Chapter - 5
Summary and Conclusion

It is well known fact that white sugar contains very high amount of sucrose and is an extremely poor food. The excessive consumption of sucrose quite often leads to variety of health problems, which can be avoided by replacing white sugar with natural sweeteners like honey. Honey is a complex mixture of carbohydrates, several enzymes, amino acids, organic acids, minerals, aroma substances, pigments etc. In comparison to white sugar, honey contains large amounts of fructose and glucose. Honey also has anti microbial, antifungal, anti oxidant properties besides several medicinal properties.

Like honey, the fruits and vegetables used in this study also have therapeutic value and uses. Aonla fruit is highly nutritive and it is richest source of vitamin C. Fruits are also utilized for making the Ayurvedic medicines such as chavanprash, Trifla, Amlaki Rasayan and powder, which are good for the diabetic patients. Guava is a rich source of ascorbic acid and pectin. High quality nectar can be prepared from guava (Baramanry et.al, 1951). Papaya is very wholesome fruit. Aykroyed (1995) ranks it second only to mango as a source of the precursor of vitamin A. They are used in preparation of jam, soft drinks, icecreams flavouring and crystallized fruits in syrup. At last, carrot is valued as food mainly because it is a rich source of α and β- carotene. Carrot roots are used as vegetable for soups, stews and used as salad. Carrot juice is a rich source of carotene and carrots are also canned.

In the present study honey was used as natural sweetener in place of white sugar for the preparation of various types of food products namely candy, murabba, squash, jam and toffee. Product wise recipes were finalized by determining optimal quantities of honey to be used. All the above named product were evaluated for various physico-chemical, microbial, textural (where ever required) and organoleptic characteristics in fresh (on 0th day of storage) as well as during six months storage at different intervals. For shelf life studies different packaging materials and storage conditions were used. Statistical and economic analysis was worked out for all above products separately to encourage small scale entrepreneurs. Results obtained on the basis of this study the most suitable conclusion are presented product wise:
1. Honey carrot candy

(i) It was observed that very good quality carrot candy can be prepared by mixing 750 g of honey per kg of carrot.

(ii) It was also observed that fresh honey carrot candy contains 28% moisture content, 72°Brix TSS, 0.064% acidity, 0.02 browning index, 30.5% reducing sugar, 78% total sugars, 16.27mg per 100gm Beta carotene content.

(iii) The fresh carrot candy scored 8.33 on 9 point hedonic scale with respect to overall acceptability which decreased up to 6.83 and 6.79 respectively in glass jar and LDPE pouch during 180 days storage at ambient condition. This score corresponded to rated between ‘liked moderately’ to ‘liked slightly’.

(iii) Honey carrot candy was found at par in various organoleptic characteristics with carrot candy prepared in sugar and jaggery syrup.

(iv) In comparison to intermediate moisture (IM) carrot preserved, the honey carrot candy scored higher for organoleptic characteristics. Similarly in comparison to carrot milk cake the honey carrot candy was found to be at par with respect to organoleptic qualities.

(v) Small scale industry can be established for production of honey carrot candy with production target 10kg/hr. The cost of production of honey carrot candy worked out to be Rs 52/kg. The annual net profit of Rs 2, 83,764 can be obtained with a return on investment 563% of the product is sold at the rate of Rs 75/kg.

2. Honey aonla murabba

(i) It was observed that honey aonla murabba can be prepared by mixing honey and aonla in 1:1 ratio. The score for organoleptic characteristic for such product on 9 point hedonic scale were respectively 7.85 for colour, 8.05 for flavour, 7.95 for juiciness, 8.05 for texture and taste and 7.99 for overall acceptability.

(ii) It was also observed that the fresh honey aonla murabba contained 48.33% moisture content, 52.5°Brix TSS, 6.88% acidity, 0.037 browning index, 27.3% reducing sugars, 50.4% total sugar, 152.1mg/100gm vitamin C.

(ii) The physico-chemical composition and microbial characteristics were respectively found to be decreasing and increasing during 180 days storage at ambient conditions when packed in glass jar and PET jars. However, with respect to microbial characteristics glass jar proved to be a better packaging material with TPC, Y & M
count being in safe limits. During 180 days storage no coliform count could be detected.

