

**CONSUMPTION PATTERN AND ANALYSIS OF  
WEIGHT REDUCING FOODS AND INDIGENOUS  
MEDICINES AMONG OVERWEIGHT AND OBESE  
ADULTS**

**By**

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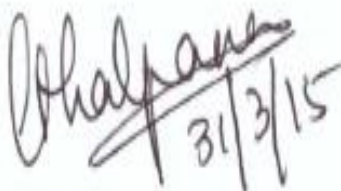
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## Introduction

### “Let food be thy medicine and medicine be thy food” – Hippocrates

Food makes our body work, grow and repair itself and the kind of food that we eat can affect the efficiency of these processes. Food consumption, which largely depends on production and distribution, determines health and nutrition of the population. Apart from supplying nutrients, foods also provide other non-nutrient phytochemicals which have a positive impact on health.

Food consumption pattern fundamentally reflects nutritional well-being of individuals and the meal pattern is defined by the culture and food availability (Prabhat and Khyrunnisa Begum, 2012).

Healthy eating is defined as eating practices and behaviours that are consistent with improving, maintaining and enhancing health. Meal pattern and food intake are markers for nutrient intakes and diet quality. Nutrient intake has an influence on health and development of several chronic diseases. Meal patterns affect resting energy expenditure, body fat, bone density, serum cholesterol and many other situations. The key features of the eating patterns include snacking, skipping meal, breakfast skipping, dieting adoption of specific diets like vegetarian diet, confectionery, and fast food eating (Chitra, 2007).

The preference for eating habits or foods in humans is established by the influences from socioeconomic level of household, religion, tradition, regional characteristics, educational level of parents, public media, and long-term education at home, school, and the society (Omidvarand Khyrunnis Begum, 2014).

Plant foods contain not only major components such as protein, fat, carbohydrate, fibre, and micronutrients but also large numbers of phytochemicals. Phytochemicals (from the Greek word *phyto* meaning plant) are biologically active,

naturally occurring chemical components in plant foods. More than 2000 plant pigments are phytochemicals, such as flavonoids, carotenoids and anthocyanins. Dietary sources of phytochemicals include fruits, vegetables, legumes, whole grains, nuts, seeds, herbs and spices (Mahan and Stump, 2012).

Nutrition during adulthood emphasizes the importance of diet in maintaining wellness and preventing disease. The role of nutrition has expanded significantly, and it is now viewed as a tool that can be used not just to prevent deficiency diseases but as a defence against chronic diseases in adulthood. Significant physiologic and psychological changes occur in the adulthood from 25-55 years. The outstanding physiological changes in many adults during this time is weight gain, involving body composition shifts with a lessening of lean body mass and an accumulation of larger fat stores. Two factors that significantly has an impact on weight gain are excessive caloric intake, which may lead to increased fat stores, and lack of physical activity, which results in a decline in lean body mass. The physiological changes that result from weight gain have important health consequences. With an increase in body weight, adult health can shift from wellness and progress to chronic disease. Comorbid conditions associated with obesity include Type 2 diabetes, impaired glucose tolerance, hyperinsulinemia, dyslipidemia, cardiovascular disease, hypertension, sleep apnea, gallbladder disease, osteo arthritis of weight bearing joints, reduced fertility and certain type of cancers (Mahan and Stump, 2008).

According to a study report of the Obesity Foundation of India (2011) in Indian scenario, even with the growing awareness about health and fitness, more than 3 per cent (3 Crores) of the Indian population are obese and more than 25 per cent of Indians are overweight (Kalpana and Aruna, 2012).

Obesity has become one of the serious health problems with the prevalence steadily increasing over the past four decades. The cause of obesity is complex and includes genetic, lack of physical activity, over consumption of high fat, energy dense food, family and social environment. Urbanization and modernization have inevitably altered dietary habits and lifestyle practices contributing to the emergence of increasing obesity. There is an urgent need for obesity screening to estimate

prevalence rates and early intervention programmes to combat this escalating menace. In 1995, there were an estimated 200 million obese adults worldwide which has increased to over 300 million in the year 2000. According to the National Nutrition Monitoring Bureau data (2010) Kerala had the highest proportion (10%) of obese population as compared to 9.6 per cent in Tamil Nadu, 4 per cent in Karnataka and Andhra Pradesh. Obesity is one of today's most blatantly visible-yet not neglected – public health problems. Both overweight and obesity poses a major risk for serious diet related non communicable diseases, including diabetes mellitus, cardiovascular disease, hypertension and stroke, osteoarthritis and certain forms of cancer. Economic growth, modernization, urbanization and globalization of food markets are just some of the forces inevitable to the emergence of increasing obesity among young adults (Ramadas and Sivakami, 2011).

Over recent years, rates of overweight and obesity have escalated rapidly in many parts of the world to epidemic proportions, reflection increased consumption of energy dense diets high in fats and sugars, compounded by declining levels of physical activity. More than 1.1 billion people are estimated to be overweight, of which around 320 million are now calculated to be obese. The International Obesity Task Force (IOTF) estimated that up to 1.7 billion people may be exposed to weight related health risk, taking into account varied Asian population with a body mass index (BMI) of 23 or more. More than 2.5 million deaths each year are attributed to higher BMI, a figure that is expected to double by 2030 (Kushwaha, *et al.*, 2011).

Indian vegetarian diets were found to have a greater percentage meeting RDA levels of macro- and micro- nutrients with less fat and lower calories than non-vegetarian diets. Vitamin B<sub>12</sub> bio-availability remains a concern and should be addressed by exploring various dietary patterns associated with deficiency across various regions of India and identifying people who need supplementation (Shridhare *et al.*, 2014).

Many Indian and other herbs have been aggressively marketed and used for weight reduction, but only a few products have been evaluated in rigorous trials. Although there is no magic bullet available among Indian herbs that can melt the kilogrammes of fat in a short period, there is a need to create awareness regarding the

evidence for and use of natural products in the form of raw materials, crude extracts, or isolated compounds to promote weight loss and thus control obesity. Traditional Indian medicine is based on good clinical practice and holds much promise in the treatment of obesity. These herbal products from Indian medicinal plants have been widely used to treat obesity, and it is important to understand how these natural medicines from traditional medicinal plants act. Nearly all the medicines currently available to treat overweight and obese patients are chemical or biochemical and greater attention should be directed towards the use and research of herbal medicines of natural origin with minimal side effects in the management and treatment of obesity. (Verma and Paraidathathu, 2014)

India has rich, centuries –old heritage of medical and health sciences. The philosophy of indigenous health care system, especially Ayurveda and the surgical skills articulated by Charaka and Shusharutha bear testimony to India's ancient tradition in the scientific healthcare. The approach of indigenous health care system was of a holistic nature which addressed all aspects of human health. (Himanshu Sekhar Rout *et al.*, 2011)

The doctrine of Ayurveda aims to keep structural and functional entities in a functional state of equilibrium, which signifies good health. Any imbalance due to internal and external factor causes disease and restoring equilibrium through various techniques, procedures, regimes, diet and medicine constitute treatment.

Siddha system of medicine emphasize that medical treatment is oriented not merely to disease, but also has to take into account the patient, environment, age, habits and physical condition. Siddha literature is in Tamil and it is largely practiced in Tamil speaking parts of India and abroad. ([http://www.arthapedia.in/index.php?title=Indigenous\\_System\\_of\\_Medicine\\_Ayurveda,\\_Siddha,\\_Unani,\\_Yoga,\\_Homeopathy\\_and\\_Naturopathy](http://www.arthapedia.in/index.php?title=Indigenous_System_of_Medicine_Ayurveda,_Siddha,_Unani,_Yoga,_Homeopathy_and_Naturopathy), 2014)

## **Objectives**

With this in view, the objectives of the study are:

To,

- Study the consumption pattern of weight reducing foods and indigenous medicines among over weight and obese adults.
- Identify the commonly consumed Ayurveda and Siddha medicines for weight reduction among adults.
- Analyse the phytochemicals, antioxidant profile and nutrient content of commonly consumed weight reducing foods, Ayurveda and Siddha medicines.

## **REVIEW OF LITERATURE**

The literature pertaining to the study is reviewed under the following heads:

- E. History of Indigenous and traditional medicines
- F. Role of Indigenous medicines in treating obesity
- G. Introduction on weight reducing foods
- H. Role of weight reducing foods in the treatment of obesity

### **A. History of indigenous and traditional medicines**

India has been divided into 16 agro climatic zones with 45000 plantspecies of which 15000 medicinal plants that includes 7000 plants usedin Ayurveda, 700 in Unani medicine, 6000 in Siddha medicine and 30in modern medicine. The Indian system of medicine have identified1500 medicinal plants of which 500 species are used in preparation ofhealing drugs out of these 150 plant species have been categorized as endangered(Parwez and OrusIlyas, 2012).

Indian Systems of Medicine are among the well-known global traditional systems of medicine.Medicinal plants based traditional systems of medicines are playing important role in providing health care to large section of population, especially in developing countries. Interest in them and utilization of herbal products produced based on them is increasing in developed countries also. To obtain optimum benefit and to understand the way these systems function, it is necessary to have minimum basic level information on their different aspects. Indian Systems of Medicine are among the well-known global traditional systems of medicine (Ravishankar and Shukla, 2007).

Three traditional medicinal systems predominate in modern India: Ayurveda, Siddha, and Unani. Ayurveda is found mostly in northern India and in Kerala in the south, Siddha medicine occurs in Tamil Nadu and parts of Kerala, and Unani, which derives from Arabic medicine, is found throughout India, mainly in the urban areas.Unlike Ayurveda, which has a long and detailed textual tradition in Sanskrit

from around the beginning of the Common Era, Siddha medicine's textual history in Tamil is vague and uncertain until about the 13th century C.E., when there is evidence of medical treatises. Most of the knowledge about Siddha medicine comes from modern-day practitioners, who often maintain a historically unverified development of their own tradition and who because of the upsurge of Tamil pride tend to make fantastic claims about the age and importance of Siddha medicine vis-à-vis its closest rival in India, Ayurveda (Zysk, 2008).

It is a well-known fact that Traditional Systems of medicines always played important role in meeting the global health care needs. They are continuing to do so at present and shall play major role in future also. The system of medicines which are considered to be Indian in origin or the systems of medicine, which have come to India from outside and got assimilated in to Indian culture are known as Indian Systems of Medicine. India has the unique distinction of having six recognized systems of medicine in this category- Ayurveda, Siddha, Unani and Yoga, Naturopathy and Homoeopathy. Homoeopathy was practised in India in the 18th Century, and is completely assimilated in to the Indian culture and got enriched like any other traditional system hence it is considered as part of Indian Systems of Medicine (Prasad, 2002).

In India, Ayurveda is considered not just as an ethno medicine but also as a complete medical system that takes in to consideration physical, psychological, philosophical, ethical and spiritual well-being of mankind. It lays great importance on living in harmony with the Universe and harmony of nature and science. This universal and holistic approach makes it a unique and distinct medical system. This system emphasizes the importance of maintenance of proper life style for keeping positive health. This concept was in practice since two millennium and the practitioners of modern medicine have now taken into consideration importance of this aspect (Kurup, 2004).

Ayurveda is one of the great gifts of the sages of ancient India to mankind. It is one of the oldest scientific medical systems in the world, with a long record of clinical experience. However, it is not only a system of medicine in the conventional sense of curing disease. It is also a way of life that teaches us how to maintain and protect

health. It shows us both how to cure disease and how to promote longevity. Ayurveda treats man as a “whole” – which is a combination of body, mind and soul. Therefore it is a truly holistic and integral medical system. The word “Ayu” means all aspects of life from birth to death. The word “Veda” means knowledge or learning. Hence Ayurveda indicates the science by which life in its totality is understood. It is a way of life that describes the diet, medicine and behaviour that are beneficial or harmful for life (<http://cincinnatitemple.com/articles/charak-ebook.pdf>).

The original source of the Ayurvedic line of treatment dates back to circa 1800 to 8000 B.C., which found its origin in the Himalayas. After centuries of research Ayurveda has made a strong comeback into the field of mainstream medicine, as more and more people find Allopathy a dissatisfactory line of treatment (Nangia, 2002).

Ayurveda witnessed a shift towards rational principles in the practice of medicine, at a very early stage in its evolutionary history. The early classical Ayurveda textbooks (samhitas) talk about the validation of knowledge and distinguish between real and chance effects of therapy.<sup>1</sup> These works also contain elaborate methods to study properties of drugs, to develop new medical formulations, and protocols to study and understand the occurrence of new diseases.<sup>2</sup> Research, it appears, was therefore in some way ingrained in the tradition of Ayurveda from the very beginning. Yet, there is no evidence of organized research activities in the evolutionary history of Ayurveda, nothing of the kind that can be compared with modern medical research. For centuries, Ayurveda seems to have perpetuated itself as a tradition of practices and knowledge transmitted through apprenticeship or more formal methods of pedagogy, in some instances akin to a university education. Research in the modern sense of the word is a recent development in the field of Ayurveda, it seems (Manohar, R., 2013).

Siddha system is one of the ancient traditional Indian medicinal systems with Dravidian origin having its entire literature in Tamil language. Siddha is a traditional healing holistic medicine of India which emphasizes the maintenance of a relaxed mind and body harmony and insists to keep pace with the laws of nature. In Siddha system, besides herbs, metal and mineral drugs were also used as medicines. In Siddha system, metals and minerals are predominantly used. Alchemy has its origin in Siddha

system and is connected with the Tantrik culture. Siddha means achievement, which was attained by Siddhars. 'Siddha Medicine' means medicine that is perfect (Rajalakshmi, *et al.*, 2012).

A historical appraisal of the Siddha System of Medicine seems to reveal as follows: In all probability there was a single system of Medicine called Ayurveda all over the India growing continuously from *Samhita* periods up to the modern times. It is only in later years of this long history that a specialized stress on the principles of rejuvenation, rasayana and attempts to make the human body immortal, took place. This led to a somewhat esoteric specialization that occurred rather concentratedly in the southern region of Indian subcontinent within these bounds however, a remarkable flourish of literature of the traditional eighteen Siddhars arose in Tamil which require all the scientific care that we can bestow upon them to understand their merits in the proper perspectives. In the current, attempts at the resuscitation of our indigenous systems of medicine, the value of an essentially historical appraisal of the two systems concerned, viz. Ayurveda and Siddha cannot be minimized. ([http://www.new1.dli.ernet.in/data1/upload/insa/INSA\\_1/20005abd\\_43.pdf](http://www.new1.dli.ernet.in/data1/upload/insa/INSA_1/20005abd_43.pdf))

Siddha system of medicine is practiced in some parts of South India especially in the state of Tamilnadu. It has close affinity to Ayurveda yet it maintains a distinctive identity of its own. This system has come to be closely identified with Tamil civilization. The term 'Siddha' has come from 'Siddhi'- which means achievement. Siddhars were the men who achieved supreme knowledge in the field of medicine, yoga or tapa (Narayanaswamy, 1975).

