Chapter - II

REVIEW OF LITERATURE

2.1 Physico-chemical properties of products:

Cruk (1944) reported that the proportion of sugar varies in Jams with the variety of the fruit and its ripeness. He suggested that the most common ratio of sugar to fruit is pound per pound, but sweet fruits of low acidity normally require less than an equal weight sugar.

Crueshs (1948) studied that boiling is desirable in order to cause intimate mixing of the fruit pulp and the sugar and partially to concentrate the product by evaporation of excess moisture and also suggested the sheet test for determining the end point.

Siddhappa (1954) reported that the skin and other tissues of apple do not have any undesirable constituents, which adversely affect the taste and flavour of the product prepared from it.

Lal and Singh (1957) gave the analysis of different kinds of jams and for apple jam TSS, acidity and degree of inversion were 69.5%, 0.52% and 64.0% respectively.

Lale et al. (1967) described that jam is prepared by boiling the fruit pulp with sufficient quantity of sugar to reasonably thick consistency, firm enough to hold the fruit tissue in position determined the end point and has observed that the cooking them containing 65% solids boil at 220.7°F at sea level. These workers while analyzing different jams reported a range of 67.5 to 79.6% of TSS.

Wyse and Dexter (1971) carried out an experiment to determine the influence of harvest date, nitrogen fertilization and storage temperature on the content of three impurities i.e. raffinose, reducing sugars, amino acids in several sugar beet varieties. It was found that the decrease in bagged sucrose per ton of beets during storage results primarily from two factors. Sucrose is respired, evolving CO$_2$. The transformation of sucrose and other beet constituents, etc., results in an accumulation of non-sucrose solutes in the thin juice and corresponding increased sucrose losses into the molasses. Reducing sugars, raff nose and amino acids account for a major portion of the fluctuation in impurities during storage.
**Patel et al. (1977)** reported 0.45 and 0.60% acidity in Maharaji and Golden Delicious varieties apple, respectively.

**Dang et al. (1974)** reported 0.65%, 0.33%, 0.380% and 0.450% pectin content in Maharaji, Red Delicious, Golden Delicious and American varieties of apple, respectively.

**Gersons and Bronkhoret (1974)** described the jellied apple product with reference to studies on the effect of sugar content etc, and found that jams must contain 50% apple sugar and 50% sugar syrup.

**Vail et al. (1978)** reported that the finished product obtained after cooking the fruit may be quite smooth or uniform or it may contain piece of the fruit. Fruit may be crushed to the extraction of juice and with all fruit containing pectin the juice obtained by cooking is richer in pectin than that obtained by cold extraction and they observed that the problem of crystallization of sugars in jams is due to incorrect amounts of sugar used or due to overcooking. Adding sugar too late in the cooking process also causes crystallization. Vail believed that jam when sufficiently cooked gives a taste similar to that for jelly and mixture “heaps up” on the spoon.

**Bose and Som (1980)** studied that the repeutical action analgesic amyl inflammatory ulcer properties block calcium influx in to muscles cells causing inhibition of isolated contractions dissolve gall stones and eliminates heart burn peppermint is an excellent breath further mint is also know for lifting the mood mint contains vitamin C and vitamin A.

**Burroughs (1981)** reported that a range of 0.14 to 0.64 percent acidity in different varieties of apple.

**Singh et al. (1983)** reported an increase in organolaptic score and a gradual decrease in acidity of the guava fruit cheese prepared from three cultivars viz. Allahabad SafedaBanarasiSurkha and Lucknow - 49.

**Khan and Ishgar (1984)** in their studies on apple observed that all sucrose jams required a higher temperature to reach the jelling point than jams containing Corn syrup.
Wallrauch (1984) showed that sugar, organic acids and mineral substances occur in all fruits, but may vary considerably in the same fruit with variety and season and in some may not differ widely.

