DEVELOPMENT AND QUALITY ASSESMENT OF HEALTH BENEFICIAL PRODUCTS MADE FROM MEDICINAL PLANTS.

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CERTIFICATE

This is to certify that **Aarti Soni** has personally completed M.Sc. dissertation entitled **"DEVELOPMENT AND QUALITY ASSESMENT OF HEALTH BENEFICIAL PRODUCTS MADE FROM MEDICINAL PLANTS"** under my guidance and supervision. To the best of my knowledge, the present work is the result of her original investigation and study. No part of dissertation has ever been submitted for any other purpose at any university.

The project report is appropriate for the submission and the partial fulfillment of the conditions for the evaluation leading to the award of Master of Nutrition and Dietetics.

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DECLARATION

I hereby declare that the work presented in Dissertation-II entitled "**DEVELOPMENT AND QUALITY ASSESMENT OF HEALTH BENEFICIAL PRODUCTS MADE FROM MEDICINAL PLANTS"** is my own and original. The work has been carried out by me at School of Agriculture, Lovely Professional University, Phagwara, Punjab, India under the guidance of **Ms. Harsha Hirdyani (17816),** Asst. Prof. of School of Agriculture, Lovely Professional University, Phagwara, Punjab, India, for the award of the degree Master of Science in Nutrition And Dietetics.

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I certified that the above statement made by the student is correct to the best of my knowledge and belief.

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Aarti Soni

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ABSTRACT

Medicinal plants were used from the ancient time as the source of medicine and healing properties. Medicinal plants having nutraceutical properties which make it effective for the use in any infection and disease according to the concept of Ayurveda.

CHAPTER -1
INTRODUCTION

Plants are the richest resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs. The use of plants and plant products as medicines could be traced as far back as the beginning of human civilization. The earliest mention of medicinal use of plants in Hindu culture is founds in "Rigveda", which is said to have been written between 4500 - 1600 B.C. and is supposed to be the oldest repository of human knowledge. The production and use of medicinal and spice plants in the organic agriculture system is an alternative to the conventional farming system, promoting environmentally friendly agricultural technologies which exclude synthetical chemicals, as well as healthy agricultural products that ensure consumers' health, environmental protection and the conservation of natural resources(Mazid *et al,*2012).

Medicinal and spice plants also have an economic importance since they can contribute to the development of sustainable agriculture in the context of natural resource depletion and constant population growth. Poverty in rural and urban areas can lead to health problems that can be treated by medicinal plants. Their high content in various active substances, such as essential oils, natural antioxidants, etc., provide natural sources for humankind's health. Nowadays there is a new, strong demand all over the world, and particularly in Europe, that has turned into a real movement concerned with obtaining food by means of clean, non-polluting technologies, free of synthetic chemicals. These food products should ensure consumers' health, environmental protection and the conservation of natural resources. Medicinal and spice plants are inexhaustible sources of raw materials for food industry, pharmaceutical industry, etc. Human beings have used natural resources since their early history. They have based their livelihood, food and clothing on plants and animals; to cure suffering, they have continuously increased their heritage of healing plants "remedies". Ayurveda, is the foundation of medicinal science of Hindu culture,

in its eight division deals with specific properties of drugs and various aspects of science of life and the art of healing. Medicinal plants are a source of great economic value all over the world. Nature has bestowed on us a very rich botanical wealth and a large number of diverse types of plants grow in different part of the country (Chadha and Gupta,1995).

Significance of Medicinal Plants

1. Many of the modern medicines are produced indirectly from medicinal plants, for example aspirin.
2. Plants are directly used as medicines by a majority of cultures around the world, for example Chinese medicine and Indian medicine.
3. Many food crops have medicinal effects, for example garlic. Medicinal plants are resources of new drugs. It is estimated there are more than 250, 000 flower plant species.
4. Studying medicinal plants helps to understand plant toxicity and protect human and animals from natural poisons.
5. Cultivation and preservation of medicinal plants protect biological diversity, for example metabolic engineering of plants (Sharma *et al,*2013)

History of Herbalism

Since the dawn of civilisation, Man utilised plants for their medicinal and edible value. By trial and error, Man distinguished between the beneficial and poisonous plants. Man also observed that in large quantities medicinal and edible plants may be poisonous, and learned about the usefulness of plants by observing animals. Sick animals utilise certain plants that they usually ignore. Today, this method is used by scientists to isolate active compounds from medicinal plants. Herbalism is thought to have started some 60,000 years ago, where pollen grains of several medicinal plants such as marshmallow (*Althaea*), yarrow (*Achillea*), ephedra and muscari were documented at burial sites at Shanidar in Iraq. This confirms the use of medicinal

plants by the Neanderthal Man. The earliest written historical information dates back to 2500 B.C. when Sumarian ideograms described the use of medicinal plants such as the poppy as the "the plant of joy" 1728 to 1686 B.C. in the Code of Hammurabi, the King of Babylon. Plants mentioned include mint, henbane, senna and licorice. It is impossible to determine at what point in time mankind first discovered the medicinal use of specific plants. With time, more documents were written or drawn and by the sixteenth century B.C. the earliest written records of practices were produced by the Egyptians, who were greatly esteemed in the ancient Mediterranean world. Medicinal plants such as fennel, castor oil, opium, thyme, linseed, aloe and myrrh, were mentioned. Some of the early uses of medicinal plants are still valid today. The first documented healer by name was Imhotep. He was so famous that after his death his stature was elevated to that of a god. During the Greek Era, knowledge on the use of medicinal plants expanded in such a way that conquered adopted skills and knowledge of various cultures to their own. Also, there was an exchange of information between professionals especially between the three great civilizations of Mesopotamia, Egypt and India. In fact, the uses of several medicinal plants are common in the Mesopotamian, Indian, Egyptian, Greek and Roman documents. Castor oil that was used as a powerful laxative, one teaspoon to two tablespoons taken in the evening. Fennel seeds that were used for their carminative, stomachic and other digestive problems, taken steeped with water, or as two drops of seed oil. Saffron was used as a carminative or to increase the blood flow. (Bhatnagar and Bisen,1996)