### **B. Role of Indigenous medicines in treating obesity.**

In recent years, obesity has become a major health problem worldwide, affecting people across all ages, sex, ethnicities, and races, and its prevalence has been increasing at an alarming rate. Currently, pharmacologic agents available to treat obesity carry high costs and serious side effects. In contrast, natural products used in the conventional Indian medicinal system have been applied effectively in clinical practice and may be potential targets in the development of future cost effective anti-obesity drugs with fewer side effects. A comprehensive chemical and pharmacological

review of numerous bioactive constituents established in Indian medicinal plants used to treat obesity was performed. Data on 30 medicinal plants were reviewed, taking into consideration their biological sources, anti-obesity active principles, and pharmacological test results, which are typically applied in the indigenous Indian system of medicine. Natural medicines used to treat obesity in the traditional Indian medical system include herbal plants from Ayurvedic medicine and chemical constituents with anti-obesity potential (Abinaya *et al.*, 2014).

Ayurveda lays great emphasis on diet regulation. According to Ayurvedic concepts, food has great influence over physical, temperamental and mental development of an individual. Food is the basic material for the production of the body and life supporting vital matter known as Rasa. The rasa is converted to body components and supports all types of life activities (Ravishankar and Shukla, 2007).

A list of Indian herbal plants used in the Ayurvedic medicine to treat obesity is presented in Table 1.

**TABLE 1**  
**LIST OF INDIAN HERBAL PLANTS USED IN THE AYURVEDIC**  
**MEDICINE TO TREAT OBESITY**

Botanical name	Sanskrit /official name	Parts used
<i>Achyranthes aspera</i>	Apamarga	Seed
<i>Acorus calamus</i>	Vacha	Root, rhizome
<i>Aloe vera</i>	Kumara	Leaf
<i>Areca catechu</i>	Khadir	Seed
<i>Boerhavia diffusa</i>	Punarnava	Whole plant
<i>Boswellia serrate</i>	Shallaki; SalaiGuggul	Resin
<i>Camellia sinensis</i>	green tea	Leaf
<i>Commiphora mukul</i>	Guggul/Guggulu	Gum-resin
<i>Clerodendron glandulosum</i>		Leaf
<i>Clerodendrum multiflorum</i>	Agnimantha	Root, bark , leaf
<i>Cyperus rotundus</i>	Mustak	Rhizome
<i>Embelia ribes</i>	Vidanga	Root
<i>Garcinia cambogia</i>	Vrikshamla	Fruit
<i>Gymnema sylvestre</i>	Meshashringi	Leaf
<i>Glycyrrhiza glabra</i>	Licorice	Root
<i>Operculina turpethum</i>	Nisonth	Root
<i>Picrorhiza kurroa</i>	Kutki	Root
<i>Plumbago zeylanica</i>	Chitrak	Root bark
<i>Withania somnifera</i>	Ashwagandha	Root

(Verma et al, 2014)

Natural ingredients and medicinal plant preparations may enhance satiety, boost metabolism and speed up weight loss. Including these foods in the diet may therefore assist slow, individual weight loss. However, doubts about human application remain. Despite the global market for satiety, fat burning, dietary supplements and other weight management remedies, patient awareness of these products is insufficient (Mahnaz *et al.*, 2012).

Traditional food is used to maintain good health and traditional medicines to cure some diseases (Mishra and Padhan, 2010).

In Ayurvedic System of Medicine, obesity is considered under the title of *medoroga*, which stands amongst *Astaninditiyaroga* as *Sthaulyaroga*. The excessive fat (*Atisthaulya*) is worse than excessive lean body (*Atikrisha*). This is an important nutritional or metabolic disorder. Several factors like physical, behavioural, cultural, metabolic and genetic factors are related to obesity. Uncontrolled eating habits are of great importance that again may occur due to several associated factors. An obese individual generally overeats beyond the normal calories than needed by the body.

Triphala is one of the most popular herbal preparations in the world used to treat variety of diseases. It is commonly available as a finely sieved powder. According to Ayurvedic formulary of India, Triphala is prepared by mixing equal parts Amalaki (*Emblica officinalis*), Vibhitaka (*Terminalia bellerica*) and Haritaki (*Terminalia chebula*)<sup>3-4</sup>. Triphala is used in Ayurvedic medicine in the treatment of a variety of conditions and also forms part of many other formulations. Triphala is one of the powerful antioxidant and detoxifying agents (Mahajan, A.D *et al.*, 2011)

Triphalachurna has been found very effective in treating acidity, constipation, flatulence, digestive disturbances and liver problems. It is reported to be cardio-tonic, reduce cholesterol level and control blood pressure. Triphalachurana is also reported as antidiabetic, antimutagenic and radioprotective (Patel M *Get al.*, 2010)

Root bark of *Agnimantha* (*Premna obtusifolia*) an anti-obesity agent has been studied among 26 subjects with severe form of *Sthaulya*. Subjects of treatment showed

remarkable decrease in BMI, triglyceride, cholesterol-HDL ratio, uric acid, LDL-HDL ratio and midtriceps skin-fold thickness. *Agnimantha* shows significant therapeutic value in obesity. It is a potent drug for the management of obesity. No adverse effects of drug have been recorded. The drug is cheap and easily available. Hence, it will pave the path for better treatment of patients suffering from obesity (Ghosh *et al.*, 2008).

Siddha medicine is equally as important as other alternative medicine to treat lifestyle related disorders. Here, many medicines are used for suppressing accumulation of fats, managing obesity and overcoming weight loss. As per Siddha, among the tri-doshas, Kapha is playing a crucial role in obesity and weight gain. It is the Kaphadosha, which tends to accumulate excess fat in the body. Kaphadosha people are having a desire of eating more as well as in taking of more sweet. Therefore such dosha individual should prefer light meals instead of having heavy meals (<http://www.gyanunlimited.com/health/15-siddha-medicines-to-lose-weight-fast/9343/>, 2015).

Kal-1 is a polyherbal decoction of seven different natural ingredients, traditionally used in controlling sugar levels, inflammatory conditions particularly regulating metabolic and immune inflammatory balance which are the major factors involved in obesity and related diseases. It exhibits substantial anti-obesity concomitant with metabolic regulatory effect especially in terms of chronic low-grade inflammation, energy equilibrium, and linked significant disorders. However, as discussed above that Kal-1 is constituted of seven different herbal ingredients, it is very difficult to conclude that a combination or a single ingredient is responsible for these observed responses at this stage. Indeed, clinical trials are needed in order to understand the relevance of formulation. It is also clear that diet rich in carbohydrate with increased sugar may affect body weight, blood biochemistry including blood glucose and serum insulin, the levels of inflammatory markers both pro and anti, and most importantly energy balance. It would also be interesting to investigate Kal-1 mechanism and its influence on metabolic process and pathways at transcriptional level (Tikoo *et al.*, 2013).

Triphala's effective combination of herbs acts as a gentle laxative on the body, cleansing the body of all toxic waste accumulated over time while at the same time strengthening and nourishing the tissues. Its two main advantages are that it is an affordable solution for the many people who require prompt relief from the discomfort and pain that is usually a given thing in GI tract disorders of all kinds and the fact that it causes very little known side effects for people using it. Apart from being a natural laxative, Triphala also provides a host of health benefits, some of the important ones being helping the body recover from ill effects of stress, boosting the immune system, preventing signs of ageing, purifying blood and aiding in weight loss by regularizing the function of the digestive tract. The regular consumption of Triphala can eliminate many ill effects caused by the unhealthy lifestyle and diet that affect our digestive health (<http://www.yoga-for-beginners-a-practical-guide.com/triphala-powder-for-sure-weight-loss.html>).

Ayurvedic and Siddha systems specify medicinal plants containing various metal constituents for curing ailments. Minerals and metals present in biological system play a vital role in metabolism. There is a definite relationship between the element content of the plant, or one of its parts, and its nutritional status. Some elements are essential for normal growth and reproduction while others have some beneficial effects<sup>1</sup>. Any element, essential/useful or not, becomes toxic if taken up in excessive amounts. Toxicity of elements such as silver and barium has rarely been reported since they are present in nature in insoluble form, to be taken up by the plant. In contrast, toxic effects of lead, arsenic, bismuth, bromine, etc. are well documented and the determination of the smallest traces of such elements has been of importance in toxicology for many years (Lalla J .K.*et al.*, 2003).

### **C. Introduction on weight reducing foods.**

According to Mangieri (2013), "Certain foods can help you shed body weight," because they help you feel full longer and help curb cravings" (<http://www.webmd.com/diet/9-foods-to-help-you-lose-weight>, 2015).

Weight loss foods do not require a 'special ingredient'; they constitute foods that you see every day in your Indian kitchens. These weight loss foods can be eaten directly or consumed in combination meals that you eat daily.

Spinach is rich in fibre, water, antioxidants, vitamins K and A, and minerals like magnesium, potassium, and iron. Spinach also helps in curing constipation, being a good source of fibre and cleanses the digestive tract.

Allicin in garlic is considered effective for fighting high cholesterol, high insulin and unhealthy blood sugar levels. Additionally, garlic is a great appetite controller - perfect for healthy weight loss. This weight loss food also helps in preventing various cancers, fight cardiovascular diseases and diabetes and respiratory problems. Garlic also helps fight various infections. (<http://timesofindia.indiatimes.com/20-weight-loss-foods-in-every-indiankitchen/articleshow/18145801.cms>).

Beans are inexpensive, filling, and versatile food. Beans are a great source of protein. Beans are also high in fibre and slow to digest. (<http://www.webmd.com/diet/9-foods-to-help-you-lose-weight>, 2015)

Cucumbers are rich in water content, almost 95 per cent, and dietary fibres, which are most effective in cleansing the body of harmful toxins released by the digestive system. Thus, they promote better digestion which in turn speeds up metabolism. Moreover, they are exceptionally low in calories, which make them an essential food for weight loss diet. Another key feature of the cucumber diet is that it aids in cooling the body, keeps you feeling refreshed and relaxed all day long. Rich in Vitamin C and Vitamin B, a diet based on cucumbers can also give you radiant glowing skin, and clear visibility. Cucumbers make tasty and filling salads that can

keep you going all along the day (<http://www.boldsky.com/health/diet-fitness/2013/cucumber-diet-how-it-helps-burn-fat-034451.html>).

Cucumber helps to reduce cholesterol levels in the body. The vegetable has a compound called sterols and this compound has been confirmed by researchers to cholesterol levels (<http://ieatndrink.com/weight-loss/12-health-benefits-attached-to-cucumbers>). A cucumber contains zero cholesterol and if you are at risk of suffering from heart disease or have had heart related problems in the past, then you should definitely eat a cucumber a day (<http://www.thehealthsite.com/fitness/health-benefits-of-cucumber-sa214/>). Due to its low calorie and high water content, cucumber is an ideal diet for people who looking for weight loss (<http://www.ehealthzine.com/15-health-benefits-of-cucumber.html>).

Broken wheat is made from whole wheat berries, it carries a great deal of nutrition and fibre, since it includes the outer bran and germ of the wheat. For this reason, it is often added to healthy diet plans. It is also a good source of iron, magnesium and phosphorus. Broken wheat is more nutritious than rice, because it contains more fibre, more vitamins and minerals, and has a better glycemic index than white rice or refined flour (<http://www.tarladalal.com/glossary-broken-wheat-426i>).

Eating a diet rich in whole grains can lower your risk of diabetes significantly. Complex carbohydrates provided by whole wheat products help burn more calories and lose weight over time by keeping you fuller for longer. Carbohydrates are also necessary for the proper functioning of the digestive system and the elimination of waste. Wheat is high in fibre but low in sugar and fat (<http://www.diethealthclub.com/diabetic-diet/wheat.html>).

People who eat whole grains as part of a healthy diet may lower their chances of developing some chronic diseases. When making half of your plate fruits and veggies, choose foods with vibrant colours that are packed with fibre, minerals and vitamins. To lose weight, reduce the number of calories you take in and increase the amount of physical activity you do each day. Research suggests that safe weight loss involves combining a reduced-calorie diet with physical activity to lose 1/2 to 2

pounds a week(after the first few weeks of weight loss) (<http://www.win.niddk.nih.gov/publications/pdfs/myths.pdf>).

To lose or maintain a healthy weight, more fruits and vegetables along with whole grains and lean meats, nuts, and beans is a safe and healthy one. Diets rich in fruits and vegetables may reduce the risk of some types of cancer and other chronic diseases. Fruits and vegetables also provide essential vitamins and minerals, fibre, and other substances that are important for good health. Most fruits and vegetables are naturally low in fat and calories and are filling ([http://www.cdc.gov/nccdphp/dnpa/nutrition/pdf/CDC\\_5-A-Day.pdf](http://www.cdc.gov/nccdphp/dnpa/nutrition/pdf/CDC_5-A-Day.pdf)).

#### **D. Role of weight reducing foods in the treatment of obesity.**

Food is an imperative internal factor that accounts for health as well as disease. As Hippocrates said 2000 years ago, “Let food be your medicine and medicine be your food” (Hari Sharma, 2011).

The optimal diet for prevention of weight gain, obesity, metabolic syndrome and Type 2 diabetes is fat reduced, high fibre rich in low energy density carbohydrate (Fruits, vegetables and whole grain products) and intake of energy containing drinks is restricted. The reduction of total fat content of ad libitum diet produces weight loss in both the short term and over periods as long as seven years (Astrup, 2008).

According to Perez-Guisado (2008), carbohydrates are the basis of the food pyramid of a healthy diet. The best way to lose weight is by cutting down on calories, essentially in the form of fat. Reduced breakfast energy intake is associated with lower total daily intake largely depends on the post- breakfast rather than breakfast intake pattern. Therefore overweight and obese subjects should consider the reduction of breakfast calories as a simple option to improve their daily energy balance (Scudziarra, 2011).

Jing (2008), Conjugated Linoleic Acid (CLA), DecosaHexaenoic Acid (DHA) and EicosaPentaenoic Acid (EPA) has beneficial effects on “weight loss” and have similar effects on alleviating obesity and preventing from obese.

Ingestion of honey is an excellent home remedy for obesity. It mobilises the extra deposited fat in the body and puts it into circulation which is utilised as energy for normal functions. Fasting on honey -lime juice water is highly beneficial in the treatment of obesity without the loss of energy and appetite. In this mode of treatment, one spoon of fresh honey should be mixed with a juice of half a lime in a glass of lukewarm water and taken at regular intervals. Another effective remedy for obesity is an exclusive lemon juice diet (Bakhru, 2011).

Cereals provide more calories when compared to pulses, hence refined cereals and incorporation of pulses and whole grain foods in a weight loss program resulted in a greater reduction waist circumference (Bernard, 2012).

Millets are small seeded annual cereal grains and are particularly low in phytic acid and rich in dietary fibre, iron, calcium and B vitamins. In the present era of food scarcity, there exists a need of diversity to use millets by developing millet products (Karuppasamy *et al.*, 2011).

According to Megat (2011), the prevalence of obesity has reduced to epidemic proportions, making finding effective solution to reduce obesity a public health priority. One part of the solution could be for individuals to increase consumption of non-oil seed pulses (dry beans, peas, chick peas and lentils) because they have nutritional attributes to benefit weight control including slowly digestible carbohydrate, high fibre and protein contents and moderate energy density.