Nkoaet al. (1986) studied that fruit product with vanilla flavour added, recorded a good flavour after 0, 30, 60 and 90 days product with vanilla flavour its better effect even after loss of its consumable condition.

Shaliniet al. (1987) reported that the butter prepared form temperate fruits preserved at 18 degree for 30 days possessed more attractive colour and secured more sucrose as compared to works also reported that during storage there was decline in vitamin C, non - reducing sugars and pH values and rise in total solids.

Dziezak (1989) reported that volatile flavouring compounds are lost during evaporation process in processing.

Elwell and Dehn (1989) classified fruits for jam making in case of apples, and crab apples are best for jam and jelly making because of their high pectin and acid content.

Singh (1989) reported the recipe for quality guava cheese.

Uddin and Mahfuz (1991) reported that apple was analyzed for soluble solids, total sugar, acidity, ascorbic acid, shorten and pH. Jellies, butter, jam, preserves and of candies were prepared from apples. These products were analysed for proximate composition.

Westerlundet al. (1991) reported that apple and apple pomace are good source of pectin having important nutritional and technological properties but are rarely being utilized.

Drzazga and Jechna (1996) studied the quantity of pectin preparations in relation to extraction pH. They found that the increase in the acidity extraction, the degree of esterification and polymerization and gelatin capacity decrease steadily, yield in terms of gelation capacity showed no clear trends.

Raphaelides and Ambatizodis (1996) reported that butter texture prepared by using cinnamon syrups of 50ml and 60ml was markedly affected by the composition of syrups. The consistency of butter ranged from very firm when 100 percent cinnamon was used and
three weeks aging was needed for stabilization. The analysis showed that butter could be classified according to their mechanical and textural attributes.

Casterline et al. (1997) reported that fermentation of dietary fibre fractions from fruits such as pear apple and fig produced low amounts of butyrate.

Solomon (1998) reported that guava cheese is simply guava butter taken a step further and cooked until it is firm enough to cut in slices and serve as a sweetmeat.

Yawin and Marsh (1999) studied that apple butter containing total soluble solids more than 74°Brix gets crystallized but no microbial growth because of sticky and gummy nature of butter.

Lachman et al. (2000) reported that process of enzymes browning of apple fruits and addition to the apple products poly-phenol content could be influenced, by pre harvest and technological procedures.

Ranganna (2001) reported that the sensory quality is combination of different senses of perception coming in to playing in choosing and coming of food appearance which can be judged by eye e.g. colour, consistency, texture, size, shape, uniformity and observance of defects is the first importance in food selection.

Ehsan et al. (2003) observed that was an increase in the TSS, acidity and reducing sugar while decreasing trend was recorded in pH value and non-reducing sugar. While sensory evaluation scores remained in the acceptable range in all the samples in apple jam.

Zaetina (2003) studied that the apple butter with pH 3.5 possess ideal texture and sweet taste.

Ahmad et al. (2004) prepared cheese from five varieties of Apple viz. Red delicious, Ambri, American, Apriouge, Maharaji and Golden Delicious and reported that Maharaji variety is best for cheese preparation in terms of yield of product, colour, appearance, flavour and aroma and overall acceptability.

Kothari (2004) reported that the tulsi is used as a flavoring agent in jellies baked food like biscuits and cakes, non-alcoholic beverages, chewing gums, candy, pudding and ice-cream.
Solomon (2005) reported that apple cheese is simply apple butter taken a step further and cooked until it is firm enough to cut in slices and serve as a sweetmeat.

Singh et al. (2006) reported that rainy and winter season apple butter stored at room and low temperature showed a gradual decrease in ascorbic acid and pectin content and increase in browning and microbial growth.

Singh et al. (2007) reported an increase in organoleptic score and a gradual decrease in acidity of the apple butter prepared from three cultivars were 8.45, 10.31 and 9.80 percent respectively.

