Chapter II

Literature Review

2.1 Herbal

Herbal ‘renaissance’ is occurring all over the world today. Everyone realized that herbal medicines do not produce any side effects and hence started to use many herbal products instead of synthetic products. Minerals, vitamins, amino acid and enzymes which are available in the herbal plants can be used for various medicinal purposes. From various reports collected worldwide, it is evident that the peoples have been using herbal plants for medicinal purposes right from ancient times. Traditionally India, Japan and China used several herbal plants for medicinal and other purposes. This practice was later transformed to western countries and America. Wide ranges of herbs were used as flavouring agents, aromatic compounds and medicinal purposes (Thomas, 1997; Shaw, 1998).

Factors attributed for the increasing usage of herbal products are

(i) ease of accessibility
(ii) desire for self-medication
(iii) perceptions that herbs are safer, gentler and less costlier than conventional drugs

Now-a-days people have realized that use of natural products helped them to avoid excess usage of conventional western medicine (Allison et al., 2001). Tyler (2000) had mentioned that the people in the Europe and United States gained interest in the use of herbal medicines, as they believe that the usage of herbal drugs did not give any ill effects which are often associated with the usage of modern chemical drugs. The people in developed countries have started to use natural products for their healthy life style, and also many herbal products are commercially available.

As the people in US started to use herbal products to the greater extent, some concern have become apparent regarding safety of these products. One of the important safety concerns in the utilization of herbal products is their potential interaction with conventional drugs (Bauer, 2000; Abebe, 2003). The list of herbal plants and their medicinal applications are given in Table 2.1.
<table>
<thead>
<tr>
<th>Herbal plants</th>
<th>Parts used</th>
<th>Medicinal applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amla (T)</td>
<td>Fruit</td>
<td>Vitamin C deficiency, Cough, Diabetes, Cold, Hyper acidity</td>
</tr>
<tr>
<td>Ashok (T)</td>
<td>Bark Flower</td>
<td>Menstrual Pain, Urine disorder, Diabetes</td>
</tr>
<tr>
<td>Aswagandha (H)</td>
<td>Root, Leafs</td>
<td>Restorative Tonic, Stress, Nerves disorder, Aphrodisiats</td>
</tr>
<tr>
<td>Bael (T)</td>
<td>Fruit, Bark</td>
<td>Diarrhoea, Dysentery, Constipation</td>
</tr>
<tr>
<td>BhumiAmla (H)</td>
<td>Whole Plant</td>
<td>Anaemic, Jaundice, Dropsy</td>
</tr>
<tr>
<td>Brahmi (H)</td>
<td>Whole Plant</td>
<td>Nervous, Memory enhancer, Mental disorder</td>
</tr>
<tr>
<td>Chiraita (H)</td>
<td>Whole Plant</td>
<td>Skin disease, Burning, Sensation, Fever</td>
</tr>
<tr>
<td>Gudmar (C)</td>
<td>Leaves</td>
<td>Diabetes, Hydrosil, Asthma</td>
</tr>
<tr>
<td>Guggul (T)</td>
<td>Gum rasine</td>
<td>Arthritis, Paralysis, Laxative</td>
</tr>
<tr>
<td>Guluchi (C)</td>
<td>Stem</td>
<td>Gout, Pile, General debility, Fever, Jaundice</td>
</tr>
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</table>

(Alfredi, 2013)
<table>
<thead>
<tr>
<th>Name</th>
<th>Part Used</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calihari (H)</td>
<td>Seed, tuber</td>
<td>Skin disease, Labour pain, Abortion, General debility</td>
</tr>
<tr>
<td>Kalmegh (H)</td>
<td>Whole Plant</td>
<td>Fever, Weakness, Release of gas</td>
</tr>
<tr>
<td>Long peeper (C)</td>
<td>Fruit, Root</td>
<td>Appetizer, Enlarged spleen, Bronchitis, Cold, Antidote</td>
</tr>
<tr>
<td>Makoi (H)</td>
<td>Fruit/whole plant</td>
<td>Dropsy, General debility, Diuretic, Anti dysenteric</td>
</tr>
<tr>
<td>Pashan Bheda (H)</td>
<td>Root</td>
<td>Kidney, Stone, Calculus</td>
</tr>
<tr>
<td>Sandal Wood (T)</td>
<td>Oil</td>
<td>Skin disorder, Burning, Sensation, Jaundice, Cough</td>
</tr>
<tr>
<td>Sarpa Gandha (H)</td>
<td>Root</td>
<td>Hyper tension, Insomnia</td>
</tr>
<tr>
<td>Satavari (C)</td>
<td>Tuber, Root</td>
<td>Enhance lactation, General weakness, Fatigue, Cough</td>
</tr>
<tr>
<td>Senna (S)</td>
<td>Dry Tubers</td>
<td>Rheumatism, General debility tonic, Aphrodisiac</td>
</tr>
<tr>
<td>Tulsi (H)</td>
<td>Leaves/Seed</td>
<td>Cough, Cold, Bronchitis, Expectorant</td>
</tr>
<tr>
<td>VaiVidanka (C)</td>
<td>Root, Fruit, Leaves</td>
<td>Skin disease, Snake Bite, Helminthias</td>
</tr>
</tbody>
</table>

*Processed Food From Aloe Vera*
Pippermint (H)  
Leaves, Flower, Oil  
Digestive, Pain killer.

