income(Rs)	≤4,500	2	6
		4,500-7,500	5	15
		>7,500	27	79
		<b>Total</b>	<b>34</b>	<b>100</b>
4.	Gender	Male	18	53
		Female	16	47
		<b>Total</b>	<b>34</b>	<b>100</b>
5.	Age(Years)	20-39 years	13	38
		40-64 years	16	47
		65+ years	5	15
		<b>Total</b>	<b>34</b>	<b>100</b>
6.	Percentage of income spent for food/month	≤25%	23	68
		≤50%	11	32
		<b>Total</b>	<b>34</b>	<b>100</b>
7.	Food consumption category	Vegetarian	1	3
		Non-vegetarian	22	65
		Ova-vegetarian	4	12
		Lacto-vegetarian	7	20
		<b>Total</b>	<b>34</b>	<b>100</b>

According to Table XX, it is evident that majority (53 %) of the subjects, who had digestive problems were males and the remaining 47 per cent were females. Seventy six per cent of subjects belonged to nuclear family system and 24 per cent belonged to joint family system and 71 per cent of subjects were

from small family having less than four members and 29 per cent belonged to large family having more than four members.

Most of the subjects who had digestive problems were between 40-64 years of age (47%), whereas remaining were between 20-39 years (38 %) and rest of them were above the age of 65 years. Majority of subjects were educated, holding diploma (29%) and rest of them were either graduates or post-graduates (24%). Concerning occupational status majority of them were government or non-government employees (32%).

Around 79 per cent of subjects belonged to high income group with a monthly income of more than Rs.7,500, six per cent of subjects belonged to low income group and rest of them were in middle income group. Sixty eight per cent of subjects spent nearly 25 per cent of their total income for food per month and majority of them (65%) were non-vegetarians.

#### **E. Evaluation of the effectiveness of the carminative bar**

Table XXI shows the effectiveness of the carminative bar after administration to selected 34 subjects for a period of ten days.

**Table-XXI**  
**EVALUATION OF THE EFFECTIVENESS OF THE CARMINATIVE**  
**BAR (N=34)**

S.No	Variables	Criteria	Number	Percentage
1.	Frequency of consumption of carminative bar	After every meals	1	3
		Once before/after dinner	31	91
		Once before/after lunch	2	6
		<b>Total</b>	<b>34</b>	<b>100</b>
2.	Comfortability in stomach	Yes	32	94
		No	2	6
		<b>Total</b>	<b>34</b>	<b>100</b>
3.	Difference in bowel movements	Yes	19	56
		No	15	44
		<b>Total</b>	<b>34</b>	<b>100</b>
4.	Side effects	Yes	0	0
		No	34	34
		<b>Total</b>	<b>34</b>	<b>100</b>
5.	Acceptability of carminative bar	Yes	0	0
		No	34	100
		<b>Total</b>	<b>34</b>	<b>100</b>
6.	Satisfaction with the sensory attributes	Yes	0	0
		No	34	100
		<b>Total</b>	<b>34</b>	<b>100</b>
7.	Easiness of preparation	Yes	34	100
		No	0	0
		<b>Total</b>	<b>34</b>	<b>100</b>
8.	Cost-effectiveness	Yes	34	100
		No	0	0
		<b>Total</b>	<b>34</b>	<b>100</b>
9.	Relief from problems related to digestion	Yes	34	100
		No	0	0
		<b>Total</b>	<b>34</b>	<b>100</b>
10.	Willingness to continue to have carminative bar	Yes	33	97
		No	1	3
		<b>Total</b>	<b>34</b>	<b>100</b>

Table XXI indicates the effectiveness of carminative bar on digestive problems after consumption of a period of 10 days.

The findings revealed that 94 per cent of subjects felt comfortability in stomach than before, after consumption of carminative bar, in terms of reduced

heaviness and pain and around 56 per cent of the subjects felt difference in their bowel movements like reduced toughness and pain during evacuation.