Jallel et al. (2007) reported that the cultivars Maharaji, Golden Delicious, Kesri, Red Delicious and American had 0.49, 0.18, 0.49, 0.18 and 0.50 percent acidity, respectively and they found highest T.S.S % in Red Delicious variety (15.80%) and Maharaji variety was rich in pectin content (0.70%) and total acidity (0.66%).

Iftikhar et al. (2007) reported that the mean maximum scores apple and pear for colour and appearance, taste, flavour and overall acceptability was recorded in the candy prepared with initial syrup strength of 60°Brix with one per cent citric acid, whereas maximum score for texture was observed in candy with initial syrup strength of 40°Brix with one per cent citric acid with or without blanching. The jam samples were stored in sterilized glass jars and evaluated physic chemically for ascorbic acid, acidity, pH, total soluble solids, reducing sugars and non-reducing sugars for an interval of 15 days during 3 months storage period. All the samples were significantly different at (P < 0.05) during storage. A decrease was observed in ascorbic acid from 17.40 mg/100g to 9.19 mg/100 g, pH 3.64 to 3.22 and non-reducing sugars 46.00% to 16.69%. While increase was noted in % acidity from 0.6% to 0.78%, reducing sugars 16.55% to 47.30% and TSS 68.5 °brix to 71.2 °brix during evaluation.

Ali et al. (2008) analysed that ascorbic acid, % moisture and organoleptically (colour, texture and overall acceptability) fortnightly during 3 months of storage. A decrease was recorded in ascorbic acid content (14.55 to 9.65 mg/100g), moisture content (82.43 to 71.71%), pH (4.34 to 3.01) and non-reducing sugar (7.33 to 3.46), while an increase was recorded in
acidity (0.26 to 0.59%), and also found that TSS (13.70 to 18.03 brix) and reducing sugars (4.02 to 7.15) in diet jam apple.

**Dang et al. (2008)** reported 0.67%, 0.337%, 0.337 % and 0.450% pectin content in Maharaji, Red Delicious, Golden Delicious and American varieties of apple, respectively.

**Selvaraj and Mohandass (2009)** reported that rose petals from the flower were separated and washed and soaked in equal amount of water for overnight than it was heated for 10 minutes and filtered through muslin cloth. The clear extract which was used for preparation of value added rose (RTS) was a good in terms of taste, flavour and shelf life of the product.

**Hiremath and Rokhade (2012)** observed that the mean maximum scores for colour and appearance, taste, flavour and overall acceptability was recorded in the kinnow candy prepared with initial syrup strength of 60°Brix with one per cent citric acid, whereas maximum score for texture was observed in candy with initial syrup strength of 40°Brix with one per cent citric acid with or without blanching.

**Clarissa Damiani et al. (2012)** observed the levels of reducing sugars were higher than the sucrose ones. This happened because, during the cooking process for the jam manufacturing, the sucrose underwent an inversion process, due to the acid medium, being partly or completely converted into glucose and fructose (invert sugar). They also reported that the main component of the areca jam soluble solids was represented by sugars (64.13%), followed by the total soluble organic acids.

**Sindumathi and Amutha (2014)** reported that the initial total sugar coconut based jam were 52.20 g/100g which was decreased to 51.60, 51.65, 51.28, 51.32g/100g in the packaging materials glass bottles and plastic container stored at room and refrigeration temperature, respectively. The actual decrease in the total sugar content was more in room temperature stored the sample than in refrigeration stored samples. The increase in reducing sugar content of the sample stored at refrigeration temperature was slightly lesser than the sample stored at room temperature, An increasing trend in bacterial and fungal population was observed in the stored coconut based jam throughout the storage period. A minimum count was recorded in the samples packed in glass bottles. The jam packed in plastic
containers exhibited a slightly higher microbial load than the jam packed in glass bottles. Acceptable amount of microbes has observed at the end of the storage period.