Henna (S)  
Leaf, Flower, Seed  
Burning, Steam, Anti-inflammatory

Gritkumari (Aloe Vera) (H)  
Leaves  
Laxative, Wound healing, Skin burns & care, Ulcer

SadaBahar (H)  
Whole plant  
Leukaemia, Hypertensive, Antispasmodic, Antidote

Vringraj (H)  
Seed/whole  
Anti-inflammatory, Digestive, Hair tonic

Bach (H)  
Rhizome  
Sedative, Analgesic, Epilepsy, Hypertensive

Vasa (S)  
Whole Plant  
Antispasmodic, respiratory, Stimulant

Nageswar (T)  
Bark, Leaf, Flower  
Asthma, Skin, Burning, Vomiting, Dysentery, Piles

Benachar (S)  
Root  
Hyperpiesia, Burning, Ulcer, Skin, Vomiting

Mandukparni (H)  
Whole plant  
Anti-inflammatory, Jaundice, Diuretic, Diarrhoea

Kaincha (H)  
Root, Hair, Seed, Leaf  
Nervous, Disorder, Constipation, Nephropathy, Dropsy
<table>
<thead>
<tr>
<th>Name</th>
<th>Part(s)</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dalchini (H)</td>
<td>Bark, Oil</td>
<td>Bronchitis, Asthma, Cardiac Disorder, Fever.</td>
</tr>
<tr>
<td>Kurai (S)</td>
<td>Bark, Seed</td>
<td>Scabies, Antipyretic, Amoebic dysentery</td>
</tr>
<tr>
<td>Kantakari (H)</td>
<td>Whole Plant, Fruit, Seed</td>
<td>Diuretic, Anti-inflammatory, Appetiser, Stomachic</td>
</tr>
<tr>
<td>Swetchitrak Perennial (H)</td>
<td>Root, Rootbar</td>
<td>Appetiser, Antibacterial, Anticancer</td>
</tr>
<tr>
<td>RaktaChitrak (H)</td>
<td>Rootbar</td>
<td>Colic, Inflammation, Cough</td>
</tr>
<tr>
<td>Harida (T)</td>
<td>Seed</td>
<td>Wound ulcer, Leprosy, Inflammation, Cough</td>
</tr>
<tr>
<td>Bahada (T)</td>
<td>Seed, Bark</td>
<td>Cough, Insomnia, Dropsy, Vomiting, Ulcer</td>
</tr>
<tr>
<td>Gokhur (H)</td>
<td>Whole Plant</td>
<td>Sweet cooling, Aphrodisiac, Appetizer, Digestive</td>
</tr>
<tr>
<td>Neem (T)</td>
<td>Rhizome</td>
<td>Sedative, Analgesic, Epilepsy, Hypertensive</td>
</tr>
<tr>
<td>Anantamool (S)</td>
<td>Root, Leaf</td>
<td>Appetiser, Carminative, Aphrodisiac, Astringent</td>
</tr>
</tbody>
</table>

(T - Tree, H - Herb, C - Climber, S- Shrub)
Zhao et al., (2013) studied advanced phytochemical analysis of herbal tea, and found that the herbal tea is a commonly consumed beverage brewed from the leaves, flowers, seeds, fruits, stems and roots of plants species, which has been widely used for health care and diseases prevention for centuries. With the increasing consumption of herbal tea, a number of public health issues for efficacy, safety and quality assurance have attracted concern.

Jungmin et al., (2013) reported that the antioxidant and antimicrobial activities of various leafy herbal tea extracts. They have reported that the antioxidant activities of various samples of leafy herbal tea extracted with 80°C water or 20°C ethanol, and their five type of antioxidant activity were measured. Green tea ethanol extract showed the highest antioxidant activity in all assays except the ferrous ion-chelating assay. Water extracts of green tea and black tea and ethanol extracts of rosemary, mate, and persimmon leaf teas also exhibited considerable antioxidant potential, followed by the green tea ethanol extract antimicrobial activities were determined leaf extract against two oral pathogens and three food-borne pathogens. Green tea ethanol extracts had the most powerful antioxidant and antimicrobial properties, suggesting their potential application as a health-promoting functional ingredient or natural preservative in foods.

Chan et al., (2010) studied the antioxidant properties of tropical and temperate herbal teas. The antioxidant properties of thirteen tropical and five temperate herbal teas were screened. Tropical herbal teas were more diverse in types and more variable in antioxidant properties values than temperate herbal teas. Exceptions were lemon myrtle, guava and oregano teas with antioxidant properties comparable to black teas.

### 2.2 Aloe Vera

The name Aloe Vera derives from the Arabic word “Alloeh” meaning “shining bitter substance,” while “Vera” in Latin means “true”. Two thousand years ago, the Greek scientists regarded Aloe Vera as the universal remedy. The Egyptians called Aloe “the plant of immortality. The botanical name of Aloe Vera is *Aloe barbadensis miller*, it belongs to Liliaceae Family. There are over 400 species of Aloe Vera grown around the world; only two species are grown commercially: *Aloebarbadensis miller* and *Aloeaborescens*. The Aloe Vera plant has been known and used for centuries for its health, medicinal, beauty and skin care properties (Dandhof, 1987).
Aloe Vera has been used for various medicinal purposes from ancient times in several countries: Greece, Egypt, India, Mexico, Japan and China. Egyptian queens Nefertiti and Cleopatra used it as part of their regular beauty regimes. Alexander the great and Christopher Columbus used it to treat soldier’s wounds. By the early 1800s, Aloe Vera was in use as a laxative in the United States, but in the mid-1930s, a turning point occurred when it was successfully used to treat chronic and severe radiation dermatitis (Davis and Robert, 1997).

The tropical Aloe Vera plant is characterized by lance-shaped leaves with jagged edges and sharp points. The two major liquid sources present in the Aloe Vera are

(i) Yellow latex (exudates)
(ii) Clear gel (mucilage)

Yellow latex is mainly composed of the following components: Aloin, aloe-emodin and phenols. The mucilaginous jelly from the parenchyma cells of the plant is the Aloe Vera gel (Schulz et al., 1997).