None of the subjects faced any side effects after consumption of carminative bar and 100 per cent of subjects found the bar to be acceptable both in terms of quantity and quality. Cent per cent of subjects felt that the preparation method of carminative bar was easy and cost effective, and all of them found some sort of relief from digestive problem after a period of 10 days in one way or the other.

Nearly 96 per cent of subjects were willing to continue the carminative bar for its medicinal property, absence of side effects and cost-effectiveness, whereas only 3 per cent of subjects were not willing to continue the consumption of carminative bar due to age factor.

## **F. Evaluation of impact of awareness created among selected families of the subjects**

### **1. Awareness on significance of spices in human nutrition and health**

Table XXII indicates the extent of awareness of selected families on medicinal benefits and carminative nature of spices before and after education.

**Table-XXII**  
**EVALUATION OF THE IMPACT OF AWARENESS CREATED AMONG**  
**SELECTED FAMILIES OF THE SUBJECTS (N=34)**

Criteria	Before				After			
	Aware		Not-aware		Aware		Not-aware	
	Number	%	Number	%	Number	%	Number	%
Health benefits and medicinal nature of spices	17	50	17	50	34	100	0	0
Carminative nature of spices	0	0	34	100	34	100	0	0

From table XXII, it is evident that 5 per cent of families were aware of very few health benefits of some spices like, cinnamon (4), ginger (38), cumin

seeds (8), fenugreek (8), cloves (12), aniseed (10), turmeric (3), garlic (30), pepper (13), coriander seeds (2) and asafoetida (1) before education and there was a rise to 100 per cent after education.

Regarding the awareness on carminative nature of spices, none of the families were aware of the property, before education, whereas, after education all the families (100%) were able to explain about the carminative nature of spices and its significance in health.

## 2. Awareness on relationship between food habits and digestive problems

Table XXIII indicates the response of selected subjects on whether changes in food habits can reduce digestive problems and their changes in responses before and after education.

**Table-XXIII**  
**EVALUATION OF AWARENESS ON RELATIONSHIP BETWEEN FOOD HABITS AND DIGESTIVE PROBLEMS**

Criteria	Before				After			
	Aware		Not-aware		Aware		Not-aware	
	Number	%	Number	%	Number	%	Number	%
Changes in food-habits can reduce occurrence of digestive problems	8	24	26	76	34	100	0	0

The responses of the families regarding, whether changes in food-habits can reduce occurrence of digestive problems, from table XIV indicates that majority (76%) of families believed that the changes in food-habits cannot reduce occurrence of digestive problems before education. The major changes mentioned by the families include, reduced intake of roots and tubers (7), limited consumption of foods (27), timely consumption of foods (24), reduced intake of pulses and legumes (8) and to avoid outside and junk foods(8).

After education there was a remarkable increase in the percentage of subjects who were aware that the changes in food habits reduce the occurrence of digestive problems and spicy foods were also effective in controlling health problems especially digestive problems.

Because of the rise in allopathic medicine, much of the folk medicine fell out of flavour and spices were replaced with prescription drugs. There is now a much renewed interest in these alternative medicines, with many new medicinal uses of spices and herbs coming to limelight. Today the researchers are confirming what herbalists have known all along that the spice rack can be as potent as a medicinal chest.

## V.SUMMARY AND CONCLUSION

*“Let living foods be thy medicine”*

*- Hippocrates*

Digestive health is an indicator of proper laxation and proper functioning of the gastro-intestinal system. Digestion related problems, not only leads to/gives discomforts, but also paves way for more serious manifestations, which may either last for some time or prolong till lifetime or in some cases end fatal.

The drugs which help in relieving certain digestive problems, mainly flatulence, which is considered to be the most embarrassing condition, are carminatives. In general, chemical or synthetic drugs are not preferred by people for the treatment of digestive problems and hence the traditional/folklore treatment from our very own country and the integral part of our exotic Indian cuisine, ‘spices’, were chosen for the study.