**Aggarwal and Michael (2014)** reported that acidity and ascorbic acid decreased while total soluble solids, reducing and total sugars and limonin increased with no change in ash content of the kinnow candies during four months of storage. And found Total soluble solids of candies were found to increase significantly (P.0.05) during storage. This increase seemed to be the result of moisture loss resulting in the concentration of total soluble solids of the samples in kinnow candy. And Moisture, acidity and ascorbic acid decreased while total soluble solids, reducing and total sugars and limonin increased with no change in ash content of the candies and the Organoleptically was equally good during four months of storage.

### 2.2 Shelf life of various products:

**Wyse and Dexter (1971)** carried out an experiment to determine the influence of harvest date, nitrogen fertilization and storage temperature on the content of three impurities *i.e.* raffinose, reducing sugars, amino acids in several sugar beet varieties. It was found that the decrease in bagged sucrose per ton of beets during storage results primarily from two factors. Sucrose is respired, evolving CO₂. The transformation of sucrose and other beet constituents, etc., results in an accumulation of non-sucrose solutes in the thin juice and corresponding increased sucrose losses into the molasses. Reducing sugars, raffinose and amino acids account for a major portion of the fluctuation in impurities during storage.

**Tomkins (1979)** reported that if storage conditions are such as to allow them would to draw moisture easily from the substratum, the atmospheric humidity will have very little effect on their growth.

**Hirst (1982)** stated that jams are rarely spoiled by yeast because of their jelly consistency in which they cannot grow or thrive.

**Singh et al. (1983)** reported that rainy and winter season guava fruit cheese stored at room and low temperature showed a gradual decrease in ascorbic acid and pectin content and increase in browning and microbial content.
Scott and Mathew (1984) worked at the C.S.I.R.O laboratories in Sydney, Australia and reported that the solutions with high total solids have a very low water acidity coefficient in regard to growth of micro-organisms.

Dremman and Carrot (1985) observed that majority of people found apple butter with cardamom helpful in intestinal infection, digestion and other digestion related problems.

Lopes (1985) reported that the levels of reducing sugars were higher than the sucrose ones. This happened because, during the cooking process for the jam manufacturing, the sucrose underwent an inversion process, due to the acid medium, being partly or completely converted into glucose and fructose (invert sugar). This inversion is necessary to prevent crystallization during the process.

Ibrahim et al. (1996) reported that preparation of dried apple sheets slices and cubes against different SO₂ doses and storage time was recorded. Five thousand ppm of SO₂ gave the best result.

Riazet al. (1999) reported that strawberry jam prepared form fresh supply of fruits and after the butter had been stored at minus 4 degree centigrade for 60 days; different formulations were tried with particular emphasis on the effect of commercial grade pectin and strawberry pulp pectin on the ultimate quality of strawberry jam. The products were subjected to organoleptic testing as well as chemical analysis on days 0, 30, 60 and 90 of storage and observed decrease in non-reducing sugars from 44.64 to 32.35% in strawberry jam.

Anjumet al. (2000) while working on apricot diet jam observed increase in reducing sugar. The increase in reducing sugar may be due to the inversion of sucrose to reducing sugar (glucose + fructose) due to acid and high temperature during storage and observed increased in acidity from 0.65 to 0.70 % after 60 days of storage in dried apricot diet jam.

Uttimins (2001) reported in his studies on apple butter. He observed that the acidity increased through the storage period, butter with 0.99% acidity is more suitable for consumption.

Sogi and Singh (2001) reported that the loss in ascorbic acid content was found to be due to the effect of light and prevailing high room temperature conditions.
Sogi and Singh (2001) increase seemed to be the result of moisture loss resulting in the concentration of total soluble solids of the samples in kinnow candy.

Oratalet al. (2002) reported that apple butter stored at 10°C,30°C at room temperature could be stored for less than 4 months. The workers reported that maximum storage capacity for apple butter is 90-110 days and afterwards it gets deteriorated during storage reducing sugars increased.