![Fig. 2.1 Schematic representation of Aloe Vera components](image)

The Aloe Vera plant is grown in warm tropical areas and cannot survive at low temperatures (freezing conditions). Internationally, Aloe Vera is grown in Mexico, the
Pacific Rim countries, South America, Central America, The Caribbean, Australia, Africa, Rio Grande Valley of South Texas, Florida and Southern California. In India, it is cultivated in Rajasthan, Andhra Pradesh, Gujarat, Maharashtra and Tamil Nadu (Marshall, 1990). The various components present in Aloe Vera are shown in Fig. 2.1.

2.2.1 Aloe Vera Composition

Anthraquinones, Amino Acids, Sterols, Hormones, Vitamins, Minerals, Enzymes, Saponins, Lignin, Sugars, Proteins and Water are the various nutrients present in the Aloe Vera (Atherton, 1998). Aloe emodin, aloetic acid, aloin, anthracine, anthranon, barbaloin, chrysophanic acid, emodin, ethereal oil, ester of cinnemonic acid, isobarbaloin and resistannol are present in the Anthraquinones of Aloe Vera (Hutter, 1996).

The Essential amino acids such as Lysine and Threonine which cannot be synthesised in our body are present in the Aloe Vera. Non essential amino acids such as Histidine, Arginine and Lignin are also present in the Aloe Vera. Saponins found in Aloe Vera are Glycosides. Lupeol and Beta is various sterols compound present in Aloe Vera. The main hormones present in Aloe Vera are auxins and gibberllins (Ro et al., 2000). Vitamin A (Beta carotene), Vitamin B (Thiamine), B2 (Riboflavin), B3 (Niacin), B5, B6 (Pyridoxine), B12, Vitamin C, Vitamin E and Folic Acid are various vitamins available in Aloe Vera (Shelton, 1991).

Atherton (1997) reported that the minerals present in Aloe Vera are calcium, sodium, zinc, chromium, potassium, magnesium, copper, manganese and selenium and also aliase, alkaline phosphatase, amylase, bradykinase, carboxypeptidase, catalase, cellulase, lipase and peroxidase are some of the enzymes present in Aloe Vera.

Lignin present in Aloe Vera is Cellulose-based substance. Sugars present in Aloe Vera are monosaccharides such as glucose and fructose and polysaccharides such as glucomannans and polymanose. Lectins and lectin-like substance are present in the Aloe Vera (Ni et al., 2004). The general compositions of Aloe Vera are presented in the Table 2.2.
Table 2.2 Composition of Aloe Vera (Muaz and Fatma, 2013)

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Constituents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Moisture content</td>
<td>97.42 ± 0.13</td>
</tr>
<tr>
<td>2</td>
<td>Protein</td>
<td>6.86 ± 0.06</td>
</tr>
<tr>
<td>3</td>
<td>Fibre</td>
<td>73.35 ± 0.30</td>
</tr>
<tr>
<td>4</td>
<td>Fat</td>
<td>2.91 ± 0.09</td>
</tr>
<tr>
<td>5</td>
<td>Ash</td>
<td>16.88 ± 0.04</td>
</tr>
<tr>
<td>6</td>
<td>Ascorbic acid</td>
<td>0.004 ± 0.05</td>
</tr>
</tbody>
</table>

2.2.2 Medicinal Properties of Aloe Vera

In recent years there has been an increasing interest in finding natural antioxidants. These natural antioxidants protect the human body from free radicals and retard the progress of many chronic diseases (Kaur and Kapoor, 2001). The synthetic antioxidants such as Butylated Hydroxy Anisol (BHA) and Butylated Hydroxy Toluene (BHT) of high medicinal values are with side effects. Hence considerable interest is shown in finding new and safe natural antioxidants to replace these synthetic antioxidants (Gazzani et al., 1998).

Aloe Vera extract has excellent natural antioxidant properties as it contains vitamin A, C and E. The antioxidant activity of Aloe Vera determined using 2, 2-diphenyl-1-picrylhydrazyl assay was 88.31%, which is higher than synthetic antioxidant such as BHT at 70.5% and α-tocopherol at 65.65% (Anilakumar et al., 2010). The increase in free radical antioxidant could be due to better extractability of antioxidant component and higher level of phenolic content. Pengseng et al., (2010) reported that phytochemicals such as phenolic compounds, ascorbic acid, tocopherol and pigment also contribute to total antioxidant activity and has a good correlation between the antioxidant activity and its total phenolic compound content.

The antioxidant property of Aloe Vera gel is an important application of Aloe Vera which protects the skin from getting damaged (Roberts and Travis, 1995). The Aloe Vera gel generates metallothionein (antioxidant protein) in skin which scavenges hydroxyl radicals and prevents suppression of superoxide dismutase and glutathione peroxidise. Thereby production and release of skin keratinocyte-derived
immunosuppressive cytokines has been suppressed. This prevents UV-induced suppression of delayed type hypersensitivity (Byeon et al., 1988).

Zawahry et al., (1973) has identified that six antiseptic agents are present namely lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols and sulphur in Aloe Vera. These antiseptic agents are capable of inhibiting several bacteria, fungi and viruses.

Glucomannans, a mannose-rich polysaccharide, and gibberellins, a growth hormone, interacts with growth factor receptors on the fibroblast, thereby stimulating its activity and proliferation, which in turn significantly increases collagen synthesis after topical and oral Aloe Vera which has been studied by Chithra et al., 1998.