The present study on “Formulation and evaluation of carminative bars (using spices) to overcome digestive problems”, was aimed at formulating a bar out of carminative spices and evaluating the effectiveness of the carminative bar in overcoming digestive problems and to develop an educational package to create awareness among the selected subjects on medicinal and carminative nature of spices and importance of digestive health.

A number of 100 families of different localities of Coimbatore city were surveyed for the study. Informations regarding their socio-economic status, general dietary pattern, health status, spices consumption pattern, digestive health and awareness on medicinal properties of spices were assessed using an interview schedule.

All the members of the selected families i.e.) 397 individuals were screened for digestive problems using an interview schedule and 34 subjects were finally selected depending on their willingness and etiology of their digestive problem.

Simultaneously surveys were conducted among 50 health care professionals (30 Dietitians+20 Doctors) of various fields, belonging to various Government and Private Hospitals and Institutions and 10 herbal-medicine shopkeepers of Coimbatore city. Information regarding medicinal properties of spices, treatments provided for various digestive problems, presence of toxic substances in spices, sales and availability of the spices were elicited through interview schedules from the hospital and market survey.

From the data collected through surveys, commonly used culinary spices were identified and among them, 16 spices with carminative nature were selected for the study.

Ten different combinations of carminative bar using 16 spices, with sweeteners like honey and jaggery were formulated. In each combination, 5 different variations were developed and sensory evaluation was conducted individually for ten different combinations.

Among the ten carminative bars, 5 bars which obtained highest scores (from different combinations) were selected and their acceptability was tested in three trials. The combination which obtained maximum score was chosen for nutrient analysis and administration. The nutrient content of all the other combinations of carminative bar were calculated using nutritive values provided by National Institute of Nutrition, Hyderabad.

The cost effectiveness of carminative bar was estimated by calculating the cost of carminative bar to increase its feasibility at household level.

Thirty four subjects with digestive problems who were identified through the household survey were administered with the selected combination of carminative bar for a period of ten days and the effectiveness of carminative bar was evaluated through an interview schedule.

An educational package i.e. booklet was developed and the selected families were educated about the medicinal values, carminative nature and

importance of spices in digestive health. The effectiveness of the awareness created through educational package was evaluated using the same interview schedule cum questionnaire developed for evaluation.

The results obtained from the study are summarized below:

#### SOCIO-ECONOMIC SURVEY:

- ✓ Socio-economic survey revealed that 84 per cent of the families were of nuclear type.
- ✓ About 77 per cent of the families had one to four members revealing the importance of small family norms.
- ✓ Nearly 78 per cent of the families belonged to high income group earning more than Rs.7,500 per month.

#### DIETARY PATTERN OF FAMILIES:

- ✓ Majority of the families i.e. 75 per cent were non-vegetarians.
- ✓ All the selected families adopted steaming method as the common method of cooking cereals, pulses and vegetables like roots and tubers.
- ✓ Around 94 per cent of the families used spices and condiments only in seasoning purposes.

#### HEALTH STATUS OF SCREENED SUBJECTS:

- ✓ It was noted that majority (25) of the individuals were suffering from diabetes mellitus.
- ✓ It was also noted that 39 individuals were suffering from gastro-intestinal problems and this reveals that gastro intestinal problems occupy primary position in debilitating the good health of majority of people.

#### SPICES CONSUMPTION PATTERN:

- ✓ Regarding amount spent for purchasing spices per month, nearly 31 per cent of families spent Rs.100-150 for spices per month.
- ✓ A greater number of 94 per cent of families consumed spices only for the purpose of taste enhancement.

- ✓ Nearly 72 per cent of families included spices in all recipes. (Except seasonings).
- ✓ It was evident that 100 per cent of the families regularly consumed cumin seeds and mustard, followed by ginger and turmeric (98%).
- ✓ Majority of the households purchased 50-100g of spices once in a month.
- ✓ A strikingly large number of families preferred consuming spices in its whole form and most of the families were found to store the spices in stainless steel or plastic containers, and not in refrigerators except for ginger and garlic pastes.
- ✓ A large number of 99 per cent of families preferred to use turmeric for colouring purposes and also for its medicinal reasons.