Cabbage is considered to be an effective home remedy for obesity. Recent research has discovered in this vegetable a valuable content called tartaric acid which inhibits the conversion of sugar and other carbohydrates into fat. Hence, it is of great value in weight reduction. Cabbage is found to possess the maximum biological value with minimum calorific value. Moreover, it gives a lasting feeling of fullness in the stomach and is easily digestible ((Bakhru, 2011).

Consuming pulses may help with weight management for people trying to lose weight; pulses are high in fibre and protein, low in fat and moderate in calories. One cup of cooked lentils or dry peas contains about half of the daily fibre

recommendations. Food higher in fibre content usually helps people feel full or satiated at meal time (Compos, *et al.*, 2010).

Epidemiological studies indicated that dietary fibre intake, especially intake of whole grains or cereal fibre, protect against development of obesity. Two cross sectional studies (including more than 100,000 persons) and found prospective cohort studies (including more than 100,000 persons) indicated a strong negative association between fibre intake and obesity.

Dietary fibre can be defined as non-digestible carbohydrates with a degree of polymerization  $\geq 3$  (Jones, 2013). Additionally, a list of beneficial physiological effects of dietary fibre was developed including reduction in blood total or LDL cholesterol; attenuation of postprandial blood glucose or insulin levels; increased stool bulk and decreased transmit time; and fermentation by colon microflora. It is noteworthy that additional fibre attributes, such as weight loss/adiposity and increased satiety were not included in the list of beneficial effects (Howlett *et al.*, 2010).

This “volumetric” effect on food promotes a sense of fullness and a delay in gastric emptying, which tends to naturally result in a decrease in caloric intake. Various fibres differ dramatically in their ability to impart volume and viscosity to foods, and it has been shown that simple distention of the gastric antrum by soluble, viscous fibres leads to a sensation of satiety that tends to promote cessation of eating during meal time (Michael *et al.*, 2012).

Dietary calcium, a non-energy supplying nutrient, has been identified as playing a pivotal role in the regulation of energy and lipid metabolism. Calcium intake is inversely associated with body weight, dyslipidemia, Type 2 diabetes and hypertension. In the same vein, higher vitamin D intake and elevated level of serum 25(OH) D have been reported to be related to lower adiposity and metabolic health. The inclusion of dairy or supplemental calcium in a weight loss diet does not preclude weight loss and, as stated previously, may enhance weight loss. While further research is needed to identify the molecular mechanisms responsible for this effect, it appears that multiple bioactive components of dairy are involved (Wei Zhu *et al.*, 2013).

Water and fibre in foods increase volume and thereby reduce energy density.

In their natural state, fruits and vegetables have high water and fibre content and are low in calories and energy density. Water has the greatest impact on energy density because it adds weight to foods without increasing calories, thus decreasing energy density. Most fruits and vegetables are low in energy density because of their high water and fibre content

and their low fat content. The water and fibre content of many vegetables and fruits is well documented. The results indicate that fruits can enhance satiety, especially when consumed as a fruit. Whole fruit is lower in energy density and more satiating because of the fibre content when compared to fruit juices ([http://www.cdc.gov/nccdphp/dnpa/nutrition/pdf/rtp\\_practitioner\\_10\\_07.pdf](http://www.cdc.gov/nccdphp/dnpa/nutrition/pdf/rtp_practitioner_10_07.pdf)).

Consumption of fruits and vegetables might prevent excessive weight gain. Their low energy density and high content of water and fibre could enhance satiation signals. Fruits and vegetables share some similar nutritional characteristics, and people with high consumption of fruit also tend to have a high consumption of vegetables (Anne *et al.*, 2012).

Cucumber is a popular vegetable crop used in Indian traditional medicine since ancient times. This vegetable is very high in water content and very low in calories. It has potential antidiabetic, lipid lowering and antioxidant activity (Mukherjee P.K. *et al.*, 2012)

A suitably planned course of dietetic treatment, in conjunction with suitable exercise and other measures for promoting elimination is the only scientific way of dealing with obesity. The chief consideration in this treatment should be the balanced selection of foods which provide the maximum essential nutrients with the least number of calories.

Exercise is an important part of weight reduction plan. It helps to use up calories stored in body fat and relieves tension, besides toning up the muscles of the body. Walking is the best exercise to begin with and may be followed by running, swimming, rowing and other outdoor sports. Certain yoga asanas are highly beneficial. Not only do they break up or re-distribute fatty deposits and help slimming, but they also strengthen the flabby areas. Sarvangasana, halasana, bhujangasana, shalabhasana,

dhanurasana, chakrasana, naukasana, ardhmatsyendrasana, paschimottanasana, vajrasana, yogamudra and trikonasana are recommended. These asanas work on the glands, improve circulation, strengthen many weak areas and induce deep breathing which helps to melt off excess fat gradually. Above all, obese persons should make every effort to avoid negative emotions such as anxiety, fear, hostility and insecurity and develop a positive outlook on life (Bakhru, 2011).

## **METHODOLOGY**

The methodology adopted for the study entitled “**Consumption Pattern and Analysis of Weight Reducing Foods and Indigenous Medicines among Overweight and Obese Adults**” is given under the following headings.

### **Phase I**

- G. Selection of area
- H. Selection of participants
- I. Formulation of the interview schedule

### **Phase II**

- J. Conduct of survey
- K. Analysis of commonly consumed weight reducing foods and indigenous medicines
- L. Statistical analysis and interpretation of data

#### **A. Selection of area**

The area selected for the conduct of the study was Coimbatore city, Tamil Nadu. The area was selected according to the accessibility and convenience of the investigator. In order to elicit information on consumption pattern of weight reducing foods and indigenous medicines, adult overweight and obese participants were selected from Ganga hospital, Mooppan Ayurveda Pharmacy and Santhigiri Ayurveda and Siddha Hospital in Coimbatore.

#### **B. Selection of participants**

A convenient sampling is a type of non- probability sampling which involves the sample being drawn from that part of population which is handy, a sample population selected because it is readily available and convenient (Gupta, 2006).

A convenient sample of 194 overweight and obese adult men and women participants between the age group of 25-45 years were selected for the study. Necessary permission was obtained from the selected hospitals to conduct the study.

### **Ethical Clearance of the study**

The proposal of the study was submitted to the Institutional Human Ethics Committee (IHEC), Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore and Ethical clearance approval was obtained. The Ethical clearance certificate is given in Appendix I.

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

Interview schedule was the tool used for collecting data where the questions are asked and filled by the investigator with face to face contact with the subjects from whom the information are elicited (Gupta,2004).

A detailed interview schedule was developed by the investigator in order to elicit information pertaining to the socio-economic status, life style pattern, health status, dietary and food consumption pattern and the consumption pattern of weight reducing foods and indigenous medicines among overweight and obese adults. The interview schedule is given in Appendix II.

### **D. Conduct of survey**

To elicit information on socio-economic status, life style pattern, health status and dietary and food consumption pattern of weight reducing participants, the investigator visited Ganga Hospital for a period of 15 days and interviewed the participants of the study which included both inpatients (IP) and outpatients (OP). 102 adults in the age group of 25-45 years were selected from the outpatients (OP) and inpatients (IP) records of the hospital based on their BMI and age. The investigator collected information by visiting the patients in their respective rooms between 10.00 am to 4.00pm on each day. Among the selected participants, 42 were men and 60 were women.

Mooppan Ayurveda Pharmacy was chosen for selecting the participants consuming Ayurveda medicines. 50 overweight and obese participants which included 19 men and 31 women were selected from Mooppan Ayurveda Pharmacy. The participants were chosen from the case history based on their age and BMI.

To identify the consumption pattern of Siddha medicines for weight reduction among adults, Santhigiri Ayurveda and Siddha Hospital was chosen. 40 overweight and obese participants were selected and interviewed for a period of seven days. The participants were selected from the case history based on the age and BMI. Among the participants 13 were men and 27 were women.

Details on age and gender of the participants, educational qualification, type of family, religion, occupation, monthly income, monthly food expenditure, were collected using the interview schedule. Information about life style pattern such as hours of sleep, exercise, daily water consumption, oil used for cooking etc. were also elicited.

Details regarding health status such as taking treatment for ailment, family history of health problems etc. were obtained.

Dietary and food consumption pattern details regarding dietary habit, meals consumed, skipping of meals, were also collected.

Apart from this, the height and body weight values of the study participants were obtained from the hospital records with due permission and their BMI was calculated. A dietary survey through 24hour recall method was conducted by the investigator for all the study participants.

#### **E. Analysis of commonly consumed weight reducing foods and indigenous medicines**

Adequate analytical methods for nutrients in foods, food ingredients and food products are the basic first step in determining the nutritional adequacy of a food supply (Jonathan, 2007).

From the survey, it was found that the participants consumed green tea, pomegranate, oats, honey, broken wheat and salad cucumber for weight reduction and among them, it was noted that broken wheat and salad cucumber were commonly consumed. Among the Ayurveda medicines, the participants consumed Lohasavam, Triphalachoornam, Ayaskrithi, Mandooravasavam, Varunadikashayam, B-fit capsules, etc for weight reduction and Triphalachoornam was found to be the most consumed medicine. Jalamanjarichendooram was consumed commonly among Siddha medicines. From the survey, two commonly consumed weight reducing food samples- **Cucumber and Broken wheat** and one sample each from Ayurveda- **Triphalachooranam** and Siddha systems of medicines- **Jalamanjari chendooram** respectively were further analysed as follows.

## **I. Assessment of Quality Control Parameters**

Various quality control parameters such as moisture content, pH, solubility, ash value, extractable matter were tested using standard protocols as follows.

### **a. Moisture content**

The moisture content was determined using the digital moisture balance (MOC120H SHIMADZU) for both the selected weight reducing food samples and Ayurveda and Siddha medicines.

### **b. Ash value**

The total ash, water soluble ash and acid insoluble ash of the weight reducing food samples and Ayurveda and Siddha medicines were determined by the following methods.

#### **i. Determination of total ash content**

Five grams of the selected weight reducing food samples and Ayurveda and Siddha medicines were placed in four crucibles separately and were weighed. The weighed samples were spread in an even layer in the crucible, and the material was ignited by gradually increasing the heat to 500-600° C until free from carbon. It was then cooled in a desiccator and weighed. Total ash content was calculated in mg/100g.

## **II. Qualitative analysis of phytochemical constituents**

Qualitative analysis of the phytochemical constituents of the selected weight reducing food, Ayurveda and Siddha medicines was done. Preliminary phytochemical screening was performed for the presence of secondary metabolites like tannins, glycosides, alkaloids, steroids, and flavonoids using standard qualitative assays (Sasidharan *et al.*, 2011). The standard protocols for the qualitative analysis of the different primary and secondary metabolites are given below:

### **Sample Extraction**

Water was used as a solvent for the extraction of selected weight reducing foods, Ayurveda and Siddha medicines using maceration and heat extraction methods. 5g of the selected samples was weighed and soaked in 50ml of the particular solvent for 12hrs. The filtrate was filtered through Whatmann filter paper No 41. The resulting sample extract was used for further assay.

#### **1. Test for carbohydrates:**

Molisch's test was used to detect the presence of carbohydrates. In four different test tubes, added two ml of the extracts of the selected weight reducing food, Ayurveda and Siddha medicines solution separately and added two drops of  $\alpha$ -naphthol solution. The test tube was carefully inclined and then concentrated. Sulphuric acid was poured drop by drop using a dropper, along the sides of the tube. Observed the violet colour at the junction of the liquids in the test tube.

#### **2. Test for Reducing Sugars:**

About one ml of the extract of the selected weight reducing food, Ayurveda and Siddha medicines was taken in separate test tubes and hydrolysed by boiling with 5 ml of dilute hydrochloric acid and the resulting solution was neutralized with sodium hydroxide solution. To this few drops of Fehling's solution was added and heated on a boiling water bath for two minutes. Appearance of reddish brown precipitate of cuprous oxide indicated the presence of combined reducing sugars.

### **3. Test for cellulose:**

To one ml of the extract of weight reducing foods, Ayurveda and Siddha medicines two to three drops of iodine solution was added followed by two drops of concentrated sulphuric acid. Formation of dark or deep brown to cherry red colour showed the presence of cellulose.

### **4. Test for steroids:**

To one ml each of the extract of weight reducing foods, Ayurveda and Siddha medicines was taken in different test tubes and few drops of chloroform and acetic acid were added and heated in a boiling water bath for two minutes and added few drops of concentrated sulphuric acid. Presence of Steroid was confirmed by bright orange/deep red/red colour.

### **5. Test for Secondary metabolites:**

#### **a) Alkaloids:**

One ml each extract of weight reducing foods, Ayurveda and Siddha medicines was stirred in five ml of 1% aqueous hydrochloric acid on a steam bath in four different test tubes, allowed to cool and filtered. One ml of four filtrates was treated with a few drops of Mayer's reagent and to another one ml of the filtrate, a few drops of Dragendorff's reagent was added. Turbidity or an orange red precipitation with either of the reagent was taken as preliminary evidence for the presence of alkaloids in the extract being evaluated (Abba *et al.*, 2009)

#### **b) Saponins:**

To one ml each extract of weight reducing foods, Ayurveda and Siddha medicines was mixed and shaken with water in four different test tubes. Frothing which persists on warming was taken as preliminary evidence for the presence of saponins (Parekh and Chanda *et al.*, 2007).

### **c) Flavonoids**

Shinoda test was used to evaluate the presence of flavonoids. To the alcoholic extraction of the formulations, magnesium powder and few drops of concentrated hydrochloric acid were added. Formulation of orange, pink, red to purple colours indicated the presence of flavonoids (Kumar *et al.*, 2007).

### **d) Anthraquinones**

Borntrager's test was used to analyse the presence of anthraquinones. One ml of the extract of the selected weight reducing foods, Ayurveda and Siddha medicines was boiled with 10 ml aqueous sulphuric acid and filtered while hot. The filtrate was shaken with 5 ml of benzene. The benzene layer was then separated and 10% Ammonia solution was added to half of its volume. A pink, red or violet colouration in the ammonia phase indicated the presence of anthraquinone derivatives in the extracts (Kumar *et al.*, 2007).

### **e) Tannins**

One ml each of the extract of weight reducing foods, Ayurveda and Siddha medicines was stirred with 10 ml of distilled water on a magnetic stirrer, filtered separately and ferric chloride reagent added to the filtrate. A blue black, green or blue green precipitate was taken as evidence for the presence of tannins (Kumar *et al.*, 2007).

### **f) Cardiac glycosides**

Salkoski test was used to identify cardiac glycosides. One ml of the extract of weight reducing foods, Ayurveda and Siddha medicines was dissolved in 2ml of chloroform and sulphuric acid carefully added to form a layer in four separate test tubes. Formation of reddish brown colour at the interface indicated the presence of steroidal ring (i.e.) a glycone portion of the cardiac glycoside (Edeoga *et al.*, 2005).

### **III. Total antioxidant activity-in vitro**

In vitro total antioxidant activity of the selected weight reducing food, Ayurveda and Siddha medicines were analysed through Ferric Reducing Antioxidant Power Assay (FRAP) (Benzie and Strain, 1996).