Heggers et al., (1996) found that Aloe Vera gel not only increase the collagen content of the wound, but also change the collagen composition and increases the degree of collagen cross linking. Due to this, it accelerates the wound contraction and increases the breaking strength of resulting scar tissue.

Sydiskis et al., (1991) studied the antiviral activity of Aloe Vera and reported that the actions may be due to indirect or direct effects. Indirect effect is due to stimulation of the immune system and direct effect is due to anthraquinones. The anthrax quinonealoin inactivates various enveloped viruses such as herpes simplex, varicella zoster and influenza.

The moisturizing and anti-aging effect has been studied by West and Zhu, (2003) and reported that the mucopolysaccharides help in binding moisture into the skin. Aloe Vera stimulates fibroblast which produces the collagen and elastin fibers making the skin more elastic and less wrinkled. It also has cohesive effects on the superficial flaking epidermal cells by sticking them together, which softens the skin. The amino acids also soften hardened skin cells and zinc acts as an astringent to tighten pores. Its moisturizing effects has also been studied in treatment of dry skin associated with occupational exposure where Aloe Vera gel gloves improves the skin integrity, decreases appearance of fine wrinkle and decreases erythema.

The digestion capability of Aloe Vera was studied by Grindlay and Reynadds, (1986). They found the deposition of toxins and unwanted substance in the intestine
prevents the absorption of essential nutrients, which results in the nutritional deficiency, lethargy, constipation and low back ache. The oral administration of Aloe Vera juice helps in flushing out these toxins and unwanted substance, and hence enhances the digestion capability.

Qian et al., (2005) studied quality and safety assurance in the processing of Aloe Vera gel juice. The control points for quality are reception of raw materials, filleting operation, grinding or homogenization, pectolytic enzyme addition, filtration, addition of vitamin C or citric acid, deearation, pasteurization, flash cooling and storage. Preventative measures were proposed and critical control limits were determined at the same time.

Garcia et al., (2010) reported that the effect of osmotic dehydration on Aloe Vera leaves Peeled and unpeeled Aloe Vera slices (15 × 50 mm), were immersed in sucrose solutions at 35, 50 and 65°Brix at 25 and 40°C. Moisture, effective diffusion coefficients and mass fluxes were determined. Osmotic dehydration experiments were conducted at atmospheric pressure. The best conditions for the osmotic dehydration of Aloe slices with the highest effect on diffusivity were obtained at 40°C for peeled samples.

Margarita et al., (2010) studied the effect of temperature on structural properties of Aloe Vera gel and Weibull distribution for modeling drying process. Aloe Vera gel was dried at five inlet temperatures 50, 60, 70, 80 and 90°C, in a convective dryer with a constant air flow of 2.0 ± 0.2 m³/s. Rehydration ratios, water holding capacity, texture, microstructure and total polysaccharide content were evaluated. Drying kinetics was estimated using the Weibull distribution (R² > 0.97 and Chi-square < 0.0009). Values of scale and shape parameters ranged from 90.94 to 341.06 (min) and 1.43 to 1.49 respectively. The influence of temperature on the model parameters as well as on the quality attributes was analysed using a least significant difference test (p-value < 0.05) and these effects were more evident for the long drying period (810 min at 50°C). However, minor alterations in the structural properties and total polysaccharide content were produced at drying temperatures of 60–70°C, resulting in a high quality gel.

Magdalini et al., (2011) reported that the effect of drying on Aloe Vera functional components, including polysaccharides, organic acids, vitamins and minerals which can be used in dietary foods and pharmaceutical products. Freeze drying, along with spray drying constitute the basic drying technologies used for the increase of shelf-life of Aloe
Vera components. Aloe Vera gel, the inner part of the plant's leaf, is the main source of these components, containing about 98% water. Gel was collected from the inner part of Aloe Vera leaf and freeze dried. Concentration of polysaccharides was affected significantly from the drying process; on the other hand minerals concentration remained practically constant. Aloe Vera gel contains a significant number of organic components, as well as minerals. The preservation and further use of these substances can be achieved by drying of Aloe Vera gel.

2.3 Processed foods

2.3.1 Chocolate

Chocolate entered the English language from Spanish. Chocolate is made from beans derived from the cocoa tree, these beans are very bitter, so the cocoa solids and cocoa butter has sugar added to it. The ancient Maya are believed to be the first people to make chocolate, over 2,000 years ago. Cocoa trees, native to Central and South America provided the beans used to make a bitter, spicy chocolate drink. Originally chocolate was exclusively consumed as a drink. Because Europeans did not like the bitter taste, they added sugar and cinnamon. Gradually chocolate was mixed with milk instead of water to produce a much lighter and smoother drink (Coe and Coe, 1996).

Coe and Coe (2007) mentioned that the world continues to consume great quantities of chocolate. As per 2002 statistics, the world’s average yearly chocolate intake is approximately 1.2 pounds per person. European consumes over four pounds per year and the Americans come in second at 2.6 pounds per person, Africa at a third with one pound, then Asia and Pacific islands less than quarter pound per year.