#### DIGESTIVE HEALTH OF SUBJECTS:

- ✓ It was noted that 39 subjects out of 397 individuals screened, were suffering from one or more digestive problems.
- ✓ Only 8 per cent out of 39 subjects suffered from digestive problem because of some other serious health problems like peptic ulcer, post-operational effect and so on and 92 per cent were suffering from digestive problem due to improper dietary and lifestyle pattern.
- ✓ Nearly 79 per cent of the subjects rarely had the digestive problems and 85 per cent of the subjects found the problem to be tolerable.
- ✓ A strikingly large number of 67 per cent of subjects did not follow any treatment for the digestive problems.
- ✓ A remarkable number of 86 per cent of families followed home remedial measures for treatment of digestive problems.
- ✓ Only one per cent among 397 subjects suffered from side effects or allergic responses due to consumption of spices.
- ✓ Regarding awareness on medicinal and carminative nature of spices, 55 per cent of families were aware of the medicinal nature of spices, whereas, 95 per cent of families were not aware of the carminative nature of spices.

- ✓ Around 26 per cent of families were only aware about flatulence, as a main digestive problem.

#### HOSPITAL SURVEY:

- ✓ Fifty per cent of health-care professionals suggested spices or drugs made of spices for treatment of certain diseases.
- ✓ Cent per cent of health care professionals unanimously accepted that spices have the ability to act as digestive stimulants and twenty per cent of them have indicated that spices can be provided in treatment of digestive problems.
- ✓ Regarding chances of presence of toxicity in certain spices, 82 per cent of health-care professionals had come out with a fact that spices, in general are not toxic.

#### MARKET SURVEY:

- ✓ From market survey, it was found that, turmeric was available in all the shops in Coimbatore city, followed by cumin seeds, pepper and dry ginger.
- ✓ Regarding the medicinal benefits of the spices cent per cent of interviewees of market survey reported that spices in general have medicinal benefits.
- ✓ Regarding the spice which is been sold in a large quantity and is fast moving, pepper stood first, followed by, turmeric, dry ginger, long pepper, cumin seeds, asafoetida, cardamom, mustard, aniseed and cloves.

#### DEVELOPMENT OF CARMINATIVE BAR:

- ✓ Regarding the bar developed, the combination with powdered dry ginger obtained maximum acceptability scores.
- ✓ From the estimated lead content, it has been proved that carminative bar is non-toxic.
- ✓ The maximum cost of preparation of carminative bar was estimated to be Rs.1.13.

#### SOCIO-ECONOMIC PROFILE AND DIETARY PATTERN OF SELECTED SUBJECTS:

- ✓ Majority of subjects with digestive problems were belonged to nuclear (76%) and small family (71%) and were in high income group (79%).
- ✓ Majority of the subjects were found to be males (53%) and their age between 40-64 years (47%).
- ✓ Sixty five per cent of subjects were non-vegetarians.

#### EVALUATION OF EFFECTIVENESS OF CARMINATIVE BAR AND EDUCATION IMPARTED:

- ✓ Majority of the subjects were found to be relieved to an greater extent from the digestive problems after administration of carminative bar, in terms of comfortability in stomach without any disturbances, bowel movements and free faecal elimination.
- ✓ Nearly 97 per cent of families were willing to continue the consumption of carminative bar even after the study.
- ✓ Cent per cent of the subjects found the bar to be cost-effective and the method of preparation to be easy.
- ✓ An increase of upto90 per cent was found in the percentage of people aware on medicinal and carminative nature of spices, after education imparted.

The findings of the study indicated that majority of the subjects were adults who were non-vegetarians. A blend of carminative spices in the form of a bar has proved to be effective against digestive problems of individuals and the education imparted to the selected families was also found to be effective.

This positive effect on adults with digestive problems is encouraging and being a dietary intervention, it is devoid of other side effects, proving that spices supplementation is a cost-effective and sustainable strategy in the management of digestive problems.