This method measures the ability of antioxidants to reduce ferric iron complex to the ferrous form at a low pH which has an intense blue colour (Benzie et al., 1996). The FRAP reagent consisted of 10mM 2,4,6-tripyridyl-2-triazine (TPTZ) in 40mM hydrochloric acid, 20mM ferric chloride and 250mM sodium acetate buffer (pH 3.6). The reagent was freshly prepared by mixing TPTZ solution, FeCl<sub>3</sub> solution and acetate buffer in a ratio 1:1:10. 100µl of the extract solution containing 0.1ml extract was mixed with 900µl of FRAP reagent. After keeping the mixture at 37°C for 4 minutes, the absorbance at 593nm was determined against blank. Trolox was used as calibration standard ( $y=0.160x$ ,  $R^2=0.981$ ). FRAP values were calculated as mg of Trolox equivalence (TE)/g extract from three determinations and average.

### **IV. Heavy metal content of Ayurveda and Siddha samples**

As per the reviewed literature, Thriphachoornam may show variable contents in their elemental composition depending on type of the soil, fertilizer used and other conditions where these fruit-bearing plants are grown. This variation may alter the potency, safety and efficacy of plant products. The results indicated that the level of elements, viz. Ag, As, Cd, Co and Hg were either below detection level or were absent. Regarding the amounts of Ba, Bi, Ni, Pb and Sn, they were found to be below the Time-weighted average limits established by the American Conference of Governmental Industrial Hygienists (Lalla J K et al., 2003). Hence the analysis of the heavy metals was not carried out by the investigator.

The siddha medicine, Jalamanjarichendooram is a GMC certified product which has permissible level of heavy metals.

## **V. Nutrient analysis**

The nutrient content of the weight reducing food Ayurveda and siddha medicines which included carbohydrates, proteins, fats, calcium, phosphorus, iron, vitamin C, dietary fibre was estimated by standard methods (NIN, 2003).

All the four samples were analysed for its nutrients content. Moisture, ash and dietary fibre were carried out by using Association of Analytical Chemists International (AOAC, 2004) procedure. Carbohydrates estimation was done by Anthrone method. The amount of protein presence was estimated by Macrokjeldhal's method. Fat was estimated by Soxhelt extraction. Calcium was estimated by using Titrimetric method. The iron and phosphorus content was estimated by colorimetric method and vitamin C was estimated using Dye method. Dietary fibre was estimated by Enzymatic-Gravimetric Method. The standard procedures are given in Appendix III – VII.



**ESTIMATION OF ASH**



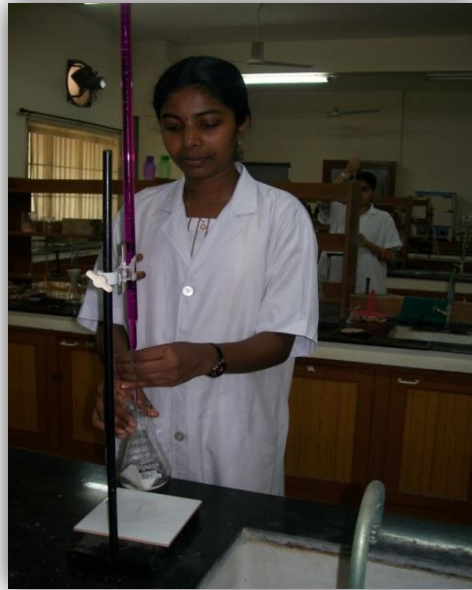
**ESTIMATION OF PHOSPHORUS**



**ESTIMATION OF NITROGEN**



**ESTIMATION OF FAT**



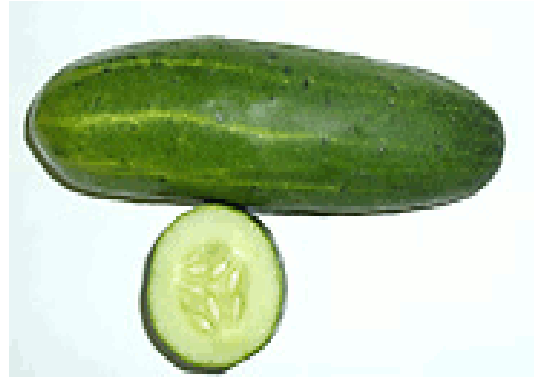
**ESTIMATION OF CALCIUM**

**PLATE I**

**NUTRIENT ANALYSIS**



**BROKEN WHEAT**



**CUCUMBER**



**TRIPHALA CHOORANAM**



**JALAMANJARI CHENDOORAM**

**PLATE II**

**SELECTED COMMONLY CONSUMED WEIGHT REDUCING FOODS AND  
INDIGENOUS MEDICINES**

## **F. Statistical analysis and interpretation of data**

Interpretation refers to the task of drawing inferences from the collected facts after an analytical and/or experimental study. In fact, it is a search for broader meaning of research findings. “In one sense, interpretation is concerned with relationships within the collected data, partially overlapping analysis. Interpretation also extends beyond the data of the study to include the results of other research, theory and hypothesis.” (Kothari, 2007)

The collected data was consolidated, tabulated, analysed and interpreted.

The research design of the study is given in Figure1

## RESEARCH DESIGN

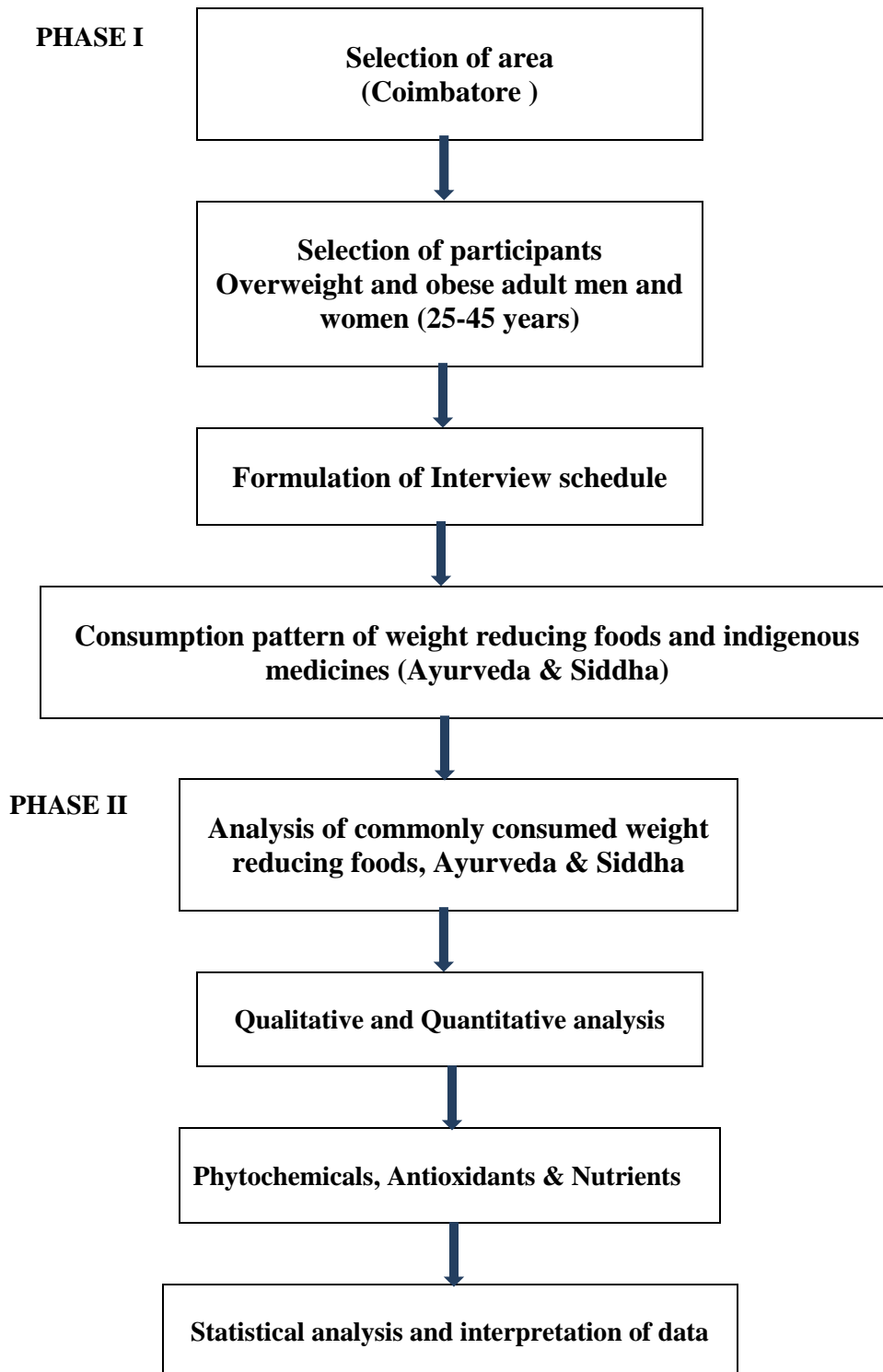


FIGURE 1

## RESULTS AND DISCUSSION

The results of the study entitled, “**Consumption Pattern and Analysis of Weight Reducing Foods and Indigenous Medicines among Overweight and Obese Adults**”, is presented under the following headings.

- F. General and socioeconomic profile of overweight and obese adults
- G. Health status, Dietary pattern and Life style pattern of overweight and obese adults
- H. Consumption pattern of weight reducing foods and Indigenous medicines
- I. Assessment of the Quality Control Parameters of the commonly consumed weight reducing foods and indigenous medicines
- J. Nutrient analysis of the selected weight reducing foods and indigenous medicines

The total number of study participants is 192. They were divided into three categories namely

Category I -102 Participants who consumed weight reducing foods

Category II-50Participants who consumed Ayurveda medicines to reduce weight

Category III -40 Participantswho consumed Siddha medicines to reduce weight

**A. General and socioeconomic profile of the overweight and obese adults**

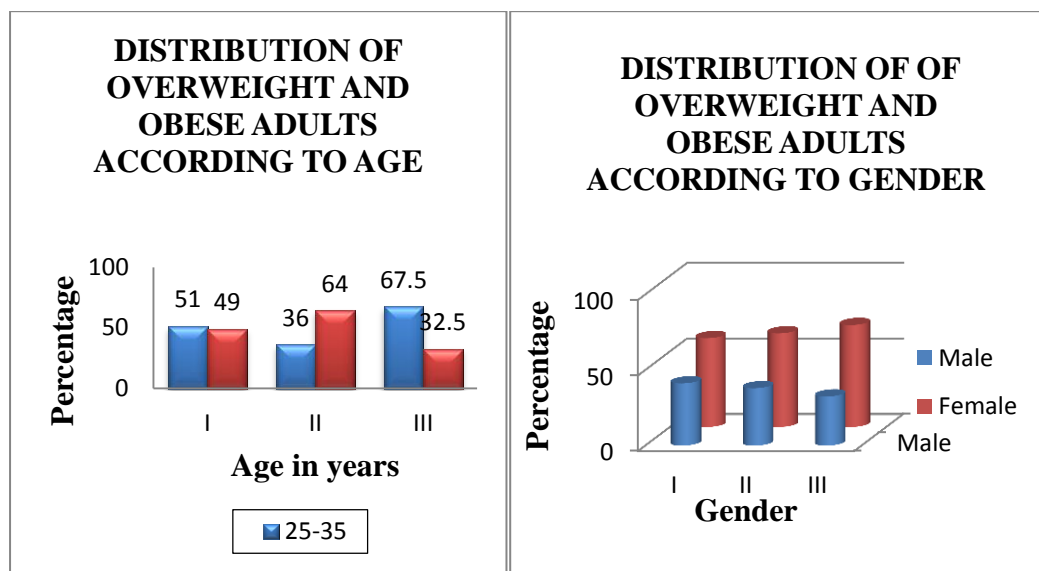
**1. Distribution of overweight and obese adults according to age and gender**

Table I and Figure 2 presents the distribution of overweight and obese adults according to age and gender.

**TABLE I**  
**DISTRIBUTION OF OVERWEIGHT AND OBESE ADULTS**  
**ACCORDING TO AGE AND GENDER**

(N=192)

Age (in years)	I (102)		II (50)		III (40)	
	No	%	No	%	No	%
25-35	52	51	18	36	27	67.5
36-45	50	49	32	64	13	32.5
<b>Gender</b>						
Male	42	41.2	19	38	13	32.5
Female	60	58.8	31	62	27	67.5



**FIGURE 2**

Out of 97 participants belonging to the age group of 25-35 years, 52 participants consumed weight reducing foods, 18 of them took Ayurveda medicines and 27 participants consumed Siddha medicines to reduce their body weight. From the 95 participants belonging to the age group of 36-45 years, 50 participants consumed weight reducing foods, 32 participants consumed Ayurveda medicines and 13 participants consumed Siddha medicines.

Among the 192 adult participants, 74 were males and 118 were females.

## 2. Overall Prevalence of Overweight and Obesity among the participants

Table II presents the overall prevalence of overweight and obesity among the participants.

**TABLE II**  
**OVERALL PREVALENCE OF OVERWEIGHT AND OBESITY**  
**AMONG THE PARTICIPANTS**

**N=192**

*BMI	Category		I		II		III		Total	
			No	%	No	%	No	%	No	%
23-24.9 kg/m <sup>2</sup>	Overweight	Male	25	24.5	12	24	9	22.5	46	23.95
		Female	51	50	19	38	12	30	82	42.70
>25 kg/m <sup>2</sup>	Obese	Male	9	8.84	7	14	7	17.5	23	12.00
		Female	17	16.66	12	24	12	30	41	21.35

\*Revised BMI for Indians status (Amruthachaitanya, 2014)

The participants were classified as overweight and obese using Asian cut off value for BMI. Based on the classification, it was found that 128 adult participants had BMI above normal and were classified as overweight and 64 adult participants were categorized as obese. Out of which, 46 participants (23.95%) adult men and 82 participants (42.70%) of adult women were in the overweight category while 23 participants (12 %) of adult men and 41 participants (21.35%) of adult women were under the obese category.

### 3. Socioeconomic profile of overweight and obese adults

Table III gives the socio economic background of overweight and obese adults.

**TABLE III**  
**SOCIOECONOMIC PROFILE OF OVERWEIGHT AND OBESE ADULTS**

**N=194**

S. No	Socio-economic factors	I(102)		II(50)		III(40)	
		No	%	No	%	No	%
<b>1.</b>	<b>Type of family</b>						
	Joint	10	9.8	7	14.0	0	0
	Nuclear	92	90.2	43	86.0	40	100.0
<b>2.</b>	<b>Religion</b>						
	Hindu	86	84.3	36	72.0	24	49.0
	Christian	1	1.0	7	14.0	10	20.4
	Muslim	15	14.7	7	14.0	6	12.2
<b>3.</b>	<b>Occupation</b>						
	Student	2	2.0	3	6.0	0	0.0
	House wife	36	35.3	20	40.0	27	67.5
	Working	64	62.7	27	54.0	13	32.5
<b>3.</b>	<b>Income / month*</b>						
	Rs.<3300 (Below poverty line)	0	0	0	0	0	0
	Rs.3301-7300 (Low income)	19	18.6	1	2.0	0	0
	Rs.7301-14500 (Middle income)	32	30.8	10	20.0	0	0
	Rs. >14501 (High income)	51	50.6	39	68.0	40	100.0
<b>4.</b>	<b>Food expenditure/month</b>						
	≤5000	43	42.2	8	16.0	0	<b>0</b>
	>5000	59	57.8	42	84.0	40	<b>100</b>

\*(HUDCO, 2010)

Majority of them (91.1%) belonged to nuclear families and the remaining (8.8%) belonged to joint families. It was found that 104 participants were working, 5 were studying and 83 were house wives. A total of 130 participants had a monthly income of more than 14,500 whereas 42 participants had a monthly income ranging from 7301 to 14500 falling into the category of middle income group, 20 participants had an income ranging from 3300 to 7300 and belonged to low income group.