Chocolate is a desirable confection product which has unique texture and flavour release properties in the mouth. Many of these desirable properties are generally attributable to the fat component of chocolate-cocoa butter-which has a narrow melting point range just slightly below normal body temperature and a sharp melting curve. Accordingly, the desirable flavour release and organoleptic sensations of chocolate occur rapidly as the chocolate melts in the mouth. Chocolate is a suspension of fine solid particles of sugar, cocoa and skimmed milk powder in a continuous fat phase. Chocolates are solid at ambient (20°C - 25°C) and melt at body temperature (37°C) giving a smooth
suspension of particulate solids with a pleasing cooling sensation in the mouth (Schroder, 2011). The functional roles of chocolate ingredients are given below:

i) Sugar

Koivistoinen and Hyvonen, (1985) studied the ingredients of chocolate and found that the main reason for the use of sugar in chocolate is due to its sweet taste, sugar has many other functions in food products. The most important among these are sweetener, preservative, texture modifier, flavouring, colouring agent, bulking agent, moisture and tenderness. In high concentration, it prevents the growth of microorganisms.

ii) Skimmed milk powder

The skimmed milk powder is the key role in colour formation due to both caramelization of the lactose present, and Maillard reaction of the lactose and amino acids (protein) present in the skimmed milk powder. Skimmed milk powder is used to produce milk chocolate for its distinct flavour and smooth milky texture characteristics. And also used frequently in soft sweets and various confection coatings (Telcioglu and Kayacier, 2007).

iii) Butter

Basappa (1993) studied the effect of butter and reported that the butter is an essential component in most of the confectionery products. Because it has low melting point, butter melts in mouth for a wonderful and luxurious mouth feel. It adds a desirable moistness, richness and flavour. And also increases tenderness and gives texture.

iv) Cocoa powder

Cocoa powder is used in the confectionery industry as a flavouring, aroma and colouring agent, especially the flavonoids and its function as potent antioxidant in human health. Cocoa is a very rich source of dietary flavonoids and reported of having higher flavonoids per serving than chocolate and tea (Afoakwa et al., 2008).

Prindiville et al., (2000) studied the effect of milk fat, cocoa butter, and whey protein fat replacers on the sensory properties of low fat and non-fat chocolate ice cream. They have reported that the low fat and non-fat chocolate ice creams were made with
2.5% of milk fat, cocoa butter, or one of two whey protein-based fat replacers. Hardness, viscosity and melting rate were measured by physical methods. From sensory analysis, attribute ratings were analyzed by analysis of variance with least significant difference mean separation and orthogonal contrasting. Ice cream containing milk fat had less intense cocoa flavour and is more resistant to textural changes over time compared with the other ice creams.

Liang and Hartel, (2004) also observed that the effects of milk powders in milk chocolate. They have reported that the physical characteristics of milk powders used in chocolate can have significant impact on the processing conditions needed to make chocolate, and the physical and organoleptic properties of the finished product. Particle characteristics (size, shape, density) of the milk powder also influence the physical and sensory product of chocolates.

Gatade et al., (2009) studied the physico-chemical and sensorial characteristics of chocolate prepared from soymilk. They have reported the formulations sample containing soymilk 50 ml, sugar 16.7 g, cocoa 6.7 g, vegetable shortening 10 g, corn flour 2 g and glycerol monostearate 1.3 g had excellent sensory score for appearance, colour, glossiness and smooth texture.

Fernanda et al., (2010) studied the flavonoids and polyphenols found in different types of chocolate and varieties of red wine. It was found that 71% cocoa dark chocolate and Tannat wine which were statistically different against other varieties gave best results. The results indicate that 49 g of 71% cocoa dark chocolate has the same quantity of flavonoids as that of 196 ml of Tannat wine, which is the daily wine intake recommended to produce health benefits in an adult of 70 kg body weight.

Karina et al., (2011) investigated three different samples of white chocolate (synthetic antioxidant, natural antioxidant and without antioxidant) for 10 months storage at 20 and 28°C. Acidity, thiobarbituric acid reactive substances and peroxide values increases with the incubation time, and also samples stored at 20°C showed lower values for these parameters than at 28°C. The values for water activity and colour intensity were increased during its shelf-life period of 10 months.
Alka and Gurmukh, (2011) revealed that 40% (w/w) of whole milk powder, sugar and cocoa butter can be successfully substituted by full fat soy flour, stevia-mannitol blend and soybean oil, respectively in the preparation of high protein and low sugar chocolate without impairing the sensory attributes. Storage study of the product indicates an increase in hardness, free fatty acid content, peroxide value, total plate count, yeast and mold count, whereas a decrease in moisture content, pH value and sensory scores. The optimized chocolate was found acceptable (score ≥7.0) after 90 days of storage at 16 ± 1°C.

Nathalie et al., (2012) investigated the impact of the cocoa butter refining process on milk chocolate quality. The major effect of the silica pre-treatment was the complete removal of phosphorus, iron and alkaline components. During the steam refining step mainly free fatty acids were removed at increased temperatures. The refining of the cocoa butter influenced the rheological properties of the chocolate. An increased packed column temperature, coinciding with the removal of free fatty acids, resulted in a lower yield stress and a higher viscosity.

Ndife et al., (2013) studied the production and quality evaluation of cocoa products (plain cocoa powder and chocolate). They have reported that the effect of processing steps include fermentation, drying, roasting, milling, pressing and conching over raw cocoa beans and chocolate samples. Sample containing cocoa powder 350 g, cocoa nibs 50 g, cocoa butter 100 g, sugar 250 g, milk 250 g and nutmeg 1 g derived from seven days fermented raw cocoa-beans were adjudged the best sensory attributes of colour, aroma, taste and texture.

2.3.2 Sauce

Sauce is a liquid adjunct to a dish such as meat, poultry and vegetables, used to moisten the food, enhance the flavour, provide contrast in taste or colour and sometimes to improve the digestibility. Peterson (1998) reported that the sauce is generally thickened by means of a liaison such as roux, egg and blood. The simplest dishes could be made appetizing by the addition of a good plain sauce while the most recherche dishes can be improved and made still more palatable by a well made sauce.
Sauces are essence of elegance. Every sauce whether plain or rich, must possess a decidedly distinct flavour and character. Plain sauces should be simple and cure show that they taste of the material employed, from which they take their name. Richer sauces always require a longer and slower process for the preparation.