#### **RECOMMENDATIONS**

The following recommendations can be made for future research from the present study on “Formulation and evaluation of carminative bars (using spices) to overcome digestive problems”:

1. Importance of spices, as medicines, should be educated to students, both at school and college levels.
2. Awareness must be created among communities regarding importance of and necessity to maintain digestive health.
3. Health care professionals should educate their patients on the role of spices in maintaining health status and in prevention of disease conditions.
4. Food based industries must come forward to manufacture spices related products and thereby utilize all the medicinal quality of spices.
5. Government must utilize media support and advertise and stress on the multifunctional role, medicinal qualities and amount of consumption of spices and also provide funds for further researchers for bringing into limelight, many unexploited uniqueness and qualities if this 'Pride of Indian Cuisine'.

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# APPENDIX-I

## SCHEDULE TO ELICIT INFORMATION ON SOCIO-ECONOMIC STATUS AND DIETARY PATTERN WITH REFERENCE TO SPICES USAGE PATTERN OF SELECTED FAMILIES IN COIMBATORE CITY

### I. GENERAL INFORMATION

1. Name of the interviewer :
2. Name of the interviewee :
3. Age and sex :
4. Composition & type of the family :
5. Residential address :

### II. INFORMATION ON SOCIO-ECONOMIC STATUS

6. Fill in the details:

S.No	Name Of The Family Members	Age	Educational Qualifications	Occupation	Monthly Income (Rs.)
<b>TOTAL FAMILY INCOME</b>					

7. How much do you spent for food per month?  
 $\leq 25\%$  of the total income       $\leq 50\%$  of the total income  
 $\leq 75\%$  of the total income       $> 75\%$  of the total income

### III. DIETARY PATTERN

8. Which category do you belong to?  
Vegetarian                      Non-Vegetarian  
Ova-Vegetarian                  Lacto-Vegetarian

9. Indicate the method of cooking of following food types:

S.No	Type Of Foods	Methods Of Cooking
1)	Cereals and millets	
2)	Pulses and legumes	
3)	Vegetables	
4)	Fruits	
5)	Milk and Milk products	
6)	Egg, Meat and poultry	
7)	Spices and Condiments	

### IV. HEALTH STATUS OF FAMILY MEMBERS

10. Does any of your family members suffer from any health problem?  
Yes                      No

- 12-a) If yes,

S.No	Name Of The Family Members	Health Problems	Duration Of Illness

**V. INFORMATION ON DIGESTIVE HEALTH OF FAMILY MEMBERS**

11. Does any of your family members suffer from any of the following problems related with digestion?

S.No	Name Of The Family Members	Flatulence	Indigestion	Abdominal Pain	Constipation	Diarrhoea	Dyspepsia	Bloating	Belching

12. Are any of your digestive disorders/digestion related problems due to any other health problems? {i.e.} side effects of chronic ill health

Yes No

12-a) If yes, what among the following is the problem?

Peptic-Ulcer                      Diverticulosis                      Stomach cancer  
 Irritable Bowel Syndrome      Tuberculosis                      Gall Bladder Diseases  
 Renal Diseases                      Metabolic disorders

12-b) If no, mention the causes digestive disorders.

Smoking                      Alcohol Consumption                      Faulty Dietary Habits  
 Age                      Post-operational effect                      Lack of proper exercise  
 Prolonged intake of Medicines      Consumption of tobacco/Betel leaves  
 Reason unknown

13. How frequently do you suffer from digestive disorders/problems?

Always                      Only before/after every meals  
 Rarely                      Only after heavy meals

14. What is the level of tolerance of the severity of the problem?

Tolerable                      Intolerable

15. Do you undergo any treatment for the digestion related problem?

Yes No

15-a) If yes, what is the kind of treatment which you undergo?