By 400 years B.C., Hippocrates, the father of medicine, tried to weed out the superstitions bound to health and the use of medicinal herbs. As a result, the Hippocratic writings that are anonymous, deal with several medical subjects, taken from a more logical point of view. He also tackled medicinal plants in a more scientific way than ever before. The Romans were famous for their organised administration. They were attentive to learn and put into practice what they learned. The two most important medical figures of Rome whose contributions remained the uncontested "standard" for botany and medicine were Dioscorides and Galen. By

around 50 A.D., Dioscorides described plants in a methodic way including their name, synomyms and picture, habitats, botanical description, drug actions, medicinal uses, harmful side effects, quantity and dosage, instructions on the collection, preparation and storage, adulterants and mode of detection and their veterinary uses. He classified plants on their medicinal action. He compiled works of previous herbalists and botanists in his herbal "De Materia Medica". Around 130 A.D., Galen traveled with the Roman army, like Dioscorides, and gathered information on several medicinal plants. He was the last and most important physician after Hippocrates. The Greek and Roman works were translated to the Syrian and Persian languages and the Arabs reintroduced these works in Europe, when they invaded Spain. The Arabs also introduced Chinese and Ayurveda works. Many plants with medicinal virtues are termed *officinalis*. The Latin name denotes that the plant is medicinally useful. This term dates back to the early Christian period, when monasteries were utilised as centres for the gathering and writing of information and usage of medicinal herbs. After the first millenium after Christ, several botanists and herbalists wrote on the usage of medicinal plants. Authors include Hildegarde, Albertus Magnus, Valerius Cordus, Theophrastus, Pier Andrea Mattioli, William Turner Carolus Clusius, Nicholas Culpeper and Friedrich Hoffmann extending from 1098 to 1791. Later the isolation of chemical substances from plants was commenced by Caventou and Pelletier who isolated alkaloids such as caffeine, while Geiger and Hess isolated atropine and other alkaloids dating up to 1850. Later scientists from the mid-nineteenth century to date, isolated most of the chemical constituents that we know of. Some of them are still in use in their natural form, while others are produced more efficiently by chemical synthesis, in industry (Mazid *et al,*2012)

Medicinal plants and their health benefits

Ocimum sanctum (Holy basil)

Holy Basil is one of the most widely grown herbs for therapeutic use. (Vani *et al*, 2009) The herb is used as a remedy for a variety of conditions including the common cold, headaches, stomach disorders, heart disease, inflammation, malaria, various

forms of poisoning, as well as spiritual and flavoring purposes. Previous studies on holy basil have proven the herb to be an adaptogen—it assists the body with stress and helps to normalize body functions. The essential oil of holy basil, eugenol, is thought to be responsible for such properties (Pandya *et al*, 2011)

Zingiber officinale **(Ginger)**

Ginger has been used by traditional Chinese and Indian medicine for over 25 centuries. (Evans *et al* 1989)

It has been claimed to decrease the pain from arthritis, though studies have been inconsistent. It may also have blood thinning and cholesterol lowering properties that may make it useful for treating heart disease. Preliminary research also indicates that nine compounds found in ginger may bind to human serotonin receptors, possibly helping to affect anxiety. Ginger has been found effective in multiple studies for treating nausea caused by seasickness, morning sickness and chemotherapy, though ginger was not found superior over a placebo for treating post-operative nausea. Ginger is a safe remedy for nausea relief during pregnancy**.** (Malhotra and Singh, 2003)

Citrus deliciosa **(Kinnow)**

Kinnow mandarin is quite popular as it has a greater variety of beverage. It is also used for industrial and medicinal purpose due to its attractive colour, distinctive flavour and being rich source of vitamin 'C', vitamin 'B', β- carotene, calcium and phosphorus. (Sogi *et al*, 2001). Kinnow is also good for the individual with high blood pressure so help in various cardiovascular diseases. also used in the treatment of various gastrointestinal problems. (Bhardwaj and Mukherjee , 2011)

Citrus limetta **(Sweet lime)**

Fresh lime juice possesses medicinal property which is well known from ancient ages in India. It is also called as sacred fruit in the Vedas The vitamin C as a primary component of the lime juice increases the resistance of individuals to several diseases, helps in wound healing and increases the health of eyes. It improves the maintenance

of good dentition of bones and bleeding of the gums (Room, 1986)

Citrus fruits are rich in flavonoids and limonoids which are known to possess antitumor and anti-inflammatory activities. As flavanoids act as antiviral , antifungal and antibacterial agent so it is also a very good source of phytochemical and used a medicinal fruit. (Gattuso *et al,* 2007)

Juice blending is one of the best methods to improve the nutritional quality of the juice. It can improve the vitamin and mineral content depending on the kind and quality of fruits and vegetables used (De Carvalho et al., 2007). Apart from nutritional quality improvement, blended juice can be improved in its effects among the variables, thus it cannot depict the net effects of various parameters on the reaction rate. Moreover, fruits can be blended with the objective of a new product development in the form of a natural health drink, which may also be served as an appetizer.

CHAPTER -2

LIST OF ABBREVIATIONS

g = Gram

µg = Micro gram

kg = Kilogram

˚C = Degree Celsius

Fig. = Figure

% = Per cent

g/lt = Gram per litre

g/ml = Gram per milliliter

et al. = And others

i.e. = That is

etc. = Et cetera

ml = Milliliter

RTS = Ready to serve

CHAPTER: 2

REVIEW OF LITERATURE

The current status of the medicinal plant used in India which support the primary health and care of the population. However many medicinal plants are used for the tribal and folk medicines. The use of medicinal plants in India is very less in comparison with the benefits and treatment of various serious diseases ,also the propagation and production of these medicinal plants as a good reservoir of health is very less as per the availability sources in India is much vast as compare to other Asian country . The production level of these medicinal plants should be increased because these medicinal plants are also exported from India to various Asian countries the future guidelines of this study indicates that the use of herbal plants as a health benefit is not only the cost effective but also safe and almost free from the various serious side effects. The use of these medicinal plants also should increase because of the availability is more in India. Efforts have been taken in India for the cultivation and utilization of various medicinal plants. (Mazid *et al*, 2012)

Pandey *et al* in 2011 studied that medicinal plants derived nutraceuticals, have great importance in the field of nutraceuticals. Plant derived nutraceuticals are of great importance in present system of Medicine and Healthcare. Future demand of nutraceutical depends upon consumer perception of mankind and the relationship between diet and disease. Although nutraceuticals and functional food have significant role in the promotion and care of human health to prevent diseases, the health professionals, nutritionists, biotechnologists, regulatory toxicologist and nutraceutical industrialist should strategically work together to plan appropriate regulation to provide the ultimate health and therapeutic benefits to mankind with purity, efficacy, and safety. The knowledge of herbals has accumulated over thousands of years and today we have many effective means of ensuring health care. Numerous nutraceuticals are present in medicinal herbs as key components. A great attention has,

now a day's, been given to discover the link between dietary nutrients and disease prevention. Large number of herbs, which had been in use since ancient time, have been shown to play a crucial role in the prevention of disease. In addition to the macro and micro nutrients such as proteins, fats, carbohydrates, vitamins or minerals necessary for normal metabolism, a plant based diet contains numerous non-nutritive phyto-constituents which may also play an important role in health enhancement.

Rathore *et al* in 2010 concluded in his research that, natural products from dietary components such as medicinal plants and Indian spices known to possess antioxidant activity and this may also include gene therapy to produce more antioxidants in the body.