#### 4. Educational status of overweight and obese adults

Table IV presents data on the educational status of the overweight and obese adults

**TABLE IV**  
**EDUCATIONAL STATUS OF OVERWEIGHT AND OBESE ADULTS**  
(N=192)

Educational level	I (102)		II (50)		III (40)	
	No	%	No	%	No	%
School education	38	37.3	13	26.0	9	22.5
Under graduation	49	48.0	32	64.0	25	62.5
Post-graduation	15	14.7	5	10.0	6	15.0

Among the 192 participants, 37.3 per cent who consumed weight reducing foods had school education, 48 per cent had under graduation and 14.7 per cent had post-graduation. Among the participants who consumed Ayurveda medicine, 26 per cent had school education, 64 per cent had under graduation and 10 per cent had post-graduation. Among the participants who consumed Siddha medicine, 22.5 per cent had school education, 62.5 per cent had under graduation and 15 per cent had post-graduation.

## **B. Health Status, Dietary Pattern and Lifestyle Pattern of Overweight and Obese Adults**

### **1. Health preservation strategies adopted on a regular basis**

**TABLE V**  
**HEALTH PRESERVATION STRATEGIES ADOPTED ON A REGULAR BASIS**

<b>Particulars</b>	<b>I (102)</b>		<b>II (50)</b>		<b>III (40)</b>	
	<b>No</b>	<b>%</b>	<b>No</b>	<b>%</b>	<b>No</b>	<b>%</b>
Exercise	<b>26</b>	<b>25.4</b>	<b>11</b>	<b>22</b>	<b>2</b>	<b>5</b>
Simple movements	<b>49</b>	<b>48</b>	<b>16</b>	<b>32</b>	<b>7</b>	<b>17.5</b>
Walking	<b>68</b>	<b>66.6</b>	<b>30</b>	<b>60</b>	<b>36</b>	<b>90</b>
Jogging	<b>5</b>	<b>4.9</b>	<b>4</b>	<b>8</b>	<b>0</b>	<b>0</b>
Yoga	<b>17</b>	<b>16.6</b>	<b>4</b>	<b>8</b>	<b>11</b>	<b>27.5</b>
Meditation	<b>10</b>	<b>9.8</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>20</b>

**\*Multiple response**

Among the 192 overweight and obese adults, 14 participants consuming weight reducing foods and 9 participants taking Ayurveda medicines were not adopting any health measures. The remaining adults adopted regular exercise, simple movements, walking, jogging, yoga and meditation as mentioned in the above table.

## 2. Health profile of the overweight and obese adults

**TABLE VI**  
**HEALTH PROFILE OF OVERWEIGHT AND OBESE ADULTS**

*Ailments	Taking treatment					
	I(102)		II(50)		III(40)	
	No	%	No	%	No	%
<b>Minor</b>						
Joint pains	31	30.3	21	42	2	5
Food allergy	0	0	7	14	0	0
Gastro intestinal disturbances	28	27.4	29	58	7	17.5
<b>Major</b>						
Diabetes	14	13.7	8	16	3	7.5
Hypertension	10	9.8	3	6	28	70
Cholesterol	5	4.9	8	16	0	0
Atherosclerosis	5	4.9	1	2	0	0
Thyroid	5	4.9	10	20	0	0
Anaemia	10	9.8	11	22	7	17.5

### \*Multiple response

Out of the 102 adults consuming weight reducing foods, 31(30.3%) adults are taking treatments for joint pains and 28(27.4%) adults for gastro intestinal disturbances, whereas no adults were taking treatment for food allergy. Among the 50 adults consuming Ayurveda medicine for weight reduction, 29(58%) adults were taking treatment for gastro intestinal disturbances, 21(42%) for joint pains and 7(14%) adults for food allergy. Among the 40 adults consuming Siddha medicine for weight reduction, 7(17.5%) adults were taking treatment for gastrointestinal disturbances, 2 (5%) for joint pains and no adults were taking treatment for food allergy.

Out of the 102 adults consuming weight reducing foods, 14(13.7%) adults were taking treatment for diabetes, 10(9.8%) adults each for hypertension and anaemia, and 5(4.9%) adults each for cholesterol, atherosclerosis and thyroid. Among the 50 adults

consuming Ayurveda for weight reduction, 11(22%) adults were taking treatment for anaemia, 10(20%) for thyroid, 8(16%) each for diabetes and cholesterol, 3 (6%) adults for hypertension and 1(2%) adult for atherosclerosis. Out of the 40 adults consuming siddha medicine for weight reduction 28 adults were taking treatment for hypertension, 7 adults for anaemia and 3 for diabetes. The remaining adults were not taking any treatment.

### **3. Family history of illness**

Among the 192 overweight and obese adults studied, family history of diabetes mellitus was found among 78. Incidence of hypertension was found among 54 of the family members. High cholesterol was also found among 39 family members of the adult participants. A total of 21 persons had heart disease among family members.

**4. Type of diet, meal pattern and meal skipping pattern among overweight and obese adults**

Table VII presents the type of diet, meal pattern, water intake and meal skipping pattern among overweight and obese adults.

**TABLE VII**  
**TYPE OF DIET, MEAL PATTERN AND MEAL SKIPPING PATTERN**  
**AMONG OVERWEIGHT AND OBESE ADULTS**

(N=192)

Criteria	I		II		III	
	No	%	No	%	No	%
<b>Types of diet</b>						
Vegetarian	48	47.1	6	12.0	4	10.0
Non vegetarian	54	52.9	44	88.0	36	90.0
<b>Number of meals per day</b>						
3 times	52	51.0	37	74.0	14	35.0
4 times	46	45.1	12	24.0	26	65.0
5 times	4	3.9	1	2.0	0	0
<b>Water intake</b>						
<7-8 glass	3	2.9	9	18.0	0	0
7-8 glass	89	87.3	39	78.0	40	100.0
>7-8 glass	10	9.8	2	4.0	0	40
<b>Type of meal skipped</b>						
Breakfast	3	2.9	10	20.0	0	0
Lunch	1	1.0	0	0	0	0
Dinner	3	2.9	2	4.0	0	0
Eat regularly	95	93.1	38	76.0	40	100.0

Out of the 102 adults consuming weight reducing foods, 54(52.9%) adults were non vegetarian and 48(47.1%) were vegetarians. In the same category, 52(51%) adults were consuming 3 meals per day and 46 (45.1%) were taking 4 meals per day and only 4(3.9%) of them consuming 5 meals per day. Among the 50 adults consuming Ayurveda medicine, 44(88%) adults were non vegetarians and 6(12%) adults were vegetarians, 37(74%) were taking 3 meals per day, 12(24%) were consuming 4 meals per day and only 1(2.0%) were consuming 5 meals per day. Among the 40 adults consuming siddha medicine 36(90%) were non vegetarians and 4(10%) were vegetarians, 14(35%) were consuming 3 meals per day, 26(65%) were consuming 4 meals per day and there is no one is taking 5 meals per day.

Among the adults consuming weight reducing foods, 89(87.3%) adults drank 7-8 glasses of water whereas 39(78%) adults of those consuming ayurveda medicine drank 7-8 glasses and 40(100%) adults consuming Siddha medicine drank 7-8 glasses per day.

Among the adults consuming weight reducing foods, 95(93.1%) adults ate regularly. Among those consuming Ayurveda medicine for weight reduction 38(76%) adults ate regularly and among those consuming siddha medicine 40 (100%) adults ate regularly.

## 5. Lifestyle pattern

Table VIII presents the lifestyle pattern among the obese and overweight adults

**TABLE VIII**  
**LIFESTYLE PATTERN OF OVERWEIGHT AND OBESE ADULTS**

(N=192)

Habits	I		II		III	
	No	%	No	%	No	%
<b>Watching time for TV/day</b>						
30minutes	30	29.4	0	0.0	24	60
1 hour	45	44.1	26	52.0	16	40
2 hour	24	23.5	23	46.0	0	0
>2 hour	3	2.9	1	2.0	0	0
<b>Hours of sleep</b>						
<8hours	17	16.7	33	66.0	0	0
8 hours	85	83.3	17	34.0	40	100
>8 hours	0	0	0	0.0	0	0
<b>Dieting</b>						
Following	66	64.7	25	50.0	35	87.5
Not following	36	35.3	25	50.0	5	12.5

Among the 102 adults consuming weight reducing foods, 45(44.1%) adults spent 30 minutes for watching TV and only 3 (2.9%) adultsspent more than 2 hours for watching TV daily, whereas 85(83.3%) of them slept 8 hours daily. Outof the 50 adults consuming Ayurveda medicine for weight reduction, 26(52%) and 23 (46%) adults were watching TV daily for 1 hour and 2 hours respectively. Only 2% were watching TV for more than 2 hours and 33(66%) of them slept for less than 8 hours and 17(34%) slept 8 hours daily. The 40 adultsconsuming Siddha medicine for weight reduction, 24(60%) spent 30 minutes for watching TV and 16(40%) spent 1 hour for watching TV daily whereas all adults (100%) slept 8 hours daily.

Among 102 adults consuming weight reducing foods, 66(64.7%) adults followed diet whereas 36(35.3%) did not follow diet. Among those who consume Ayurveda medicine for weight reduction, 25 (50%) adults each followed and did not follow diet respectively. Out of the 40 adults who consumed siddha medicine for weight reduction, 35(87.5 %) followed diet whereas 5(12.5%) did not follow diet for weight reduction.

### **C. Consumption Pattern of Weight Reducing Foods and Indigenous Medicines**

#### **1. Awareness of weight reducing foods among overweight and obese adults**

Among 192 adults 102(100%) adults were aware about the weight reducing foods from those consuming weight reducing foods, 22(44%) adults from those consuming Ayurveda medicine and 32(80%) adults from those consuming Siddha medicine. All others were not aware about the weight reducing foods.

#### **2. Basis for the consumption of weight reducing foods and indigenous medicines**

Among the 102 adults consuming weight reducing foods, 74 adults chose to consume these foods based on dieticians advice whereas the remaining 28 chose themselves. Out of all the participants from Ayurveda and Siddha consumed medicines for weight reduction according to the doctors' advice.

### 3. Type of foods and indigenous medicines consumed for weight reduction

**TABLE IX**

#### **TYPE OF FOODS CONSUMED FOR WEIGHT REDUCTION**

<b>*Foods</b>	<b>No</b>	<b>%</b>
Broken wheat	52	50.9
Cucumber	54	52.9
Green tea	8	7.8
Oats	17	16.6
Pomegranate	12	11.7
Honey	12	11.7

**\*Multiple response**

Among the 102 overweight and obese adults, 52 (50.9%) consumed broken wheat, 54(52.9%) ate cucumber, 8(7.8%) drank green tea, 17(16.6%) ate oats, 12(11.7%) took pomegranate and 12(11.7%) consumed honey for weight reduction.

**TABLE X**

#### **TYPE OF AYURVEDA MEDICINES CONSUMED FOR WEIGHT REDUCTION**

<b>*Medicines</b>	<b>No</b>	<b>%</b>
Thriphalachooranam	16	32
Varunadhikashayam	11	22
Lohasavam	14	28
Shuddaguggulu	13	26
Ayaskrithi	12	24
Mandooravasavam	5	10
Lomethus	9	18
B fit capsule	1	2

**\*Multiple response**

Among 50 overweight and obese adults, 16 (32%) consumed Thriphalachoornam, 11(22%) took Varunadhikashayam, 14 consumed Lohasavam, 13 took

Shuddhaguggulu, 12 consumed Ayaskrithi, 5 took Mandooravasavam, 9 consumed Lomethus, 1 took B fit capsule.

**TABLE XI**

**TYPE OF SIDDHA MEDICINES CONSUMED FOR WEIGHT REDUCTION**

<b>*Medicines</b>	<b>No</b>	<b>%</b>
Jalamanjarichendooram	19	47.5
Mandooram	7	17.5
Ayakanthachendooram	7	17.5
Njerinjilkudineer	14	35
Vediuppuchendooram	14	35

**\*Multiple response**

Among 40 overweight and obese adults, 19(47.5%) consumed Jalamanjarichendooram, 7(17.5%) took Mandooram and Ayakanthachendooram, 14(35%) consumed Njerinjilkudineer and Vediuppuchendooram for weight reduction.

**4. Duration of taking weight reducing foods and Indigenous medicines**

**TABLE XII**

**DURATION OF TAKING WEIGHT REDUCING FOODS AND INDIGENOUS MEDICINES**

<b>Duration</b>	<b>I (102)</b>		<b>II (50)</b>		<b>III (40)</b>	
	<b>No</b>	<b>%</b>	<b>No</b>	<b>%</b>	<b>No</b>	<b>%</b>
1-3 months	21	20.58	1	2.0	5	12.5
4-6 months	30	29.42	49	98.0	35	87.5
> 6 months	51	50	0	0.0	0	0

Among the adults consuming weight reducing foods, 21(20.58%) adults took these foods for 1-3 months, 30(29.42%) took for 4-6 months and 51(50%) took for more than six months. Out of the adults consuming Ayurveda medicines for weight reduction, 49(98%) adults took medicines for 4-6 months and among those who had siddha medicines for weight reduction 35(87.5%) adults took medicines for 4-6 months.

### 5. Frequency of consumption of weight reducing foods and indigenous medicines

**TABLE XIII**  
**FREQUENCY OF CONSUMPTION OF WEIGHT REDUCING FOODS**  
**AND INDIGENOUS MEDICINES**

Frequency/day	I (102)		II (50)		III(40)	
	No	%	No	%	No	%
Once	30	29.4	1	2.0	0	0
Twice	52	70.6	32	64.0	32	80.0
Thrice	0	0	17	34.0	8	20.0

Out of the 102 adults who consumed weight reducing foods, 30(29.41%) of them had these foods once whereas 72(70.6%) adults had twice daily. Among those who consumed Ayurveda medicines for weight reduction 32(64%) took medicines twice a day and among those consumed siddha medicines 32(80%) took medicines twice daily.

### 6. Additional treatments adopted by overweight and obese adults

Among the 192 adults, only in Siddha medicine consumers, 7.5 % took other treatments as kizhi, 55% took massage treatment and 37.5% took no other treatments.