The sauces were hardly made use of in English cuisine till the beginning of the nineteenth century. Today there are at least six fifty different type of sauces and gravies. All sauces should be smooth, glossy in appearance, definite in taste, light in texture. The ingredients of Aloe Vera sauce reported by Thangam, (2005); Stefaniek et al., (2009) are given below:

i) Cinnamon

Cinnamon is obtained from the bark of an evergreen tree belonging to the ‘laurel’ family which is chiefly cultivated in Ceylon and in East India. The best cinnamon should not be too dark in colour and should be as thin as paper. It has a fragrant odour and its taste is pleasant and aromatic. It is used in both Western and Indian foods like cakes, buns, ketchup, pickles and pulaos.

ii) Cardamom

Cardamom is the fruit of a reed-like plant, native of the mountain of the Malabar Coast. The fruit is a small pod and the seeds within the pods have a strong, sweetish flavour. The pods vary in length, the small sized ones are considered best. Rich foods like khorma include cardamom. Powdered cardamom is a big favourite in cakes; puddings, halwas, pulavs and biryani also depend on this spice for their popular flavour. Tincture of cardamom is used in stomach medicines.

iii) Ginger

Ginger mainly produced in Jamaica and to a less extent Sierra Leone, China, Japan and India. Because of its stimulating and digestive properties it is employed medicinally for dyspepsia and colic. It is also frequently used to disguise nauseous tastes in medicine. The most common use of ginger is in making masalas, soft drinks, pickles, sauces and preserves, and in confectionery such as ginger biscuits, gingerbread and sanps.
iv) Salt

Sodium chloride is one of the most important ingredients for many foods. It influences not only the flavour profile of food products, but also their texture, and it plays an important role in the preservation of foods against microbes.

v) Onion

The flavour and aroma of onion turns any normal dish into mouth watering and delicious one. The size, taste and colour of onions depend upon its variety. Onions are available in three colours: red, yellow and white. Onion is one of the best sources to provide phosphorous, manganese, folate, copper, molybdenum and vitamin B. They are extremely good source of chromium, dietary fiber and vitamin C.

vi) Garlic

Garlic is a vegetable and is a species of the onion genus. Garlic is often used to add flavour to recipes and dishes. However, garlic can also be used as a medicine to prevent or treat a wide range of ailments and diseases. Garlic cloves contain many vital nutrients including vitamins, amino acids and enzymes. Garlic contains sulfur compounds from the amino acid allicin, which is most noted for producing garlic’s powerful odour.

vii) Chilli powder

This is one of the most powerful hot spices, which can easily affect the ears, tongue and stomach; and also give good colour to dishes in which it is used. The ethnic dishes are mostly imparted with the flavour and heat blend of the chilli powder. They are also good in other antioxidants like vitamin A and flavonoids like β-carotene, α-carotene, lutein, zeaxanthin and cryptoxanthin. These antioxidant substances in capsicum help to protect the body from injurious effects of free radicals generated during stress, diseases conditions. Chillies contain a good amount of minerals like potassium, manganese, iron, and magnesium. Potassium is an important component of cell and body fluids that helps controlling heart rate and blood pressure.

Cheng and Meei, (1998) studied the biochemical changes in soy sauce prepared with extruded and traditional raw materials. They have observed that the soy sauce
prepared with raw materials which were subjected to traditional pre-treatment. After 180 days aging period, the contents of total nitrogen, amino nitrogen, free amino acids, reducing sugars, and the protein utilization rate and intensity of brown colour were higher in soy sauce prepared with extruded raw material than traditional raw material. However there is no noticeable difference in pH.

Hanifah et al., (2007) observed that the chemical and sensory characteristics of low molecular weight fractions obtained from three types of Japanese soy sauce. It was found that the tastiest fractions of the three types of soy were those containing sodium salt, free L-glutamic acid and most other free amino acids, especially sweet taste-eliciting amino acids at concentrations above their thresholds.

Gustaf et al., (2007) studied the seasonal effects on the physico-chemical characteristics of fish sauce made from capelin. They have reported that the response surface methodology optimizations were conducted ranging from 5% to 30% salt and incubation temperature from 0 to 65°C. Samples for fish sauce production were then prepared under optimized conditions by mixing ground capelin with 10% salt and incubating at 50°C for up to 270 days for the summer capelin and up to 360 days for the winter capelin. Samples were collected at regular intervals and analyzed for liquid yield, protein content, moisture content and pH were lower in the summer capelin fish sauce; but Brix and density were higher than those in fish sauce from winter capelin.

Sylvie et al., (2008) reported that the nutritional value of six multi-ingredient sauces and analysed for their dry matter, macronutrient (lipids, proteins) and micronutrient (iron, zinc, carotenoids and retinol) contents. Groundnut sauce has the highest dry matter content and highest lipid contents. Sauces made from green-leafy vegetables formed a homogeneous group with a high content of retinol activity and to a lesser extent of iron. An isomer of beta carotene was detected in sauces made from green leafy vegetables. The content of this isomer was strongly correlated with beta carotene content and not with cooking time.

Moustapha et al., (2010) studied the effects of external supplementation of soy lecithin on physico-chemical properties of tomato juice, grape juice and sauce. It was found that the levels of protein, soluble solids and ash content were significantly enhanced by the addition of lecithin. The bulk viscosity of tomato juice and the sauce
preparation was also enhanced by addition of lecithin. The yellow colour values of the juice and sauce preparations were enhanced by lecithin. In grape juice preparations, the addition of lecithin did not cause any negative effects, but enhanced the solids content of the juice. Lecithin may form complexes with pectin, lipids and other carbohydrates, affecting the food property and stability by various mechanism.