Medicinal plants and probiotics both have very high potential in terms of their antimicrobial activity against antibiotic-resistant enteric pathogens. The probiotics being enteric microorganism do not have any parasitic effect on human beings. They have been an integral part of daily food for centuries. They have been shown to have health beneficiary properties (Bose *et al*, 2012)

Karmakar *et al* in 2012 proved with his study that combining the effect of medicinal plant extract and probiotics may be a new approach due to their complementary antimicrobial effects and practically no side effects. The synergistic effect of the essential oil and probiotics will be necessarily higher than using them alone as health product. Medicinal plants and herd extracts also have great importance in antibacterial activity, these extracts show positive effects and relations with many food borne bacteria (Bacillus cereus, Listeria monocytogenes, Staphylococcus aureus, Escherichia coli, and Salmonella anatum). Many herb and spice extracts contained high levels of phenolics and exhibited antibacterial activity against food borne pathogens. Gram-positive bacteria were generally more sensitive to the tested extracts than Gram-negative ones.

Schilter *et al* in 2003 studied that the usage of herbal and medicine plants in food production were having a great importance. There is a growing interest by both consumers and industry for the development of food products with 'functional' properties, or health benefits. These products may take the form of dietary supplements or of foods. The health benefits are given by particular ingredients, and in many cases these are derived from botanicals. The variety of plants providing these functions is large, ranging from staple food sources such as cereals, fruits and vegetables, to herbals as used in traditional medicine. The scientific literature is abundant with articles not only on the beneficial properties, but also on possible adverse health effects of plants and their components. The present report discusses by the data required to determine the safe use of these types of ingredients, and provides advice on the development of risk assessment strategies consistent with due diligence under existing food regulations. Product specifications, composition and characterization of standardised and authentic materials, documented history of use and comparison to existing products (taking into account the effect of industrial processing), description of the intended use and consequent exposure are highlighted as key background information on which to base a risk evaluation. The extent of experimental investigation required, such as in vitro, animal, and/or human studies, depends on the adequacy of this information. . A lower safety margin may therefore be expected than for food ingredients or additives where no physiological effects are intended. In rare cases, post launch monitoring programmes may be envisaged to confirm expected exposures and adequacy of the safety margin.

Peters *et al* in 2013 Nutritional therapy and phyto-therapy have emerged as new concepts of health aid in recent years. Strong recommendations for consumption of nutraceuticals from plant origin have become progressively popular to improve health, and to prevent and treat diseases. Nutraceuticals are "naturally derived bioactive compounds that are found in foods, dietary supplements and herbal products, and have health promoting, disease preventing and medicinal properties."

Dennehy *et al* in 2013 found that, plant derived Nutraceuticals/functional foods have received considerable attention because of their presumed safety and potential nutritional and therapeutic effects. Some popular phyto-nutraceuticals include glucosamine from ginseng, Omega-3 fatty acids from linseed, Epigallocatechin gallate from green tea, lycopene form tomato etc. Majority of the nutraceuticals are claimed to possess multiple therapeutic benefits though substantial evidence is lacking for the benefits as well as unwanted effects. With these trends, improvement of the dietary nutritional values of fruits, vegetables and other crops or enhancement of the bioactive components in folk herbals have become the targets of blooming plant biotechnology industries. The Phyto-nutrients are unique substances occur naturally in plants, have been found to hold specific and powerful disease preventing possibilities. Both essential and nonessential phyto-nutrients should be considered as bioactive food components based on the specific physiological function they impart, including characterization of their metabolic and physiological functions and associated targets, and biomarkers

A study is based on the use of natural plants in chronic pain conditions, such as neuropathic pain was conducted. Despite the large number of drugs available, the adherence is limited by the large range of side effects and pharmacological ineffectiveness. Thus, the search for new chemical entities that can act as promising molecules to treat chronic pain conditions has emerged. The natural products remain as the most promising sources of new chemical entities with applicability for the medical approach. He performed a systematic review analysing pre-clinical studies shown to be promising in a possible applicability in neuropathic pain. The search terms neuropathic pain, phytotherapy and medicinal plants were used to retrieve the chronic pains. (Quintan *et al* 2013)

Health benefits of the medicinal plants used

***Ocimum sanctum* (Holy Basil)**

"The Queen of Herbs" - is the most sacred herb of India. Tulsi (Ocimum sanctum), although also known as Holy Basil, is a different plant from the pesto variety of Basil (Ocimum basilicum). Tulsi has been revered in India for over five thousand years, as a healing balm for body, mind and spirit, and is known to bestow an amazing number of health benefits. Some of Tulsi effects are quite immediate, while others develop gradually after weeks of regular use. Although Tulsi has many specific effects on different body systems, its main benefits arise from its impressive general capacity to assist the body's natural process of healing and maintaining health. Tulsi overall health promotion and disease prevention effects are powerful, but often subtle. Recent studies suggest tulsi may be a (cyclooxygenase-2) COX-2 inhibitor, like many modern painkillers, due to its high concentration of eugenol (Prakash *et al* 2005). One small study showed it to reduce blood glucose levels in type 2 diabetics when combined with hypoglycemic drugs (Rai *et al*, 1997). The same study showed significant reduction in total cholesterol levels with tulsi. Another study showed its beneficial effect on blood glucose levels is due to its antioxidant properties (Sethi et al 2004). Tulsi also shows some promise for protection from radiation poisoning (Devi *et al* 1999) and cataracts (Sharma *et al* 1998). It has anti-oxidant properties and can repair cells damaged by exposure to radiation. The fixed oil has demonstrated antihyperlipidemic and cardioprotective effects in rats fed a high fat diet (Suanarunsawat *et al*, 2010). Experimental studies have shown an alcoholic extract of tulsi modulates immunity, thus promoting immune system function (Mondal *et al*, 2011). Some of the main chemical constituents of tulsi are: oleanolic acid, ursolic acid, rosmarinic acid, eugenol, carvacrol, linalool, β-caryophyllene (about 8%), β-elemene (c.11.0%), and germacrene D (about 2%). β-Elemene has been studied for its potential anticancer properties, but human clinical trials have yet to confirm its effectiveness. O. sanctum extracts acts against E. coli, S. aureus and P. aeruginosa (Golshahi *et al*, 2011).

It is also very effective in the treatment of respiratory disorders. Leaves of tulsi with honey and ginger is an effective remedy for bronchitis, asthma, influenza and common cold. Basil leaves are also regarded as anti – stress agents. Recent studies proved that the significant effect or the protection against stress by the use of basil leaves. Even healthy person can chew 12 leaves of basil, twice a day, to prevent stress and is also beneficial in headaches. (Khogare *et al,* 2011)

Tulsi is act as an anti hyperglycaemic agent. A study was done to calculate the quantitative and qualitative effect of tulsi on blood glucose level, the result shows that there is decrease in the level of blood glucose when tulsi was taken in the diet. The investigation shows that there is beneficial effect of tulsi in hyperglycaemic states and there is a significant fall on blood glucose, blood urea, serum cholesterol and serum triglycerides. (Khogare *et al*, 2011)

Zingiber officinale **(Ginger)**

The active components of ginger is reported to stimulate digestion, absorption, relieve constipation and flatulence by increasing muscular activity in the digestive tract. The effectiveness of ginger (940 mg) in motion sickness was compared to that of dimenhydrinate (100 mg) in 18 male and 18 female college students, who were self rated as having extreme or very high susceptibility to motion sickness. (Tanabe *et al*, 1993)

In addition, a double blind study in 27 pregnant women suffering from morning sickness demonstrated that oral administration of 250 mg of powdered ginger 4 times daily over 4 days significantly reduced symptoms of nausea and vomiting (Yamahara *et al* 1989). Ginger has strong antibacterial and to some extent antifungal properties. In vitro studies have shown that active constituents of ginger inhibit multiplication of colon bacteria. These bacteria ferment undigested carbohydrates causing flatulence. This can be counteracted with ginger. It inhibits the growth of Escherichia coli, Proteus sp, Staphylococci, Streptococci and Salmonella (Ody *et al* 2000).