## 7. Changes in dietary habits during medication

Changes in dietary habits of the overweight and obese adults during medication. This is given in Table IX

**TABLE XIV**  
**CHANGES IN DIETARY HABITS DURING MEDICATION**

*Dietary habits	I (102)		II (50)		III (40)	
	No	%	No	%	No	%
Limited use of cooking oil	81	79.4	43	86	36	90
Ate boiled food	82	80.3	45	90	37	92.5
Ate Higher amount of green leafy vegetables	88	86.2	43	86	34	85
Consumption of More amount of cereals and pulses	79	77.4	40	80	34	85
Consumption of fleshy foods in boiled or soup form	12	11.7	32	64	32	80

\*Multiple response

Among the adults consumed weight reducing foods, 81(79.4%) took limited use of cooking oil, 82(80.3%) ate boiled foods, 88 (86.2%) ate higher amount of green leafy vegetables, 79(77.4%) consumed more amount of cereals and pulses, 12(11.7%) consumed fleshy foods in boiled or soup form. Out of the adults consumed Ayurveda medicine for weight reduction, 43(86%) took limited use of cooking oil, 45(90%) consumed more amount of cereals and pulses, 43(86%) ate higher amount of green leafy vegetables, 40(80%) consumed fleshy foods in boiled or soup form. Among the adults consumed Siddha medicine for weight reduction, 36(90%) took limited use of

cooking oil, 37(92.5)ate boiled foods, 34(85%)ate higher amount of green leafy vegetables and more amount of cereals and pulses and 32(80%) consumed fleshy foods in boiled or soup form.

### **1. Quantity of consumption of weight reducing foods and Indigenous medicines**

The findings showed that, consumption of broken wheat was found to be 85g per day and consumption of cucumber was found to be 400g per day for weight reduction. The consumption of Thriphalachooranam was found to be 6g per day and Jalamanjarichendooram was found to be 0.8g per day for weight reduction.

### **2. Opinion regarding the benefits of weight reducing foods and indigenous medicine**

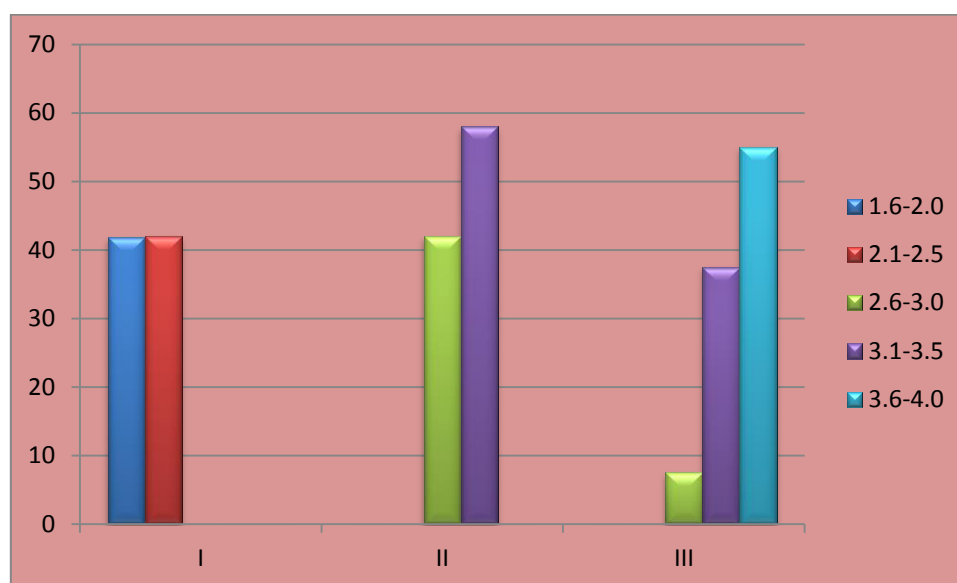
Among the 192 adults who consumed weight reducing foods, 74(72.5%) adults had reduced their weight within a period of 3 months and 28(27.5%) of them had not gained weight. Out of the 50 adults consumed Ayurveda medicine for weight reduction all the adults had reduced their weight within the same time and all the 40 adults consumed Siddha medicine for weight reduction had reduced their weight within 3 months.

### 3. Weight reduction within a period of 3 months

Weight reduction of adults who consumed weight reducing foods and indigenous medicines within a period of 3 months is given in the Table XV and Figure III

**TABLE XV**  
**WEIGHT REDUCTION WITHIN A PERIOD OF 3 MONTHS**

Reduction in weight (kg)	I(74)		II(50)		III(40)	
	No	%	No	%	No	%
1.6-2.0	31	41.8	0	0	0	0
2.1-2.5	43	42	0	0	0	0
2.6-3.0	0	0	21	42	3	7.5
3.1-3.5	0	0	29	58	15	37.5
3.6-4.0	0	0	0	0	22	55



**FIGURE III**

### **WEIGHT REDUCTION WITHIN A PERIOD OF 3 MONTHS**

Out of the 192 overweight and obese adults, 164 of them had shown a remarkable reduction in weight within months. Among them 74 adults consumed weight reducing food had reduced 1.6-2.5 kg weight within 3 months, 50 adults consumed Ayurveda medicine for weight reduction had reduced 2.6-3.5 kg weight within 3 months and 40

were consuming Siddha medicine for weight reduction had reduced 2.6-4 kg weight within 3 months.

The findings revealed that weight reduction was more seen in adults who consumed Siddha medicine for weight reduction.

#### **D. Assessment of the Quality Control Parameters of the commonly consumed samples**

##### **1. Qualitative analysis of Phytochemicals**

The details of the phytochemical constituents in the selected samples are discussed in

Table XVI

**TABLE XVI**

#### **QUALITATIVE ANALYSIS OF THE PHYTOCHEMICAL CONSTITUENTS**

Phytochemicals	Water			
	Broken wheat	Cucumber	Thriphalachooranam	Jalamanjarichendooram
Sugars	Nil	+	++	Nil
Cellulose	Nil	+	++	Nil
Alkaloids	Nil	Nil	++	Nil
Flavonoids	Nil	+	Nil	Nil
Saponins	Nil	Nil	++	Nil
Glycosides	Nil	+	++	Nil
Tannins	Nil	Nil	++	Nil
Steroids	Nil	Nil	++	Nil
Anthraquinones	Nil	Nil	++	Nil

‘+ +’- Moderate Amount; ‘+’- trace amount; Nil-Complete absence

The above table shows that Thriphalachooranam has all the phytochemical constituents except flavonoids such as sugars, cellulose, alkaloids, saponins, glycosides, tannins,

steroids and anthraquinones in moderate amounts. Cucumber was found to have only sugars, cellulose, flavonoid and glycosides in trace amount.

## 2. Total Antioxidant activity-in vitro

The FRAP value of the selected categories as follows,

**TABLE XVII**  
**TOTAL ANTIOXIDANT ACTIVITY-IN VITRO**

<b>S. No</b>	<b>Samples</b>	<b>Total Antioxidant activity (µg/g)</b>
1.	Cucumber	118.32
2.	Broken wheat	228.06
3.	Thriphalachooranam	0.465
4.	Jalamajarichendooram	105.83

The findings revealed that, out of the selected sample, broken wheat had highest FRAP value and Jalamanjarichendooram and cucumber also had high amount of FRAP value and the least FRAP value had Thriphalachooranam that is also had anti-oxidant activity.

## E. Nutrient analysis

The samples were analysed to find out the nutrient content such as carbohydrates, proteins, fats, calcium, phosphorus, iron, vitamin C, dietary fibre. The details of the analysis are presented as follows.

### 1. Nutrient content of broken wheat

**TABLE XVIII**

**NUTRIENT CONTENT OF BROKEN WHEAT**

<b>S. No</b>	<b>Nutrients</b>	<b>Per 100g</b>
1.	Moisture	3.2
2.	Ash	1.3
3.	Carbohydrate (g)	75.8
4.	Protein (g)	11.2
5.	Fat (g)	1.1
6.	Calcium (mg)	18
7.	Phosphorus (mg)	110
8.	Iron(mg)	1.8
9.	Vitamin C	0.00
10.	Dietary fibre (g)	12.4

From the above table, it was evident that the moisture and ash content were found to be 3.2g, 1.3g respectively. The amount of carbohydrate content of broken wheat was found to be 75.8g. The protein and fat content were found to be 11.2g and 1.1g respectively. The calcium, phosphorus and iron content of the broken wheat were 18 mg, 110 mg and 1.8 mg. The content of dietary fibre was found to be 12.4g.

The study findings indicated that the content of dietary fibre was higher and this may be the weight reducing component.

## 2. Nutrient content of cucumber

**TABLE XIX**

**NUTRIENT CONTENT OF CUCUMBER**

<b>S. No</b>	<b>Nutrients</b>	<b>Per 100g</b>
1.	Moisture	97
2.	Ash	0.5
3.	Carbohydrate (g)	3.63
4.	Protein (g)	0.65
5.	Fat (g)	0.11
6.	Calcium (mg)	16
7.	Phosphorus (mg)	24
8.	Iron(mg)	0.28
9.	Vitamin C (mg)	4
10.	Dietary fibre (g)	0.7

From the above table, it was clear that the moisture and ash content was found to be 97 g, 0.5g respectively. The amount of carbohydrate content of cucumber was found to be 3.63g and protein and fat content to be 0.65g and 0.11g respectively. The calcium, phosphorus and iron content of the cucumber were found to be 16 mg, 24mg and 0.28mg respectively. The vitamin C content of was found to be 4 mg. The content of dietary fibre was found to be 0.7g.

The study findings indicated that the presence of vitamin C, dietary fibre and low carbohydrate, low fat contents are the components in cucumber which contributes to weight reducing.

### 3. Nutrient content of Thriphalachooranam

**TABLE XIX**

#### **NUTRIENT CONTENT OF THRIPHALA CHOORNAM**

<b>S. No</b>	<b>Nutrients</b>	<b>Per 100g</b>
1.	Moisture	4.4
2.	Ash	8.6
3.	Carbohydrate (g)	34.0
4.	Protein (g)	44.3
5.	Fat (g)	0.0
6.	Calcium (mg)	430.0
7.	Phosphorus (mg)	238.0
8.	Iron(mg)	19.0
9.	Vitamin C (mg)	38.0
10.	Dietary fibre (g)	36.0

From the above table, it was revealed that the moisture and ash content was found to be 4.4g, 8.6g respectively. The amount of carbohydrate content of Thriphalachoornam was found to be 34g. The protein content were found to be 44.32g. The calcium, phosphorus and iron content of the Thriphalachoornam was found to be 430 mg and 238mg respectively. The content of dietary fibre was found to be 36g.

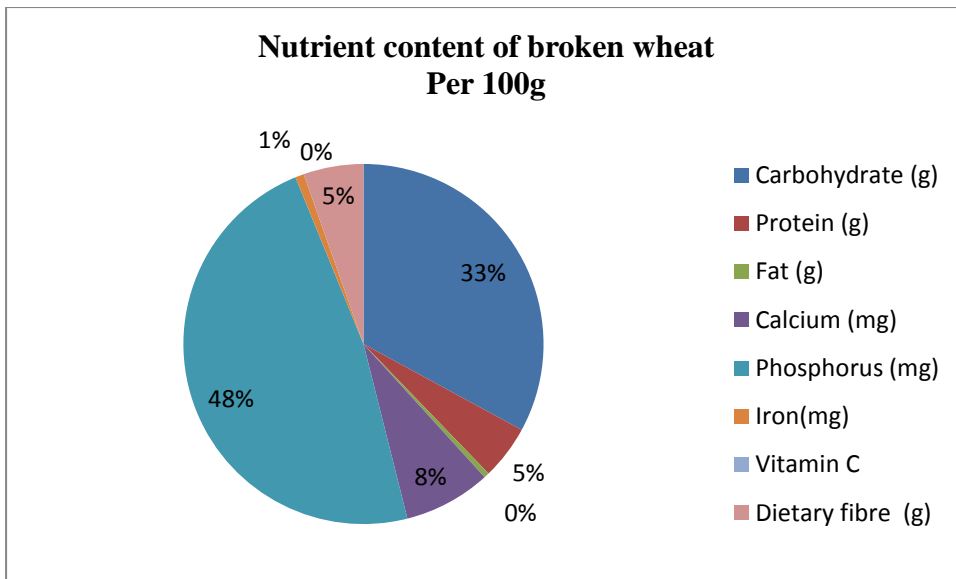
#### 4. Nutrient content of Jalamanjarichendooram

**TABLE XXI**

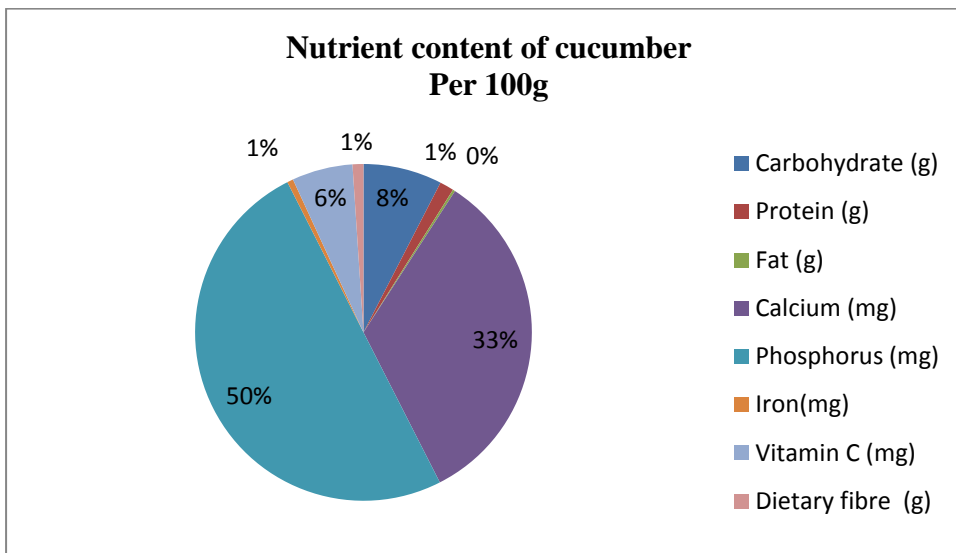
#### **NUTRIENT CONTENT OF JALAMANJARI CHENDOORAM**

<b>S. No</b>	<b>Nutrients</b>	<b>Per 100g</b>
1.	Moisture	2.1
2.	Ash	7.7
3.	Carbohydrate (g)	38.0
4.	Protein (g)	46.32
5.	Fat (g)	0.0
6.	Calcium (mg)	442.0
7.	Phosphorus (mg)	250
8.	Iron(mg)	23.0
9.	Vitamin C (mg)	40.0
10.	Dietary fibre (g)	38.0

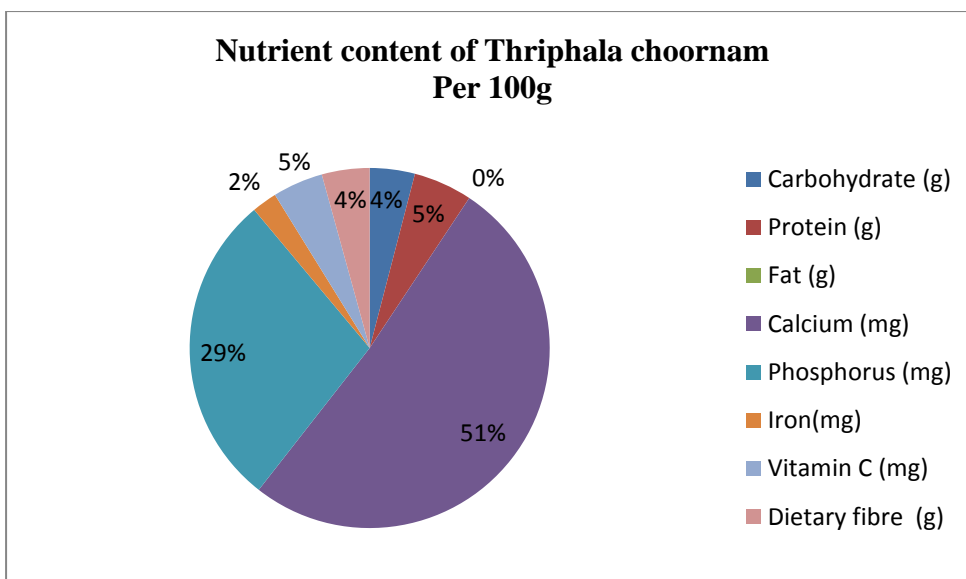
From the above table, it was seen that the moisture and ash content was found to be 2.1g, 7.7g respectively. The carbohydrate content of the Jalamanjarichendooram was found to be 38g. The protein content was found to be 46.3g. The calcium, phosphorus and iron content of the sample were found to be 442mg, 250mg and 23mg respectively. The content of dietary fibre was found to be 38g.