Raymond et al., (2010) investigated that the changes in the antioxidant activities of seven herbs and spices in chicken sauces after cooking. Even though a large percentage of the antioxidant activity was lost following chicken sauces and cooking, both sesame ginger teriyaki and jerk sauces retained very high antioxidant activities and could be very good sources of antioxidants in the diet. These indicate that chicken sauces and cooking significantly reduce the antioxidant activities of chicken sauces, and consequently reduce the amounts of antioxidant availability.

Gamonpilas et al., (2011) reported that the physico-chemical and rheological characteristics of commercial chilli sauces as thickened by modified starch or xanthan mixture. The sauce with the weakest network contained only starch. The xanthan–starch mixture was shown to be beneficial as they could interact synergistically in acidic condition to enhance the gel-like characteristics and shear thinning behaviour of chilli sauces.

Magdalena et al., (2012) studied the sensory attributes of caramel sauces thickened with combinations of potato starch and xanthan gum. The applied combinations of hydrocolloids produced useful rheological, textural and sensory properties in caramel sauces. The texture of the laboratory sauces improved with an increase in the concentration of xanthan gum, and such improvement was also observed in the sauces after storage. Sauce prepared with 0.3% potato starch and 0.02% xanthan gum, received the highest score.

Seniz and Duygu, (2012) studied the antimicrobial effects of both traditional and commercial pomegranate sour sauce samples on some green vegetables. It was found that the inhibitory effect of the pomegranate products on the naturally existing bacterial microflora of lettuce, spring onion and parsley were analyzed. Although the pomegranate products had an antimicrobial effect on the natural bacterial microflora of the food samples, the effect on inoculated food samples was more prominent.
2.3.3 Jam

The term "jam" refers to a product made of whole fruit cut into pieces or crushed then heated with water and sugar to activate its pectin before being put into containers. Jams are usually made from pulp and juice of one fruit, rather than a combination of several fruits. Berries and other small fruits are most frequently used, though larger fruits such as apricots, peaches or plums cut into small pieces or crushed are also used for jams. Good jam has a soft even consistency without distinct pieces of fruit, a bright colour (one of the most important parameters to which consumers are sensitive), a good fruit flavour and a semi-jellied texture that is easy to spread but has no free liquid (Berolzheimer et al., 1959).

The traditional food with good nutritional value and similar characteristics of traditional processed foods remains a challenge for food industry. The effects of the defence of natural antioxidants in fruits and vegetables were studied by (Thaipong et al., 2006; Tachakittirungrod et al., 2007) related as three major groups: vitamins, carotenoids and phenolics. The various ingredients and their role in the preparation of Aloe Vera jam from literature are cited below.

i) Sugar

Sugar is used in jams, jellies and marmalades. It is important because it makes the shelf life longer, makes the taste better and more over the texture of the product will be improved; these factors make sugar as one of the most important constituents is fruit processed products. Since the percentage of sugar that is used is usually high, choosing a suitable type of sugar is important due to the potential of sugar for re-crystallization; sugars that have high tendency to crystallize like pure dextrose (glucose) are not used, on the contrary refined sucrose (partly inverted to glucose and fructose) is known to be a good sugar for addition to jams because it has low tendency to re-crystallization. This fact is important because it reduces the tendency of sugar to form crystals (Cancela, 2005).

ii) Pectin

The most important application of pectin in food industry is as a thickening agent for jams and jellies. Frequently when pectin is added in the formulation, the producer is looking for changes in the texture or flow behaviour of the final product. If low esterified
pectin solution is used in mixture with some sugar and calcium salts it will create a soft
network that the elastic properties can be measured. Viscous properties of pectin solutions
are important in food products especially in fruit based products such as fruit juices,
jellies and fruit jams due to increasing the viscosity; which is desired because it gives
better mouth feel and a greater sense of fruitiness and also sweetness in the final product
(Endress, 2005).

iii) Citric acid

Citric acid anhydrous appears as an odourless white crystalline granule with a
strong acidic taste. It is soluble in water, freely soluble in alcohol and slightly soluble in
ether. Citric acid is a constituent of jams, jellies and other food products. Uses include
flavour enhancement, bacterial inhabitant, pH adjustment, and as an anti oxidant (McGee,
1997).

Isabel et al., (2004) studied quince jam quality on microbiological, physico-
chemical and sensory evaluation. Microbiological analyses revealed that four quince jam
samples presented a total number of yeasts and molds higher than 103 cfu/g. A large
variability among the commercial brands of quince jam was noticed for benzoic, sorbic,
citric, malic, quinic and succinic acids contents. Benzoic acid content exceeded the legal
limits of 500 mg/kg in five samples. The sum of benzoic and sorbic acids was above the
limits allowed by legislation (1000 mg/kg) in two samples. Sensory analysis revealed
mainly a group of samples with typical soft odour and taste, attributes correlated with low
granules texture and shiny surfaces, in contrast to another group of samples with intense
odour, but less typical, more acid and puree, sandy type of texture.

Acosta et al., (2008) reported that the optimisation of low calorie mixed fruit jelly
by response surface methodology to evaluate model effects of three factors (sweetener,
low methoxyl pectin and calcium content) at three levels each, on the overall acceptability
of a tropical mixed fruit (pineapple, banana and passion fruit) jelly for sensory attributes.
Calcium level had a significant effect on overall acceptability, but low methoxyl pectin
and sweetener levels were not significant.