In traditional Chinese medicine, ginger is used to improve the flow of body fluids. It

stimulates blood circulation throughout the body by powerful stimulatory effect on the heart muscle and by diluting blood (Mowery *et al*, 2982). The improved circulation is believed to increase the cellular metabolic activity, thus contributing to the relief of cramps and tension. A Japanese study showed that active constituents in ginger reduced the blood pressure and decreased cardiac workload. Ginger reduced the formation of proinflammatory prostaglandins and thromboxane thus lowering the clotting ability of the blood. The inhibition of platelet aggregation by ginger mis more than the similar effects observed with garlic and onion (Kobayashi *et al*, 1988). Ginger can prevent the increase in cholesterol levels following intake of cholesterol-rich diet. Ginger is also known to possess antioxidant properties.

Several pieces of evidence, mainly from rat studies, have suggested that ginger exerts many direct and indirect effects on blood pressure and heart rate (James *et al*, 1999). Ghayur and Gilani in 2005 reported that the crude extract of ginger induced a dose-dependent (0.3–3 mg/kg) fall in the arterial blood pressure of anesthetized rats.

***Citrus deliciosa* (Kinnow)**

Kinnow mandarin is quite important as it has a great variety of beverage, industrial and medicinal uses due to its attractive colour, distinctive flavour and being rich source of vitamin 'C', vitamin 'B', β-carotene, calcium and phosphorous (Sogi and Singh, 2001). Kinnow mandarin juice turns bitter after extraction due to conversion of limonate-a-ring-lactone (non-bitter) to limonin (bitter compound) during storage (Premi et al., 1994), and makes the processing of this fruit limited. For improving the taste, aroma, palatability, nutritive value and reducing bitterness kinnow juice was blended with some other highly nutritive fruit juices namely pomegranate and Amla juice with spice extracts like ginger. All these fruits are valued very much for their refreshing juice with nutritional, medicinal properties and ginger juice also have anti-bacterial and anti-fungal properties.

Various citrus fruits have prominent effect on pathogenic micro-organisms, the effect of various fruits on four pathogenic bacteria isolated from human suffering from

wound infections. *Citrus limmone* and citrus limetta has highest antibacterial activity. Sweet lime also shows effective actions against the bacterial growth . The wide spectrum of these fruits against bacterial growth qualify them for their use as medicinal fruits. Ponia *et al*, 2012.

Nambiar *et al* observed that *Cymbopogon ciratus* is well known for its uses in unani and ayurvedic medicines . It is rich in vitamin and mineral content and having good amount of fiber, active phytochemicals , flavonoids , terpinoids, carotenoids and saponin. Study conclude that there is good therapeutic effect on the Indian population and also the fruit promote good antioxidant defense mechanism for human body.

Citrus limetta **(Sweet lime)**

Fresh lime juice possess medicinal property which is well known from ancient ages in India. The vitamin C as a primary component of the lime juice increases the resistance of individuals to several diseases, helps in wound healing and increases the health of eyes. It improves the maintenance of good dentition and keeps away toothache, dental caries, swollen gums, fragility of bones and bleeding of the gums. (Room, 1986)

Lime is vital in the treatment of gastric disorders like indigestion, constipation and peptic ulcer. It stops the occurrence of indigestion, burning in the chest due to high acidity in the stomach, abrupt bilious vomiting and excessive accumulation of saliva in the mouth. Lime juice with a pinch of soda bicarb mixed in water improves indigestion and gastric upset due to severe acidity after heavy rich/ spicy meals. It can also be used as carminative in indigestion and sedation is produced by release of carbonic acid and gas. In chronic constipation by promoting biliary secretion from the liver, it improves intestinal motility. Acidic juice of the fruit acts as curative for tonsillitis. Oral ingestion of lime juice mixed with salt in water provides relief from burning sensation and also stops bleeding in cystitis (inflammation of urinary bladder) (Raichlen *et al*, 1992)

Blending of fruit juices

Juice blending is one of the best methods to improve the nutritional quality of the juice. It can improve the vitamin and mineral content depending on the kind and quality of fruits and vegetables used (De Carvalho et al., 2007). The quality of juices depend upon processing and storage procedures.

Sethi in 2004 conceptualized that fruit drink based on ayurvedic formulations has great medicinal and therapeutic value for an individual and also evaluate that there are different fruit drinks or herbal drinks according to the seasonal requirement for an individual. There are many fruit drinks or RTS beverages of ayurveda has been made or utilized for the health benefits of an individual.

Bhardwaj and Mukherjee ,2010. developed different ratios of juice blends of kinnow , ginger, amla has been prepared and tested for the storage study by adding preservative potassium meta bi-sulphite and also studies had been conducted to detect the flavour , palatability , nutritive value and medicinal value. There was very less non enzymatic browning in case of ginger juice. Lemon in the juice increase the storage period of the juices by reducing their microbial growth and also the products are rich in antioxidant values so has very good medicinal effect.

Parkash *et al in* 2014 compare the Organoleptic properties of various Indian culinary herbs and are analyzed statistically which conclude that the ginger mint tea having good organoleptic property and overall acceptability and act as a potent health and energy drink.

CHAPTER 3

RATIONALE AND SCOPE OF THE STUDY

Utilization of the medicinal plants in diet or by incorporation and optimizing their use in dietary products an individual will get all the benefits related to health and also reduces the risk of serious diseases like diabetes and other cardiovascular diseases. There is increase production of natural plants which have great medicinal effects example Indian spices, herbs and various fruits but there is huge under utilization of their medicinal value. The main objective is to study the benefits of these medicinal plants and to make a valuable product by using their one part either leaves or fruit which provide the overall health and also good in taste. By studying the various aspects of these plants it can be concluded that these medicinal plants have very good nutraceutical properties and if utilized in the formation of health related products will be of great importance to the community.

CHAPTER -4

OBJECTIVES OF THE STUDY

1. Development of value added health drinks using medicinal plants
2. Organoleptic evaluation of the developed products
3. Nutritional evaluation of the developed products.
4. Shelf life study of the developed products.