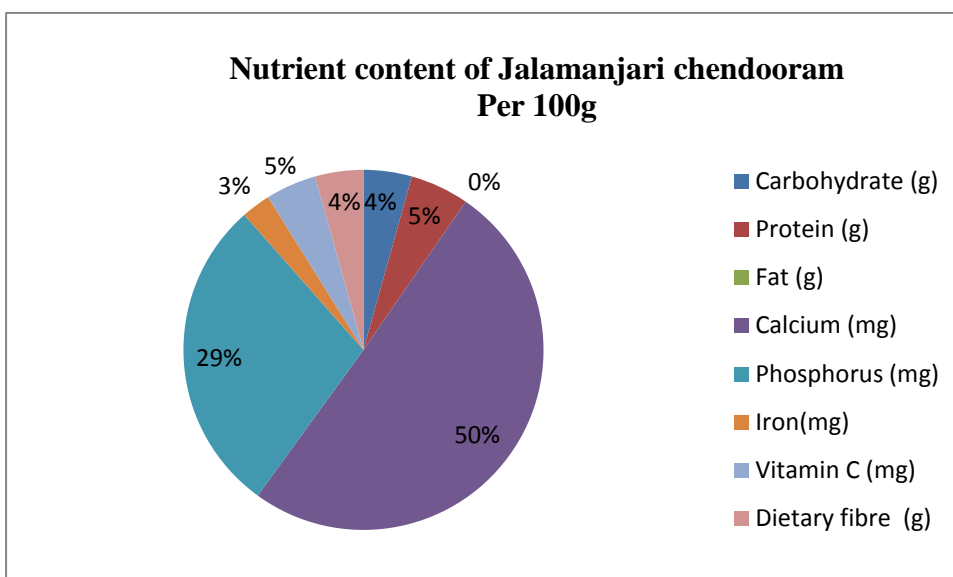
**FIGURE 3**



**FIGURE 4**



**FIGURE 5**



**FIGURE 6**

## SUMMARY AND CONCLUSION

Obesity has become the most prevalent nutritional problem in the world, and it is emerging as the most significant contributor to ill health and mortality and is affecting not only adults but also children and adolescents. Usage of indigenous medicine for the management of obesity in the recent times is attracting attention.

Therapeutic regimens employed for the long term reduction of the body weight are largely ineffective, where 90-95 per cent of people who lose weight subsequently regain it. On the other hand, dietary intake is the major modifiable factor which is responsible for the increase or decrease in body weight. Several drugs designed to treat obesity have not proven to be useful on a long-term basis, owing to the tolerance and several adverse side effects. In this respect, some indigenous medicines and natural food intake had been proven to have significant anti-obesity effects,

With this in view the study entitled “**Consumption Pattern and Analysis of Weight Reducing Foods and Indigenous Medicines among Overweight and Obese Adults**” was aimed to study the consumption pattern, identification and analysis of weight reducing foods and indigenous medicines among overweight and obese adults.

The salient features of the study are summarized below:

- Out of 97 participants belonging to the age group of 25-35 years, 52 participants consumed weight reducing foods, 18 of them took Ayurveda medicines and 27 participants consumed Siddha medicines to reduce their body weight. From the 95 participants belonging to the age group of 36-45 years, 50 participants consumed weight reducing foods, 32 participants consumed Ayurveda medicines and 13 participants consumed Siddha medicines.
- 128 adult participants had BMI above normal and were classified as overweight and 64 adult participants were categorized as obese. Out of which, 46 participants (23.9%) adult men and 82 participants (42.7%) of adult women were in the overweight category while 23 participants (12 %) of adult men and 41 participants (21.3%) of adult women were under the obese category.
- Among the 192 overweight and obese adults, 14 adults consuming weight reducing foods and 9 adults taking Ayurveda medicines were not adopting any health

measures. The remaining adults adopted regular exercise, simple movements, walking, jogging, yoga and meditation as mentioned in the above table.

- 192 overweight and obese adults studied, family history of diabetes mellitus was found among 78. Incidence of hypertension was found among 54 of the family members. High cholesterol was also found among 39 family members of the adult participants. A total of 21 persons had heart disease among family members.
- 102 adults consuming weight reducing foods, 74 adults chose to consume these foods based on dieticians advice whereas the remaining 28 chose themselves. Out of all the participants from Ayurveda and Siddha consumed medicines for weight reduction according to the doctors' advice.
- 102 overweight and obese adults, 52 (50.9%) consumed broken wheat, 54(52.9%) ate cucumber, 8(7.8%) drank green tea, 17(16.6%) ate oats, 12(11.7%) took pomegranate and 12(11.7%) consumed honey for weight reduction.
- Among 50 overweight and obese adults, 16 (32%) consumed Thriphalachoornam, 11(22%) took Varunadhikashayam, 14 consumed Lohasavam, 13 took Shuddhaguggulu, 12 consumed Ayaskrithi, 5 took Mandooravasavam, 9 consumed Lomethus, 1 took B fit capsule.
- Fourty overweight and obese adults, 19(47.5%) consumed Jalamanjarichendooram, 7(17.5%) took Mandooram and Ayakanthachendooram, 14(35%) consumed Njeringilkudineer and Vediuppuchendooram for weight reduction.
- Among the adults consuming weight reducing foods, 21(20.58%) adults took these foods for 1-3 months, 30(29.42%) took for 4-6 months and 51(50%) took for more than six months. Out of the adults consuming Ayurveda medicines for weight reduction, 49(98%) adults took medicines for 4-6 months and among those who had siddha medicines for weight reduction 35(87.5%) adults took medicines for 4-6 months.
- Out of the 102 adults who consumed weight reducing foods, 30(29.41%) of them had these foods once whereas 72(70.6%) adults had twice daily. Among those who consumed Ayurveda medicines for weight reduction 32(64%) took medicines twice a day and among those consumed siddha medicines 32(80%) took medicines twice daily.
- Among the 192 adults, only in Siddha medicine consumers, 7.5 % took other treatments as kizhi, 55% took massage treatment and 37.5% took no other treatments.

- Among the adults consumed weight reducing foods, 81(79.4%) took limited use of cooking oil, 82(80.3%) ate boiled foods, 88 (86.2%) ate higher amount of green leafy vegetables, 79(77.4%) consumed more amount of cereals and pulses, 12(11.7%) consumed fleshy foods in boiled or soup form. Out of the adults consumed Ayurveda medicine for weight reduction, 43(86%) took limited use of cooking oil, 45(90%) consumed more amount of cereals and pulses, 43(86%) ate higher amount of green leafy vegetables, 40(80%) consumed fleshy foods in boiled or soup form. Among the adults consumed Siddha medicine for weight reduction, 36(90%) took limited use of cooking oil, 37(92.5) ate boiled foods, 34(85%) ate higher amount of green leafy vegetables and more amount of cereals and pulses and 32(80%) consumed fleshy foods in boiled or soup form.
- Consumption of broken wheat was found to be 85g per day and consumption of cucumber was found to be 400g per day for weight reduction. The consumption of Thriphalachooranam was found to be 6g per day and Jalamanjarichendooram was found to be 0.8g per day for weight reduction.
- 192 adults who consumed weight reducing foods, 74(72.5%) adults had reduced their weight within a period of 3 months and 28(27.5%) of them had not gained weight. Out of the 50 adults consumed Ayurveda medicine for weight reduction all the adults had reduced their weight within the same time and all the 40 adults consumed Siddha medicine for weight reduction had reduced their weight within 3 months.
- Out of the 192 overweight and obese adults, 164 of them had shown a remarkable reduction in weight within months. Among them 74 adults consumed weight reducing foods had reduced 1.6-2.5 kg weight within 3 months, 50 adults consumed Ayurveda medicine for weight reduction had reduced 2.6-3.5 kg weight within 3 months and 40 were consuming Siddha medicine for weight reduction had reduced 2.6-4 kg weight within 3 months.
- Weight reduction was more seen in adults who consumed Siddha medicine for weight reduction.
- Thriphalachooranam has all the phytochemical constituents except flavonoids such as sugars, cellulose, alkaloids, saponins, glycosides, tannins, steroids and anthraquinones. Cucumber was found to have only sugars, cellulose, flavonoid and glycosides.

- Out of the selected sample, broken wheat had highest FRAP value and Jalamanjarichendooram and cucumber also had high amount of FRAP value and the least FRAP value had Thriphalachoornam that is also had anti-oxidant activity.
- The moisture and ash content were found to be 3.2g, 1.3g respectively. The amount of carbohydrate content of broken wheat was found to be 75.8g. The protein and fat content were found to be 11.2g and 1.1g respectively. The calcium, phosphorus and iron content of the broken wheat were 18 mg, 110 mg and 1.8 mg. The content of dietary fibre was found to be 12.4g.
- The study findings indicated that the content of dietary fibre was higher and this may be the weight reducing component.
- The moisture and ash content was found to be 97 g, 0.5g respectively. The amount of carbohydrate content of cucumber was found to be 3.63g and protein and fat content to be 0.65g and 0.11g respectively. The calcium, phosphorus and iron content of the cucumber were found to be 16 mg, 24mg and 0.28mg respectively. The vitamin C content of was found to be 4 mg. The content of dietary fibre was found to be 0.7g.
- The presence of vitamin C, dietary fibre and low carbohydrate, low fat contents are the components in cucumber which contributes to weight reducing.
- The moisture and ash content was found to be 4.4g, 8.6g respectively. The amount of carbohydrate content of Thriphalachoornam was found to be 34g. The protein content were found to be 44.32g. The calcium, phosphorus and iron content of the Thriphalachoornam was found to be 430 mg and 238mg respectively. The content of dietary fibre was found to be 36g.
- The moisture and ash content was found to be 2.1g, 7.7g respectively. The carbohydrate content of the Jalamanjarichendooram was found to be 38g. The protein content was found to be 46.3g. The calcium, phosphorus and iron content of the sample were found to be 442mg, 250mg and 23mg respectively. The content of dietary fibre was found to be 38g.

## **CONCLUSION**

From the survey it is revealed that, cucumber (A local variety with a mean weight of 200g), broken wheat are the commonly consumed foods used for weight reduction and in Ayurveda and Siddha system of medicine Triphalachoornam and Jalamanjarichendooram are commonly used for weight reduction as indigenous medicines.

The selected samples- cucumber, broken wheat, Triphalachoornam and Jalamanjarichendooram were analysed for phytochemical constituents in aqueous extract. Analysis of nutrient content of selected samples were carried out to ensure the nutritional value of the four samples. The antioxidant activity of the selected samples were analysed by FRAP method.

The phytochemical analysis showed that Triphalachoornam is rich in phenols and tannins while flavonoids were found to be absent and it also possesses antioxidant activity.

## **RECOMMENDATIONS**

1. The findings pave way for supplementation in future obesity studies.
2. More samples of medicines can be studied based on the regions or states.
3. Role of nature cure therapy along with indigenous medicines in treating obesity can be studied.

## **LIMITATIONS OF THE STUDY**

Within a limited period, Indigenous medicines participants availability is limited.

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## APPENDIX II

### INTERVIEW SCHEDULE ON CONSUMPTION PATTERN OF WEIGHT REDUCING FOODS & INDIGENOUS MEDICINES AMONG OVERWEIGHT AND OBESE ADULTS

#### A. SOCIOECONOMIC STATUS

1. Name :
2. Age :
3. Gender :
4. Qualification :
5. Occupation :
6. Family income per month (rupees) :  
a) <10,000       b) 10,000-30,000       c) > 30,000
7. Food expenditure per month (rupees) :
8. Religion :
9. Family type  
a) Nuclear family       b) Joint family
10. Place of residence  
a) Home       b) Hostel       c) others specify
11. Address :

#### B. LIFESTYLE PATTERN

12. Which oil is used in your family for cooking?  
Refined oil       Coconut oil       Groundnut oil   
Gingelly oil       Sunflower oil
13. How much oil is purchased every month in your family?  
1-3liters       3-5 liters       5 liters and above
14. How much water do you consume daily?  
7-8 glass       <7-8 glass       >7-8 glass
15. Do you have the habit of snacking while watching TV? Yes / no
16. How long you watch TV?  
30 minutes       1 hour       2 hours       >2 hours
17. Duration of sleep  
< 8 hours       8 hours       >8 hours
18. Do you have the below mentioned habits  
Smoking       Alcohol consumption       both       No
19. Do you follow dieting? Yes/ no.
20. What other health preservation strategies do you adopt on a regular basis?