Allopathic                      Homeopathy                      Ayurvedic  
 Siddha                      None of the above

16. If you undergo any home-remedies/folklore treatment, explain.

S.No	Disease Condition	Frequency Of Occurrence	Home- Remedies/ Folklore Treatment Followed		Effect	Impact	Source Of Knowledge
			Ingredients	Type Of Preparation			

**VI. INFORMATION ON SPICES CONSUMPTION PATTERN**

17. How much do you spent for spices/month?

<Rs.50                      Rs.50-Rs.100                      Rs.100-Rs.150                      >Rs.150

18. For what purpose do you consume spices?

Health benefits      Taste Enhancement      Flavour Enhancement      As Cosmetic

19. In what kinds of recipes do you generally include spices (except chillies)?

Non-Veg recipes      Gravies      Selective recipes      All recipes except seasonings

20. Give the list of spices you buy, frequency and quantity of purchasing them, forms of usage and storage of spices and indicate the reasons to buy them.

S.No	Name of the spices	Reasons to buy	Frequency						Quantity(g)					Forms of usage				Storage devices			
			Whenever needed	Once in a month	Once in fortnight	Once in a year	Once in 6 months	≤5	5-25	25-50	50-100	>100	Whole	Powder	Paste	Others*	Wooden box	Stainless steel/plastic containers	Refrigerators	Plastic covers	

**VII AWARENESS ON HEALTH BENEFITS, CARMINATIVE NATURE AND IMPORTANCE OF SPICES AND DIGESTIVE HEALTH**

21. Are you aware of the carminative and anti-spasmodic nature of spices?

Yes No

21-a) If yes, specify \_\_\_\_\_

22. Do you think that changes in food habits can reduce occurrence of digestive disorders?

Yes No

22-a) If yes, mention the changes. \_\_\_\_\_

23.. Do spices have medicinal benefits?

Yes No

23-a) If yes, specify.

Name of the spices	Medicinal benefits

24. List the digestion related problems/digestive disorders which you are aware of?

A) B)

25. Are you satisfied with the methods of preparation and quantity of consumption of spices?

Yes No

25-a) Give reasons: \_\_\_\_\_

26. Have any of your family members suffered from any side effects/allergic responses due to consumption of spices?

Yes No

26-a) If yes, specify.

S.No	Name Of The Spices	Side Effects/Allergic Response

27. What spice do you prefer for colouring purposes?

Turmeric Saffron

27-a) Give reasons. \_\_\_\_\_

28.. How do you prefer to have the bar?

With sweetness Without sweetness

28-a) If with sweetness, mention type of sweetener and reasons: \_\_\_\_\_

## APPENDIX-II

### SCHEDULE TO ELICIT INFORMATION FROM HEALTH-CARE PROFESSIONALS ON CARMINATIVE SPICES USED IN TREATING SELECTIVE DIGESTIVE DISORDERS

#### I. GENERAL INFORMATION

10. Name of the interviewer :  
11. Name of the interviewee :  
12. Designation :  
13. Qualification & Specialization :  
14. Years of Experience :  
15. Name of the Hospital/Institution :  
16. Address :

#### II. INFORMATION ON CARMINATIVE SPICES

17. Do you prescribe diet for the treatment of ill health?  
Yes No

8-a) If yes,

S.No	Name Of The Ill Health	Types Of Foods Used	Frequency Of Intake

18. Do you suggest spices/spice related drugs for the treatment of diseases?  
Yes No

9-a) If yes,

S.No	DiseaseCondition	Spice Recommended	Method Of Preparation	Type Of Intake	Dosage Of Intake

9-b) If no, give reasons.

---

19. Is there any condition when you advise patients to avoid spices?  
Yes No

10-a) If yes, specify.

S.No	Disease Condition	Spices Avoided	Reasons For Avoiding

11. Do spices act as digestive stimulants?

Yes No

12. Can spices be provided to treat flatulence /abdominal pain which may be due to any other serious ailments? (Like peptic ulcer, diverticulosis)

Yes No

14. Do you think that certain spices may be toxic in nature?

Yes No

13-a) If yes,

S.No	Name Of The Spices	Dosage Level Which Is Considered To Be Safe

14. Is there any history of any patients who has suffered from allergic response due to consumption of spices?

Yes No

15-a) If yes, mention the name of the spices.