CHAPTER- 5

EQUIPMENT, MATERIALS AND EXPERIMENTAL SETUP

EQUIPMENT

1. Spectrophotometer
2. refractometer
3. pH meter
4. Hot air oven
5. Centrifuging machine

MATERIAL USED

1. Holy basil **(*Ocimum Sanctum*)**
2. Ginger **(*Zingiber officinale)***
3. Kinnow **(*Citrus deliciosa)***
4. Sweet lime**(*Citrus Limmone*)**

CHAPTER 6
METHODOLOGY

The present investigation entitled "Development and quality assessment of health beneficial products made from medicinal plants" was conducted in the Post-graduate laboratory of Department of Food Technology and Nutrition, Lovely professional university, Punjab.

The most fundamental step in research is to develop a systematic plan for investigation. Hence this chapter contains relevant information pertaining to the research design. It includes the methodological aspect such as selection of tools, procedure of data collection and other techniques of statistical analysis in order to achieve all objectives of the present investigation.

The present study was conducted in the following phases:

1 Procurement of materials

2 Selection of new product ready to serve Beverage

3 Selection of Base fruits and effective medicinal value plants holy Basil and Ginger

4 Product development

5 Organoleptic evaluation

6 Biochemical evaluation

7 Statistical analysis

6.1 Procurement of raw material.

Planting of holy basil: The collection was done from Phagwara Punjab,and planted in the university campus. These were then utilized to form the product Ready to serve beverages were prepared using the other fruits which has been purchased from Jalandhar Punjab .Type of fruit used have an effective medicinal value which were highlighted in the literature review.

Figure 6.1- Plants of Holy Basil

6.2 Extraction of juice from holy basil : Fresh holy basil leaves were washed and then blended in pestle mortar .The thick paste was used to extract the juice with the help of distilled water and musclin cloth . Appropriate quantity of that juice was then used in different ratios in the preparation of the RTS drink

6.3 Kinnow RTS with basil and ginger: Fully matured, freshly harvested kinnow were purchased from the local market of Jalandhar, to make the RTS . **G**inger fruit was first cut into small pieces and then blended very finely in a pestle mortar. Juice was extracted using distilled water. Appropriate amount of this juice and sugar syrup was used in the formulation of kinnow based beverage

6.4 Sweet lime RTS with basil and ginger: Fully matured freshly harvested sweet lime were purchased from the local market of Jalandhar and RTS beverage was prepared by extracting juice from fresh ginger and mix with the appropriate amount of sugar syrup and basil extract and was used in the formulation of sweet lime based

6.5.1 Preparation of juice blends :

Product were formed and optimized, using suitable combinations of the fruit combination of medicinal herb basil , ginger, kinnow and Sweet lime . Different set of ratios were combined and the resulting products were subjected to sensory evaluation.The best accepted 2 concentrations of each of the fruit blends considered as the final product. The quantity of ginger, and sugar syrup was kept same and Kinnow and lime were used as a base juices.

Figure 6.5- RTS Drinks (made up of Medicinal plants)

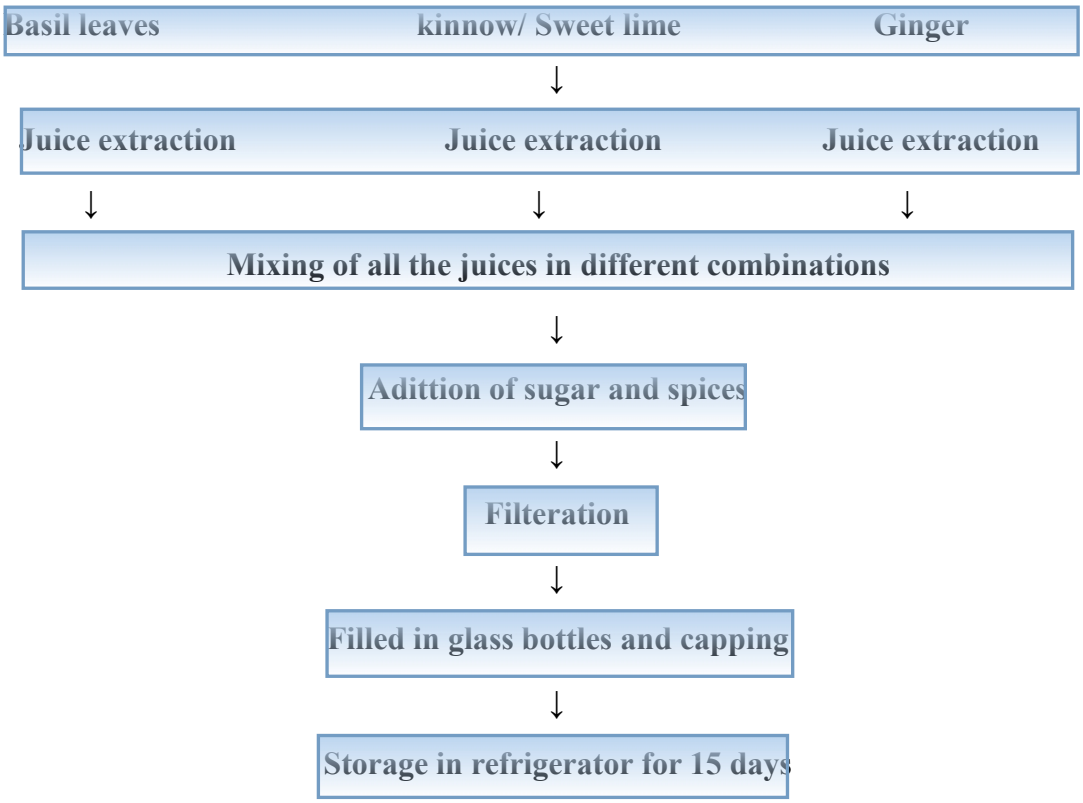
10% KB and 15% KB were formulated by using the different concentrations of basil with fuit base kinnow . To formulate kinnow RTS , the extracted juice from basil , ginger and sugar syrup were used . simillarly10% CB and 15% CB were made with the samer procedure but the base was different i.e. Sweet lime.

Samples	Basil extract	Kinnow juice	Lime juice	Ginger extract	Sugar syrup	Total volume
KB 10%	10ml	40ml	—	5ml	45ml	100ml
KB 15%	15ml	35ml	—	5ml	45ml	100ml
CB 10%	10ml	—	40ml	5ml	45ml	100ml
CB 15%	15ml	—	35ml	5ml	45ml	100ml

6.5.2 Product formulation procedure: The RTS beverage thus was refrigerated for 15 days in glass bottles at 4°C.The RTS beverages were then evaluated for the nutritional, physicochemical and sensory parameters at 0 day, 5th day, 10th day and 15th day

Figure- 6.5.2
Juice blends of the products along with sugar syrup for the formulation of RTS

Prepration method of juices from basil leaves, ginger and Kinnow/Sweet lime



6.6 Sensory analysis:

Sensory evaluation is a scientific discipline that applies principles of experimental design and statistical analysis to the use of human senses (sight, smell, taste, touch and hearing) for the purpose of evaluating consumer products. The discipline requires panels of human assessors, on whom the products are tested, and recording the responses made by them. Product is analyzed on the basis of many attributes such as appearance color, flavor (odor and taste), mouth feel, consistency, texture etc.. By applying statistical techniques to the results it is possible to make interferences and insights about the products under test.