Particulars	Yes	No
1. Exercise 2. Simple movements 3. Walking 4. Jogging 5. Yoga 6. Meditation 7. Any other specify		

### C. HEALTH STATUS

21. Please indicate whether you are taking treatments for any of the ailments

Sl.No.	Ailments	Taking treatment
1.	<b>Minor</b> Joint pains	
2.	Food allergy	
3.	Gastro intestinal disturbances	
4.	<b>Major</b> Obese/ over weight	
5.	Diabetes	
6.	Hypertension	
7.	Cholesterol	
8.	Atherosclerosis	
9.	Thyroid	
10.	Anaemia	

22. Do you suffer from any disorder/diseases other than the above mentioned question?

23. Do you have any of the following complications

Tiredness  Hip pain  Anorexia nervosa    
 Back pain  Sleeplessness  Asthma   
 Knee pain  Swelling  Frequent eating

24. Do you have a family history of the following?

Health problems	Family member ( Relationship )
Diabetes	
Hypertension	
Cholesterol	
Heart problem	
None	

25. Are you aware of weight reducing foods?

Yes  No  if yes specify

26. Do you take any weight reducing foods for reducing the body weight? Yes/no

If yes, specify

27. Do you take any medicines for reducing the body weight?

Yes  No

If yes, specify

28. What type of medicines do you consume to reduce weight?  
Ayurveda  Siddha  if yes specify
29. On what basis you take the Ayurveda /Siddha medicines or weight reducing foods?  
Doctor's advice  Family members & Friends influence  self
30. How long have you been taking this indigenous medicine regularly?  
1-3 months  4-6 months  >6 months
31. How many times a day do you take this?  
Once  twice  thrice
32. Do you follow any regime? Yes  No
33. What changes in eating habits are you followed?
34. Have you got any positive responses from the consumption of this medicine? Yes/no  
If yes specify

#### D. DIETARY AND FOOD CONSUMPTION PATTERN

35. Food consumption pattern (Tick the appropriate one)

- Vegetarian
- Non-vegetarian

36. Type of meal pattern followed (tick the appropriate column)?

Meal pattern	Early morning	Breakfast	Mid-morning	Lunch	Evening	Dinner
3 meal						
4 meal						
5 meal						

37. Frequency of consumption of non-vegetarian foods (mutton/chicken)?

- a) Once a week      c) Once a month      d) rarely

38. Do you skip meals? Yes/ no

If yes, breakfast/ lunch/ dinner

39. Frequency with which you skip meal?

- a) Daily      b) once/twice in a week      c) occasionally

40. Do you have the habit of drinking fresh juice every day? Yes/no

41. Do you eat snacks? Yes / no

42. Do you consume soft drinks? Yes/no

If yes,

- a) Daily      b) weekly      c) occasionally

43. Do you eat outside? Yes/no

if yes, where?

- Restaurant  Fast food stalls   
Cafeteria  Ready to eat foods

44. Do you have the habit of reading nutritional information in any snacks pack?

- Yes  No

45. 24-Hour recall

Time	Menu	Ingredients	Quantity
Early morning			
Breakfast			
Midmorning			
Lunch			
Tea time			
Dinner			
Bed time			

46. ANTHROPOMETRIC MEASUREMENTS:

- a) Height (cm) \_\_\_\_\_  
b) Weight (kg) \_\_\_\_\_  
c) BMI (kg/m<sup>2</sup>) \_\_\_\_\_

### APPENDIX III

#### PROCEDURE FOR NUTRIENT ANALYSIS

##### DETERMINATION OF FAT CONTENT

**AIM:** To determine the fat content of the food stuff.

**PRINCIPLE:** Ether extraction of the crude fat in vegetable products is carried out in a continuous extractor that is an apparatus in which the ether, after dissolving a portion of the fat of the material and discharging into the extraction flask, is volatilized, condensed and again followed to act on the material. The steps in the process are repeated continuously and automatically until the extraction is complete. The Soxhlet extraction used depends on the intermittent action of a glass siphon. The ether gradually condenses into the extraction tube containing the material until it rises to the top when it is discharged into the extraction flask.

**PROCEDURE:** The Soxhlet flask was weighed to consecutive concordant weights. 2g of the moisture free sample was packed into an extraction thimble and placed in an extractor which was fixed into a Soxhlet flask. Poured sufficient amount (150 ml) of petroleum ether so as to permit siphon action. The thimble and the contents were allowed to soak in ether for 24 hours. The entire set up was kept over an electric water bath and the extractor was connected to the condenser. The nozzle of the condenser was always plugged with moistened cotton. The temperature was maintained at 60°C. A steady stream of water in the condenser was maintained. The ether evaporated rose up but owing to the condenser arrangement, it fell back into the condenser extractor. When the extractor got filled with ether, it was siphoned back into the flask. This went on till the ether that got collected in the extractor was free from any yellow colour indicating the presence of fat. The Soxhlet flask was then disconnected and ether was evaporated in a water bath maintained at 60°C. When the ether in the flask was evaporated, the flask was weighed again to get concordant values. From the difference in weight, the fat content was calculated.

## APPENDIX IV

### ESTIMATION OF CALCIUM

**AIM:** To estimate the amount of calcium present in the given sample.

**PRINCIPLE:** Calcium is determined by precipitating it as calcium oxalate and titrating the oxalate solution in dilute sulphuric acid against standard potassium permanganate.

**APPARATUS:** Beaker, burette, pipette, flask and standard flask

#### REAGENTS:

1. Ammonium oxalate: Ammonium oxalate was dissolved in 200 ml of water till it was saturated.
2. 0.01N Oxalic acid: 0.063g Oxalic acid crystals were weighed and dissolved in 100 ml of distilled water.
3. 0.01N Potassium permanganate: 0.316g of Potassium permanganate was dissolved in 1000 ml of distilled water.
4. Strong Ammonia
5. Glacial acetic acid.
6. 2N of sulphuric acid: 5.5 ml of sulphuric acid was dissolved in 94.5 ml of distilled water.

**PROCEDURE:** Ash from the ignited sample was dissolved in hydrochloric acid and made up to the 100 ml. 10 ml of the ash solution was pipetted out in a conical flask and 90 ml of distilled water was added to it. Added 2 drops of methyl red indicator. It was made strongly alkaline by adding ammonia (colour-yellow) and kept for boiling for minutes. 20 ml of saturated ammonium oxalate was added to the solution, 10 ml of each time to ensure complete precipitation directly. When it was hot, a few drops of acetic acid was added to render the medium acidic (colour pink). The precipitate was allowed to settle overnight. The next morning the solution was filtered with Whatman No.40 filter paper. The precipitate was washed first with ammoniacal water and then with hot water several times until it was free from chloride. To test it 5 ml of the washing was collected, in a test tube and a drop of silver nitrate solution was added. The washing was continued till there was no precipitate with silver nitrate or calcium chloride solution. The filter paper was collected in a flask by making a hole in the filter

paper. To this, 2 ml of 2N sulphuric acid was added. This solution was heated to 60-80°C and when still hot was titrated against N/100 potassium permanganate solution. From the volume of potassium permanganate solution used up the milligrams of calcium present in 100g of the sample was calculated.

## APPENDIX V

### ESTIMATION OF PHOSPHORUS

**AIM:** To estimate the amount of phosphorus present in the given sample.

**PRINCIPLE:** When the ash solution is treated with ammonium molybdate, phosphomolybdic acid is formed. Phosphomolybdic acid is reduced by the addition of 1,2,4 amino naphtholsulphonic acid reagent to produce a blue colour which is apparently a mixture of oxides of molybdenum. The intensity of the colour developed is the measure of phosphorus present.

**APPARATUS:** Measuring cylinder, Klett, Test tubes, Pipette.

#### REAGENTS:

1. Molybdate solution No.I : Dissolved 25g of reagent grade ammonium molybdate in about 200 ml of water. In one litre volumetric flask 500ml of 10N sulphuric acid was added. The molybdate solution was added and was diluted with water to one litre. This solution is stable indefinitely.
2. Molybdate solution No.II : Dissolved 25g of reagent grade ammonium molybdate in about 200ml of water. In one litre volumetric flask, 300ml of 10N sulphuric acid was added and was diluted with water to one litre. This solution is stable indefinitely.
3. ANSA: 195ml of 15% sodium bisulphite solution was placed in a glass stoppered cylinder. 0.5g of 1,2,4 ANSA ( amino naphtholsulphonic acid) was added followed by 5ml of 20% sodium sulphite. Put the stopper and shook until the powder was dissolved. If the solution was not complete, added more sodium sulphite, 1 ml at a time with shaking but avoided excess. This solution was transferred to a brown glass bottle and stored in the refrigerator.
4. Stock standard phosphorus solution : 35.1 mg of pure potassium di-hydrogen phosphate is weighed and dissolved in water. Added 10ml of 10N sulphuric acid and made up to 100ml with water. Prepared a working standard containing 8 gamma of phosphorus in 1ml of the solution by making up 5ml of the standard solution to 50ml with water.

**PROCEDURE:** 0.1 ml of the ash solution was taken in two test tubes. 1ml of molybdate II and 0.4 ml of 1,2,4 Amino naphtholsulphonic acid were added and the volume was made upto 10ml with distilled water. to 1ml, 2ml, 3ml, 4ml and 5ml of standard solution, 1ml of molybdate I solution and 0.4ml of ANSA were added and made upto 10ml. All the tubes containing 10ml of the solution were mixed well and allowed to stand for 15 minutes. Simultaneously, a blank was prepared by mixing 8.6ml of water, 1ml of molybdate II and 0.4ml of ANSA. The colour developed was read in the colorimeter using red filter of wavelength 660 millimicrons.

## APPENDIX VI

### ESTIMATION OF IRON

**AIM:**To estimate the amount of iron present in 100g of the given food sample.

**PRINCIPLE:**The food sample is oxidized with ignition or oxidation. Iron as ferric iron reacts with ammonium thiocyanate or with potassium thiocyanate to give ferric thiocyanate which is red in colour. The colour which is a measure of the concentration is measured colorimetrically.

**APPARATUS:**Volumetric flask, test tubes, klett, pipette.

#### REAGENTS:

1. Stock iron solution: Dissolved 0.0702 gm (70.2mg) of reagent grade crystalline ferrous ammonium sulphate (Mohr's salt) in 100 ml of water.
2. Working standard: Prepared a working standard solution in a 100ml volumetric flask by adding 10ml of the stock solution and diluted to the mark with distilled water.
3. Saturated potassium persulphate solution: Shook 7to8 g of reagent grade potassium per sulphate in 100ml of water in a glass stoppered flask. The undissolved crystals settled to the bottom and compensates the loss by decomposition.
4. 3N Potassium thiocyanate: Dissolved 146g of reagent grade potassium thiocyanate in water and diluted to 500 ml with water. Filtered if turbid. Added 20ml of pure acetone to improve the keeping quality. Deterioration will be evident from the rapid fermentation of a yellow colour in the blank. Stored in brown bottles.

**PROCEDURE:**2g of the sample was ashed by ignition. When ashing had been completed 5 ml of hydrochloric acid was added and made up to 100 ml in a volumetric flask.

Took different aliquots of the standard solution ( 1 ml – 5ml) corresponding to 10-50 gamma in a series of test tubes. 2ml of the unknown solution was taken in the test tube. Added 1ml of 30%

H<sub>2</sub>SO<sub>4</sub>, 1ml of potassium persulphate and 1.5ml of potassium thiocyanate to all the test tubes. This was made upto 10ml with water. A blank was prepared by adding the reagents except the standard or the unknown solution. Allowed the colour to develop for 20 minutes and the intensity was read at 530-540  $\mu$  filter in the colorimeter.

## APPENDIX VII

### ESTIMATION OF NITROGEN

**AIM:** To determine the amount of nitrogen present in the given sample.

**PRINCIPLE:** The given sample is digested with concentrated sulphuric acid in a macrokjeldahl flask when nitrogen gets converted to ammonium sulphate. Ammonia is liberated by the action of strong alkali in a macrokjeldahl steam distillation apparatus. This nitrogenous substance is converted to ammonium borate by absorbing 2% boric acid and is titrated against N/70 H<sub>2</sub>SO<sub>4</sub>. The volume of acid required to bring the test sample to the colour of the blank gives the acid equivalent to the ammonia.

#### REAGENTS:

1. N/70 Sulphuric acid
2. 40% Sodium Hydroxide
3. 2% Boric acid (in warm water)
4. Digestion mixture: A mixture of copper sulphate and potassium sulphate in the ratio of 2:98
5. Concentrated Sulphuric acid
6. Mozazaga indicator: A mixture of bromocresol green and methyl red indicator in 95% alcohol in the ratio of 4:1 (80mg and 20 mg in 100 ml alcohol).

**PROCEDURE:** 0.5 g of the sample was taken into the digestion flask. To this added 15 ml of concentrated sulphuric acid and a pinch of digestion mixture as a catalyst. Kept at boiling gently over a heating mantle.

1. After digestion, the flask was cooled and the contents were transferred to a 100 ml standard flask and made upto the mark with distilled water.
2. The whole apparatus was washed with distilled water and allowed to back suck.
3. 10ml of boric acid was taken in a conical flask. A drop of indicator was added to it and kept under the condenser.
4. The tip of the condenser was well below the liquid.

5. 5 ml of the digested blank was added into the
6. Distillation chamber through the funnel. Then added 10ml of 40% NaOH. Washed the funnel with 2 to 3 ml of distilled water.
7. Closed the tap and steam was generated.
8. Steam entered the distillation chamber and drove all the ammonia which is in turn absorbed by boric acid.
9. Solution was pinkish white in colour, turned blue.
10. Steam was passed for 5 min and then the conical flask was lowered and the tip of the condenser washed.
11. The boric acid solution containing the liberated ammonia was titrated against N/70 H<sub>2</sub>SO<sub>4</sub>.
12. The end point was the appearance of pale permanent pink colour
13. Between each estimation, the apparatus was washed.
14. The experiment was repeated to get concordant values.

## **APPENDIX VIII**

### **ESTIMATION OF VITAMIN 'C' BY DYE METHOD**

**AIM:**To estimate the amount of Vitamin C present in the given sample.

**PRINCIPLE:**Vitamin C is a good reducing agent and it reduces the dye 2,6 dichlorophenol indophenols. In this reaction, the ascorbic acid itself is oxidised to dehydro ascorbic acid. In the absence of interfering substances, the capacity of an extract of the sample to reduce a standard solution of the dye as determined by titration is directly proportional to the vitamin C content. Oxalic acid is not only used to reduce the pH of the extracting medium, thereby establishing vitamin C but also form complexes with metals eg. copper thereby preventing the catalytic oxidation of vitamin.

**APPARATUS:**Centrifuge, centrifuge tubes, mortar and pestle, beakers, pipette, 100ml standard flask, burette and funnel.

#### **REAGENTS:**

1. 2,6Dichlorophenol indophenols dye: Dissolved 42 mg of sodium bicarbonate and 52 mg of 2,6 dichloro phenol indophenols in about 50 ml of water. This was diluted to 200 ml, filtered, and stored in the refrigerator.
2. 4% oxalic acid: Dissolved 4g of oxalic acid in 100ml distilled water.
3. Standard Ascorbic acid: Dissolved 100mg of pure ascorbic acid crystals in 100 ml of 4% of oxalic acid.

**STANDARISATION OF THE DYE:**Pipetted out 10 ml of the standard ascorbic acid solution into a beaker and then added 25ml of 4% oxalic acid. From this solution pipetted out 5 ml into a conical flask and placed in an ice container and the contents were titrated against the dye in the burette. The end point was the appearance of pink colour which persisted for 30 seconds. The amount of dye consumed is equivalent to the amount of ascorbic acid present.

**PROCEDURE:**5 g of the sample was weighed and soaked in 4% oxalic acid for 10 mts. This was then ground in a mortar and transferred to centrifuge tubes adding more oxalic acid. The solution was

centrifuged and the supernatant clear liquid was transferred to a 100 ml standard flask. Repeated the extraction with oxalic acid for three to four times. All the supernatants were collected in the same standard flask and this was finally made upto the mark with acid. The dye was taken in a microburette and titrated against 5 ml of the extract in a beaker. The end point was the appearance of pink colour which persisted for 30 sec. The titration was repeated till concordant values were obtained.