Ashaye and Adeleke, (2009) studied the quality attributes of stored Roselle jam
from dark and light red varieties. Roselle jam was processed using the open kettle
method, and were stored at ambient and cold temperatures. At two weeks interval they
were evaluated for pH, titratable acidity, vitamin C, ash, dry matter, moisture content and sensory properties for a period of six weeks. Finally they have concluded that Roselle jams prepared from either dark or light red varieties stored for six weeks at ambient and cold temperatures are still acceptable.

Oyeyinka et al., (2009) reported that osmotic dehydration with sugar solutions has been described as a suitable method for preserving fruit quality to a great extent. Pre-frozen whole cashew apples were soaked in varying osmotic solution concentration at different soaking times before conversion into jam products has been studied. Jam made with sugar solution of 60°brix without osmotic treatment was used as a reference sample and other samples were compared with it. It was observed that as soaking time progressed, titratable acidity, moisture content and vitamin C decreased gradually while the pH value increased. Similar trend observed for increase in osmotic solution concentration. Generally, jam made from 50°brix for 3 and 4 h were most preferred by the panellist.

Santanu and Shivhare, (2010) investigated that the rheological, textural and sensory properties of mango jam. They have reported that the hardness of mango jam increased with increase in pectin concentration and acidity, whereas the hardness increased up to 60% sugar concentration but decreased with further increase in sugar concentration at all pH and pectin levels. The overall acceptability was rated highest for mango jam prepared with 65% sugar, 1% pectin at pH 3.4.

Santanu et al., (2011) reported that full replacement of sucrose with sorbitol is feasible in mango jam manufacturing. Dynamic rheological tests characterized mango jam manufactured with sucrose/sorbitol as weak gel. Gel strength decreased with increasing sorbitol concentration because of weaker junction zones in pectin gel network.

Ajenifujah-Solebo and Aina, (2011) studied the physio-chemical properties and sensory evaluation of jam made from wild-growing indigenous fruits such as black-plum which was remained largely untapped. Black-plum jam was produced by traditional open kettle method. Statistical evaluation using simple-paired comparison between black-plum jam and commercial black currant jam on a nine-point hedonic scale showed a preference for the commercial jam, particularly in terms of colour. The differences in flavour and
spread ability were not significant ($P > 0.05$), while the differences in colour, taste and overall acceptability were significant ($P < 0.05$).

Melgarejo et al., (2011) studied the Anthocyanin content and colour development of pomegranate jam. Anthocyanin and colour development of pomegranate jams made from the ‘Mollar’ cultivar were analysed during five months. Different temperatures ($5^\circ C$ and $25^\circ C$) and light exposures (daylight and darkness) were tested during storage. Also the influence of pectin on jam preparation was evaluated and concluded that the high methoxypectins yielded better pomegranate jams. Optimal storage conditions were achieved at $5^\circ C$ with no light exposure at all.

Vidhya and Anandhi, (2011) investigated that the formulation and evaluation of preserved products utilizing under exploited fruit (Wood Apple). The jam and fruit bar was formulated, bottled and quality parameters were assessed during different periods of storage upto 90 days. The storage stability was good in both jam and fruit bar with respect to flavour and consistency. No significant change observed in total soluble solids, pH, pectin and ash value for both jam and fruit bar during storage. The limited microbial growth at the end of 90 days indicated that both were safe and fit for consumption.

Rehman et al., (2012) studied the development of strawberry jam (open kettle method) and to evaluate its quality parameters during storage. Fruit jam was allowed to cool and store in sterilized glass jars for 60 days. The strawberry jam was also organoleptically evaluated by sensory analysis using nine point hedonic scale. Results showed that the values of total soluble solids (°brix), acidity (%), pH, sugar acid ratio and non reducing sugar (%) significantly decreased during 60 days of storage, whereas reducing sugar increased. From the overall results it is concluded that the prepared strawberry jam is of good quality and has maximum consumer acceptance.

Muhammad et al., (2012) studied the storage stability of jam preparation from various mango varieties (Chaunsa, Dusehri and Anwar Ratol) was investigated at ambient temperature ($25\pm3^\circ C$) and relative humidity ($60\pm6\%$). Mango jams were prepared and analyzed for physico-chemical, microbial and sensory parameters at 30 days storage interval for 150 days. Anwar Ratol jam had the highest total soluble solids (68.20°Brix), brix/acid ratio (101.79), reducing sugars (19.88%) and total sugars (60.14%) whereas Chaunsa jam had the highest acidity (0.71%) and lowest pH (3.52). Negligible total viable
count was observed in all mango jam samples. Sensory evaluation results revealed that Dusehri jam was ranked the highest and more acceptable than others. However, all mango jams remained organoleptically acceptable.

Eke and Owuno, (2013) reported that the physico-chemical and sensory properties of jackfruit jam (open pan method), where as pineapple jam was used as a control. The sensory analysis showed that there was a significant difference at (P<0.05) in colour, aroma, flavour, taste and general acceptability with control rated higher. While texture and spreadability showed no significant difference.

Kerdsup and Naknean, (2013) studied the effect of sweetener (sorbitol) substitution on physico-chemical and sensory properties of low-sugar mango jam. No differences were detected in colour, but hardness was significantly decreased when substituted sucrose with sorbitol. The chemical properties (total moisture, total acidity and pH) of the original and low sugar jams were not changed much. The total acidity and hardness of the sorbitol replaced jam were maintained during storage over six weeks at room temperature; during which no detectable growth of bacteria and fungi were observed, which showed the suitability of sorbitol as sweetener.

Wani et al., (2013) investigated that the shelf life of karonda jams under ambient temperature based on variations of sugar.1000 g pulp + 1150 g sugar possessed the best physico-chemical and sensory parameters of jam with ideal value of total soluble solids, pH, acidity, moisture, ascorbic acid, iron and overall acceptability for 80 days of storage.