6.7 Determination of total soluble solids:

Clear liquid products The formulated products were thoroughly mixed and a small quantity of the solution was put on the fixed prism of the refractometer and intermediately adjusted .Suitably illuminated the field view ,the line dividing the light

and dark parts of the surface in the field view of crossing of the threads and read the value of refractive index.

6.8 Ascorbic acid test:

Vitamin C content of fruit juice was determined by titration. Juice blends or samples of different ratio was taken and titrated it with iodine or Iodate salts for the determination of vitamin C content in the RTS beverage. The Ascorbic acid content in fruits and vegetables was estimated by macerating the sample with stabilising agents such as 20% Metaphosphoric acid.

Reagents used were standard indophenol solution was used in the testing of vitamin C content ,Standard ascorbic acid solution, Metaphosphoric acid and Acetone reagents were used in the chemical evaluation of the RTS i.e. Ascorbic acid value.

Standardization of dye: pipette 10 ml of standard ascorbic acid solution in a small flask and titrated it with indophenol solution until a faint pink colour persist for 15 seconds. Express the concentration as m,g Ascorbic scid equivalent to 1 ml of dye solution i.e 10ml of Ascorbic acid solution = 0.002 gm ascorbic acid .

Procedure : Pipette 50 ml of unconcentrated juice into a 100ml volumetric flask and then25 ml of 20% metaphosphoric acid was added to it which act as a stablizing agent and diluted to volume . Pipette10 ml in a flask and add 2.5 ml acetone . Titrate it with indolphenol solution until a faint pink colour persist for 15 seconds.

6.9 Determination of titrable acidity:

Take 10 gm well mixed juice , diluted to 250ml with neutralized or recently boiled water. Titration was done with 0.1N NaOH , 0.3ml phenolpthlein for each 100ml of the solution to pink. End point remain for 30 seconds.

6.10 Determination of antioxidant activity:

Free radical scavenging activity of extracts was measured by: the evaluation of the free radical - scavenging effect on the1,1-diphenyl-2-picrylhydrazyl radical. An aliquot of fruit extract will mixed with 3.9 ml of 0.1 mM DPPH methanol solution . The mixture will thoroughly mixed and kept in the dark for 30 minutes. The absorbance wasl measured later,at 515 nm, against a blank of methanol without DPPH.

6.11 Determination of pH: pH testing was done with the help of pH meter. Reading was taken at the interval of every 5 days of testing to check the variation in the acidity and the basicity of the product.

6.12 Determination of Total Flavonoids:

Ten gram of sample was extracted repeatedly with 100 ml of 80 per cent aqueous methanol at room temperature . The whole solution was filtered through whatman filter paper no.42(125mm). The filtrate was later transferred in to a crucible and evaporated to dryness over a water bath and weighed . The flavonoid was calculated in per cent.

6.13 Storage studies:

Beverage was subjected to storage studies at 4 degree celcius in refrigrator for a period of 10 to 15 days by drawing samples after 5 days to evaluate the changes in chemical and organoleptic parameters.

6.14 Statistical analysis:

The experiments were carried out in triplicates and the data so obtained was subjected to mean and standard deviation between the different samples and were documented

CHAPTETR - 7
RESULTS AND DISCUSSION

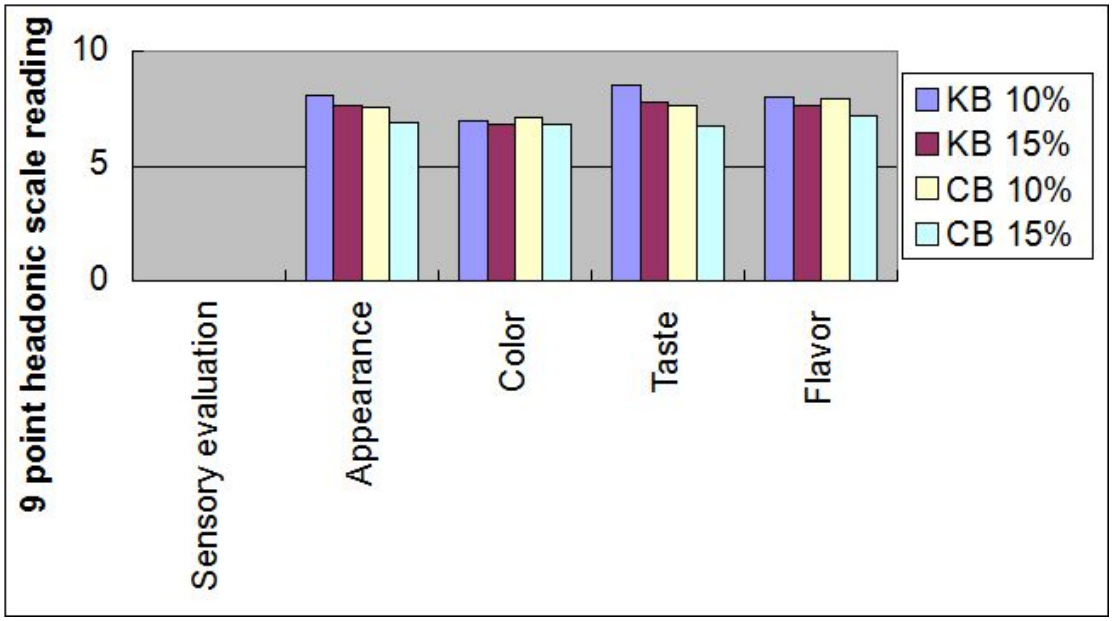
The present study **"**Development and quality assessment of health beneficial products made from medicinal plants." was conducted in the Department of Food Technology and Nutrition, Lovely Professional University, Phagwara, Punjab during the year 2014-2015. In the light of available literature, pertinent results are discussed under the following subheads:

- Formulation of products
- Sensory evaluation
- Physicochemical evaluation of products developed
- Storage studies
- Overall acceptability

7.1Sensory evaluation

TABLE 7.1.1

Parameter Sensory evaluation	**KB 10%**	**KB 15%**	**CB 10%**	**CB 15%**
Appearance	8.05±0.7	7.6±0.65	7.55±0.5	6.9±0.61
Color	7±0.52	6.85±0.66	7.1±0.5	6.8±0.58
Taste	8.5 ± 0.47	7.8 ± 0.58	7.65 ± 0.52	6.75 ± 0.54
Flavor	8±0.6	7.6±0.39	7.9±0.61	7.2±0.67



Overall sensory score of all the four combinations were formed to be acceptable as shown in table 7.1.1. The intention was to incorporate the maximum possible quality of basil extract in the juice mixture with higher sensory scores and adjustment of acidity to get good taste . It was observed that highest sensory score of KB 10% was

obtained with maximum incorporation of basil extract in juice blend.