A) B)

15. Apart from culinary uses do you think that people are aware of medicinal/therapeutic uses of spices?

Yes No

16. Mention the reasons for having difference in quantity of spices, in the routine dietary pattern of various people?

Economical status      Food preparation methods      Taste preference  
 Individual likes/dislikes      Geographical differences      Cultural taboos

17. What is the remedial measure, which you would suggest for flatulence?

---

18. Can flatulence lead to any other complications?

Yes No

19-a) If yes, specify.

A) B)

19. What are the other forms in which spices can be provided for the treatment of ailments?

A) B)

## APPENDIX-III

### SCHEDULE TO ELICIT INFORMATION ON MEDICINAL BENEFITS OF SPICES FROM SELECTED SPICES (HERBAL-MEDICINE) SHOP KEEPERS IN COIMBATORE CITY

#### III. GENERAL INFORMATION

20. Name of the interviewer :  
21. Name of the interviewee :  
    [Shop owner/staff]  
22. Years of Experience :  
23. Name of the shop & address :

#### IV. INFORMATION ON SPICES AND ITS MEDICINAL BENEFITS

24. What kind of spices do you sell in your shop?  
a) \_\_\_\_\_ b) \_\_\_\_\_  
c) \_\_\_\_\_ d) \_\_\_\_\_  
e) \_\_\_\_\_ f) \_\_\_\_\_  
g) \_\_\_\_\_ h) \_\_\_\_\_

25. Do spices have any medicinal benefits?  
Yes                      No

7-a) If yes,

S.No	Name Of The Spices	Medicinal Benefits

26. In which form do you suggest people to consume spices?

S.No	Name Of The Spices	Form Of Consumption			
		Powder	Paste	Whole	Others

27. How do you suggest spices for the treatment of digestive disorders?

S.No	Digestive Disorders	Name Of The Spices	Methods Of Preparation	Dosage

28. What kinds of spices are fast moving and mention the reasons?

S.No	Name Of The Spices	Reasons For Fast Moving

29. In what season are the spices been sold in large quantum?

Summer Winter

11-a) Give reasons.

---

30. What kinds of people mostly prefer buying spices for medicinal reasons?

---

31. Does income play a major role in spices consumption pattern of people?

Yes No

13-a) Give reasons.

---

32. Mention the reasons for variation in spices consumption pattern of various people?

Economical status Food preparation methods Taste preference

Individual likes/dislikes Geographical differences Cultural taboos

33. Are there any spice related confectionaries which are available commercially?

Yes No

15-a) If yes, specify.

S.No	Spices Used	Type Of Confectionary	Manufacturers	Nutritional Significance	Health Benefits

## APPENDIX-IV

### SCORE CARD FOR SENSORY EVALUATION OF CARMINATIVE BAR C-Combination; V-Variation

S.No	Criteria	Score	C	V	C	V	C	V	C	V
	<b><i>Appearance</i></b>									
1)	Very Good	4								
2)	Good	3								
3)	Satisfactory	2								
4)	Poor	1								
	<b><i>Colour</i></b>									
1)	Yellowish Brown	4								
2)	Greenish Brown	3								
3)	Brown	2								
4)	Brownish Black	1								
	<b><i>Flavour</i></b>									
1)	Highly acceptable	4								
2)	Acceptable	3								
3)	Fairly acceptable	2								
4)	Not acceptable	1								
	<b><i>Texture</i></b>									
1)	Soft & Moldable	4								
2)	Hard	3								
3)	Rubbery	2								
4)	Soggy & Sticky	1								
	<b><i>Taste</i></b>									
1)	Sweet/Sour	4								
2)	Hot & sweet/sour	3								
3)	Hot	2								
4)	Pungent	1								
<b>TOTAL</b>										

**NAME & SIGNATURE**

## APPENDIX-V

### TOOLS USED FOR STATISTICAL ANALYSIS

**i) Arithmetic Mean:**

The most popular and widely used measure of representing the entire data by one value is called arithmetic mean, which is calculated as follows:

$$\bar{X} = \frac{X_1 + X_2 + X_3 + \dots + X_n}{N} \text{ or } \bar{X} = \frac{\sum X}{N}$$

Where,

- $\bar{X}$  = Arithmetic mean,
- $\sum X$  = Sum of all the values of the variable X.i.e.  $X_1, X_2, X_3, \dots, X_n$
- N = Number of observations.