Torzen (2002) observed the acidity up to 0.9% in jam prepared by continuous process and 0.6% from jam prepared by conventional method. The increase in acidity may be due to the breakdown of pectin into pectin acid.

Ahmed et al. (2003) observed that a well-balanced body textured apple butter prepared with addition of citric acid 2%, 2.5% and 3% where butter containing 2.5% citric acid showed better quality during storage time and citric acid levels 2 and 3 percent showed bitterness in taste during storage period.

Giannakourou and Taoukis (2003) concluded that there was a 62.5% loss, during its processing, reaching more than 70%, during its storage, due to storage temperature and presence of residual O₂. After consuming all the oxygen, the ascorbic acid can be anaerobically degraded to furfural. Another possible explanation is low moisture content.

Ehsanet al.(2003) observed decreased in non-reducing sugars of grape fruit apple marmalade. The maximum decrease recorded was from 49.41 to 34.85 % and minimum decrease recorded was from 49.50 to 34.60 %. Decrease in non-reducing sugar may be due to the conversion of non-reducing sugar to reducing sugar. The pH of all the jam samples was decreased during storage. The mean values of all the treatments showed significant difference. An increasing trend in reducing sugars of grape fruit apple marmalade was noticed from 16.55 to 31.36% after 60 days of storage.

Iftikharet al. (2007) reported that The mean maximum scores for colour and appearance, taste, flavour and overall acceptability was recorded in the candy prepared with initial syrup strength of 60°Brix with one per cent citric acid, whereas maximum score for texture was observed in candy with initial syrup strength of 40°Brix with one per cent citric acid with or
without blanching. The jam samples were stored in sterilized glass jars and evaluated physically for ascorbic acid, acidity, pH, total soluble solids, reducing sugars and non-reducing sugars for an interval of 15 days during 3 months storage period. All the samples were significantly different at (P < 0.05) during storage. A decrease was observed in ascorbic acid from 17.40 mg/100g to 9.19 mg/100 g, pH 3.64 to 3.22 and non-reducing sugars 46.00% to 16.69%. While increase was noted in % acidity from 0.6 % to 0.78%, reducing sugars 16.55% to 47.30% and TSS 68.5 °Brix to 71.2 °Brix during evaluation.

Srivastava et al. (2007) reported that the fruit cheese have a long shelf-life and are at their best after 3 to 6 months storage.

Ali et al. (2008) analysed that ascorbic acid, % moisture and organoleptically (colour, texture and overall acceptability) fortnightly during 3 months of storage. A decrease was recorded in ascorbic acid content (14.55 to 9.65 mg/100g), moisture content (82.43 to 71.71%), pH (4.34 to 3.01) and non-reducing sugar (7.33 to 3.46), while an increase was recorded in acidity (0.26 to 0.59%). They also found that TSS (13.70 to 18.03 brix) and reducing sugars (4.02 to 7.15) in diet jam apple.

Vidhya and Narain (2010) have observed the microbial load of wood apple jam was under the limit at the end of the storage period.

Priyadarshini (2013) observed that with the storage period of all the candies from the different treatments up to 40 days after storages. There was slight decline in score in 60 days after storage. It was evident the colour and appearance in apple whey candy improved up to 40 days thereafter decline with the advancement of the storage period.

Sindumathi and Amutha (2014) reported that the initial total sugar coconut based jam were 52.20 g/100g which was decreased to 51.60, 51.65, 51.28, 51.32g/100g in the packaging materials glass bottles and plastic container stored at room and refrigeration temperature, respectively. The actual decrease in the total sugar content was more in room temperature stored the sample than in refrigeration stored samples. The increase in reducing sugar content of the sample stored at refrigeration temperature was slightly lesser than the sample stored at room temperature, an increasing trend in bacterial and fungal population was observed in the stored coconut based jam throughout the storage period. A minimum
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