7.2 Overall Acceptance : The product overall acceptability in terms of sensory evaluation depict the product acceptance according its color, flavor, taste and appearance all these parameters indicate the products were accepted by the panel of judges as per the 9 point headonic scale readings. All the products of different concentrations were liked by the consumer in order of their taste appearance and flavor. The best accepted product in comparison to all the three different concentrations was KB 10%.

7.3 Evaluation of chemical properties of the RTS

Table7. 3.1:pH of the RTS

pH	KB10%	KB 15%	CB 10%	CB 15%
Day 0	5.49 ± 0.13	5.35 ± 0.05	5.18 ± 0.05	5.2 ± 0.01
Day 5	3.19 ± 0.01	3.37 ± 0.04	3.5 ± 0.02	3.63 ± 0.2
Day 10	2.35 ± 0.05	2.50 ± 0.01	2.77 ± 0.017	2.37 ± 0.06

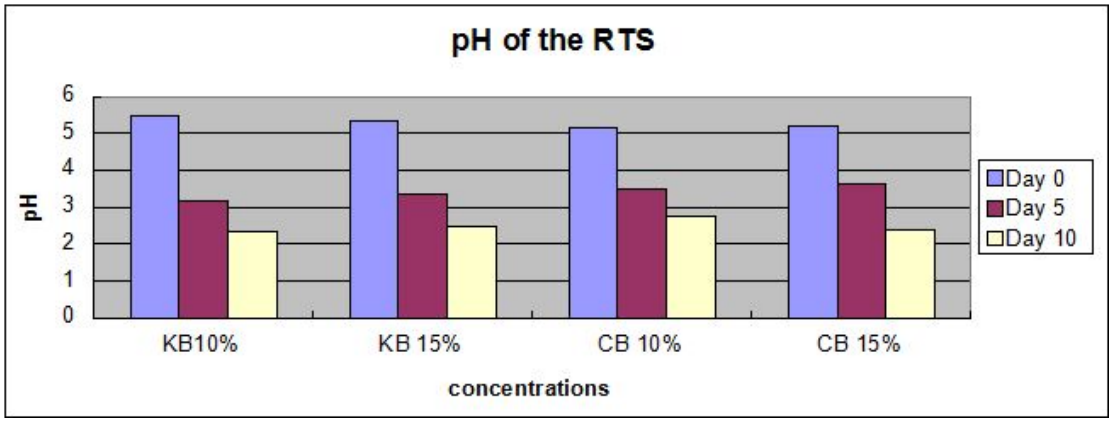


Table 7.3.1 depicts the pH of all the four samples i.e.KB 10%, KB15%,. CB10%, CB15% was slightly varied from day 1 to day 10 . The pH of the samples was in decreasing order as compared through chart and columns.decreased pH indicates the higher level of acidity. There are significant statistical differences($p<0.05$) among the pH of the RTS of different concentrations.pH plays important role or as a very good factor in the preservation and describes the stability of bioactive compound in fruit juice, also plays important role in the flavour of the fruit juice(Hashem et al; 2014)

Table 7.3.2: Ascorbic acid value

Parameter Ascorbic acid	KB 10%	KB 15%	CB 10%	CB 15%
Day 0	52.66 ± 0.52	39.26 ± 0.40	46.7 ± 1.8	38.04 ± 4.6
Day 5	45.35 ± 0.34	32.60 ± 0.37	42.4 ± 0.32	33.54 ± 0.17
Day 10	38.54 ± 0.17	25.35 ± 0.22	35.44 ± 0.22	26.7 ± 0.22

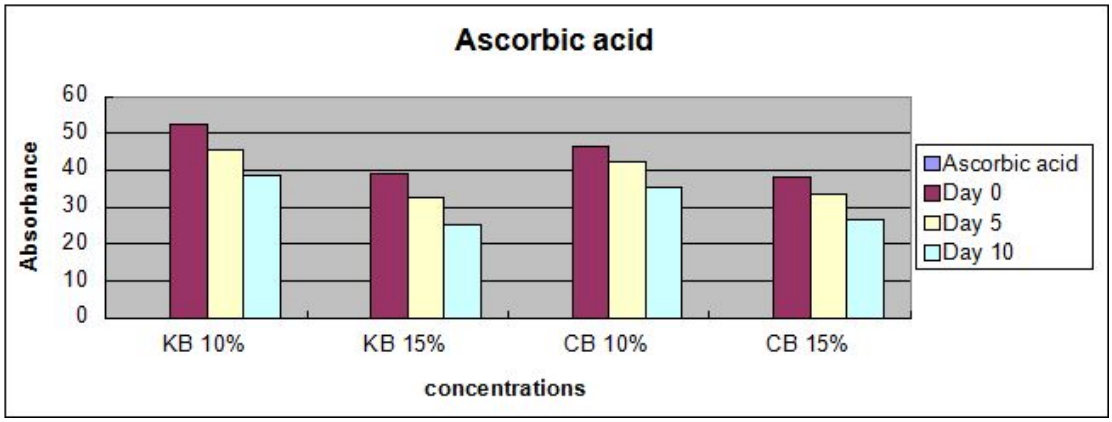


Table 7.3.2 Indicate the variation in the Ascorbic acid value of the RTS of different concentrations.The beverage made up with kinnow juice base and having 10% basil having good amount of vitamin c content in it rather than with 15% basil with base kinnow. Similarly 10% basil with base citrus limmone juice blend also having good value of vitamin c content than that of 15% basil with base citrus limmone. Both charts provide a good comparision of both RTS beverages made up of different base and thus gives idea about the rich source of ascorbic acid content in the comparision of RTS with same base having different concentrations of basil juice.The significant statistical difference among both the values of RTS juice is ($p<0.05$)(Gadze et al; 2011)

7.3.3Titrable acidity

Titrable acidity contribute to the particular flavour and increase the shelf life of the

juice, by modifying the sweetness of the sugar present and also acting to preserve the juice from spoilage. There was a significant increase in the titrable acidity during storage of each juice blend ratio .During storage the salt production was also increased which results in the increased titrable acidity of the juice product.Statistical analyses of the data also depict the significant ($p<0.05$) variation of the titrable acidity on different ratios of the juice blends of kinnow and citrus limmone (Hashem et al;2014)

TABLE- 7.3.3

Parameter Titrable acidity	**KB 10%**	**KB 15%**	**CB 10%**	**CB 15%**
Day 0	0.576 ± 0.02	0.5593 ± 0.025	0.4443 ± 0.01	0.3696 ± 0.027
Day 5	0.3963 ± 0.07	0.319 ± 0.17	0.3256 ±0.02	0.3783 ±0.012
Day 10	0.2223 ± 0.01	0.3 ± 0.01	0.287 ±0.01	0.273 ± 0.01