**ii) ANOVA:**

The analysis of variance technique, developed by R.A.Fisher in 1920's, which is referred to by the contraction ANOVA is a statistical technique, specially designed to test whether the means of more than two quantitative populations are equal.

The specimen of ANOVA table is as follows:

**Analysis of variance: ANOVA Table: One-way Classification**

SOURCE OF VARIATION	SUM OF SQUARES (SS)	DEGREES OF FREEDOM (v)	MEAN SQUARE (MS)	VARIANCE RATIO OF F
<b>Between samples</b>	<b>SSC</b>	<b>v1=c-1</b>	<b>MSC=SSC/(c-1)</b>	
<b>Within samples</b>	<b>SSE</b>	<b>v2=n-c</b>	<b>MSE=SSE/(n-c)</b>	<b>MSC/MSE</b>
<b>Total</b>	<b>SST</b>	<b>n-1</b>	-	-

Where,

- SST =Total sum of squares of variations.
- SSC =Sum of squares between samples (Columns).
- SSE =Sum of squares within samples (Rows).
- MSC=Mean sum off squares between samples.
- MSE=Mean sum of squares between samples.

## **APPENDIX-VI**

**BOOKLET USED FOR IMPARTING EDUCATION TO SELECTED FAMILIES**

## APPENDIX-VII

### SCHEDULE TO EVALUATE THE EFFECTIVENESS OF CARMINATIVE BAR AND IMPACT OF EDUCATION IMPARTED ON SELECTED SUBJECTS WITH PROBLEMS RELATED TO DIGESTIVE DISORDERS

34. Name of the investigator :
35. Name of the subject :
36. Age and gender :
37. Residential address :
38. Mention the problems which you were suffering:  
Flatulence      Indigestion      Bloating      Belching  
Constipation      Diarrhoea      Abdominal Pain
39. How long were you suffering from these problems?  
Past few days      Past few weeks      Past few months  
Past few years      Mention: \_\_\_\_\_
40. How many days did you have the carminative bar?  
1-3 days      4 days-1 week      >1 week
8. How many times did you have the carminative bar/day?  
After every meals      Once before/after dinner      Once before/after lunch
9. Do you have comfortable feeling in the stomach?  
Yes      No  
If yes, specify: \_\_\_\_\_
10. Do you feel any difference in your bowel movements after the consumption of carminative bar?  
Yes      No  
If yes, mention: \_\_\_\_\_
11. Do you experience any side effects after consumption of carminative bar?  
Yes      No  
If yes, mention: \_\_\_\_\_
12. Is the carminative bar acceptable?  
Yes      No  
If no, mention the modifications which can be incorporated:  
\_\_\_\_\_
13. Are you satisfied with the sensory attributes (Flavour, colour, texture, taste, appearance) of the carminative bar?  
Yes      No

14. Do you find the preparation of carminative bar to be easy?

Yes                      No

15. Is the carminative bar cost effective?

Yes                      No

16. Do you feel relieved from symptoms related to digestive disorders after consumption of carminative bar?

Yes                      No

17. Will you continue to have the carminative bar?

Yes                      No

If yes, mention the reasons:

Medicinal benefits                      Cost effectiveness

Easy method of preparation                      Storage stability

Absence of side effects

If no, give reasons:

---

18. Are you aware of the health benefits and medicinal value of Carminative bar?

Yes                      No

If yes, specify: \_\_\_\_\_

---

19. Are you aware of the carminative nature of spices?

Yes                      No

If yes, specify: \_\_\_\_\_