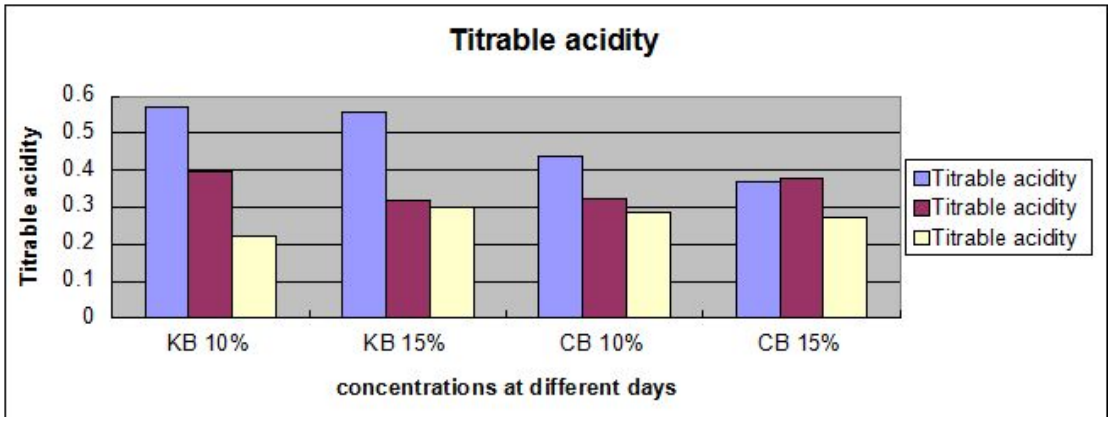


Figure 7.3.3

Chart of titrable acidity of different ratios shows comparison between

Above charts depict the titrable acidity of the RTS in comparison with different ratios and at different days shows increase in titrable acidity which indicate the storage capacity of the RTS having significant difference ($P< 0.05$)

7.3.4 Antioxidant value

TABLE 7.3.4

Parameter Antioxidant	**KB 10%**	**KB 15%**	**CB 10%**	**CB 15%**
Day 0	**67.7±1.11**	**65.59±1.82**	**50.31±2.0**	**56.9±1.8**

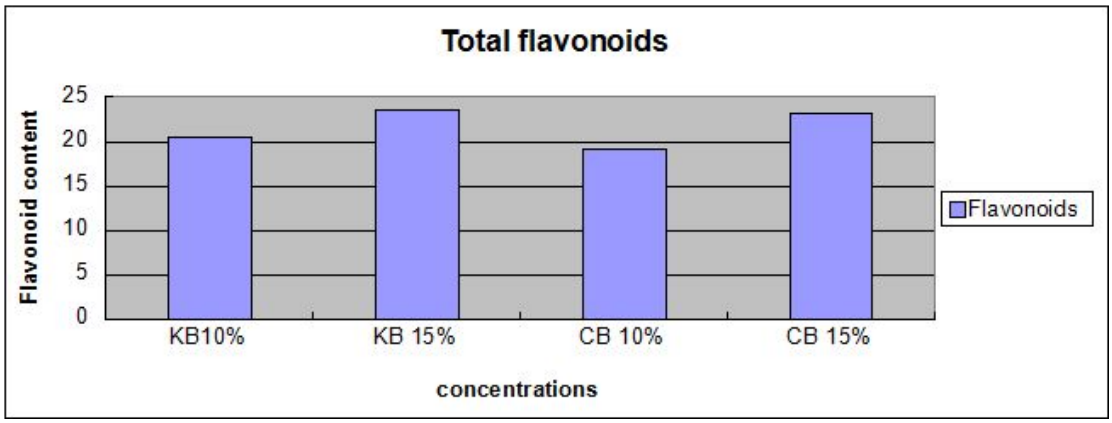
Graph 7.1.4

Evaluation of Antioxidant value of KB10% and KB15% : Indicates that there is slight variation in the two composition of two RTS with same base (kinnow) shows its phytochemical properties which describe there is significant increase in the antioxidant value of the juice with increase in the composition of basil in the RTS. Graph indicate that the increase in concentration of basil in the proportion results in the increase in the antioxidant value of the RTS. There was significant difference in the value of the antioxidant i.e. ($p < 0.05$).

7.3.5 Total flavonoids

TABLE 7.35

Parameter	KB 10%	KB 15%	CB 10%	CB 15%
Total flavonoids				
Day 0	20.5±0.5	23.5±0.5	19.16±0.28	23.13±1.02

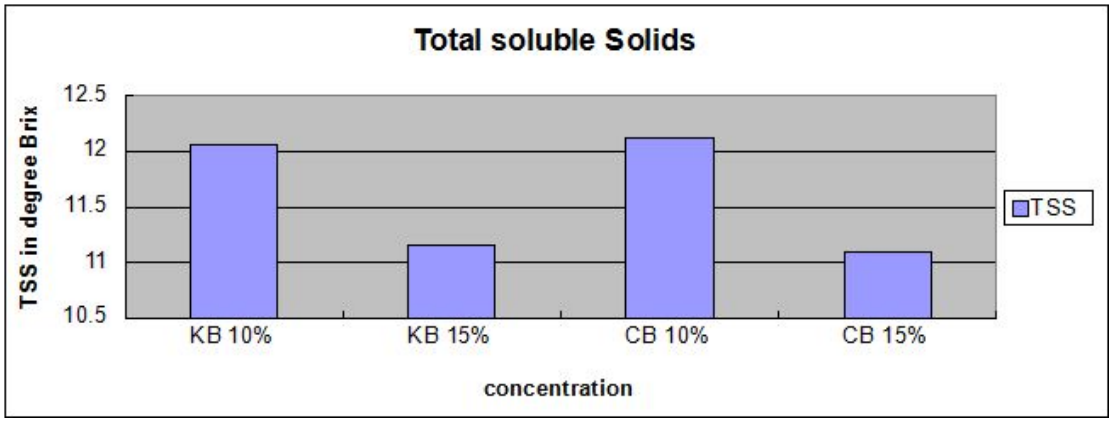


Graph 7.3.5

Total flavonoids gives the phytochemical properties of the juice which describe the flavonoid content present in the products and increases the nutraceutical property of the products. In comparison to each other the products flavonoid content increase with the increase in the concentration of holy basil . From the above table and chart the best proportion of RTS comes out to be KB 15%.

7.3.6 Total soluble solids

Total soluble solids	KB 10%	KB 15%	CB 10%	CB 15%
Day 0	12.06 ± 0.11	11.16 ± 0.15	12.13 ± 0.15	11.1 ± 0.1



Graph 7.3.6

Total soluble solid is the property of the juice or any clear solution which play important role in the indication of any pulp content and also predict the product specific gravity of the juice or RTS beverage. From the above table concentrations with almost same amount of base and juice of basil having light variation in terms of TSS of the product. The best concentrations in terms of TSS were both KB 10% and CB 10%.

CONCLUSION AND FUTURE SCOPE

The study concluded on the basis of the results i.e. chemical evaluation the

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