(iii) After 180 days storage the score for colour, flavour, juiciness, texture, taste and overall acceptability were respectively 7.15, 7.10, 7.77, 7.52, 6.98 and 7.31 in glass jar and between 7.37 to 6.75 for these characteristics in PET jar showing that the product was rated between ‘liked moderately’ to ‘liked slightly’ after 180 days of storage. However with respect to taste the product was rated between ‘liked very much’ to ‘liked moderately’.

(iv) In comparison to sugar syrup segments of aonla, the fresh honey aonla murabba had higher vitamin C content.

(v) A small industry can be set up for production of honey aonla murabba with the investment of Rs 48,442. With a production target of about 18kg/hr, the cost of processing worked out to be Rs 45/kg and with a sell price of Rs 75/kg. The net annual profit works to be Rs 2,63,702 with return on investment of 545%.

3. Honey Aonla Squash

(i) It was observed that honey aonla squash can be prepared by mixing 60% of aonla juice and 40% of honey.

(ii) It was also observed that fresh honey aonla squash had 35.0°Brix TSS, 0.4% acidity, 0.08 browning index, 23.7% reducing sugar, 45.5% total sugar and 78.6% vitamin C content.

(iii) The scores for organoleptic characteristic for such product on 9 point hedonic scale were respectively 7.66 for colour, 7.66 for flavour, 8.66 for taste and 8.00 for overall acceptability. This score decreased gradually during 180 days storage. The overall acceptability scores remained 6.20 and 7.05 respectively at ambient and refrigerated temperatures. This score corresponded to rated between ‘liked moderately’ to ‘liked slightly’.

(iv) In comparison to aonla syrup the honey aonla squash has very high scores for all organoleptic characteristics. The ascorbic acid content is higher (78.6mg/100g) in honey aonla squash as compared to aonla squash (51.1mg/100g) prepared with sugar.

(v) The microbial counts were found to be increasing during 180 days of storage at room temperature and refrigerated temperature. However with respect to microbial characteristics refrigerated storage was better as compared to storage at room
temperature with TPC, yeast and mould being in safe limits. No coli form count was detected during 180 days storage.

(vi) Small scale industry can be established for production of honey aonla squash with production target 10 lt/hr. A cost of production of honey aonla squash worked out to be Rs 56/lt and with a sell price of Rs 75/kg. The annual net profit of Rs 1,1052 can be obtained with a return on investment of 266%.

4. Honey mixed fruit jam

(i) It was observed that honey mixed fruit jam can be prepared by mixing 750g of honey per kg of mixed fruit pulp. The score for organoleptic characteristic for such product on 9 point hedonic scale were respectively 8.78 for colour, 8.06 for flavour, 7.63 for texture, 8.57 for taste and 8.26 for overall acceptability.

(ii) It was also observed that the fresh honey mixed fruit jam contained 48.33% moisture content, 52.5°Brix TSS, 6.88% acidity, 0.037 browning index, 27.3% reducing sugars, 50.4% total sugar, 152.1mg/100gm vitamin C.

(iii) The microbial counts were found to be increasing during 180 days of storage at room temperature and refrigerated temperature. However with respect to microbial characteristics refrigerated storage was better as compared to storage at room temperature with TPC, yeast and mould being in safe limits. No coli form count was detected during 180 days storage.

(vi) Small scale industry can be established for production of honey mixed fruit jam with production target 10kg/hr. The cost of production of honey mixed fruit jam worked out to be Rs 77/kg. The annual net profit of Rs 2,7072 can be obtained with a return on investment 118% of the product is sold at the rate of Rs 105/kg.

5. Honey toffee

(i) It was observed that honey toffee can be prepared by mixing 400g milk powder, 120g hydrogenated fat/kg of honey.

(ii) It was also observed that Fresh honey toffee contains 7.83% moisture content, 6.50 pH, 14.6% fat content,0.25 browning index, 27.99% reducing sugar and 67.43% total sugar.

(iii) The fresh honey toffee scored 8.00 on 9 point hedonic scale with respect to overall acceptability which decreased up to 6.08 and 7.50 respectively at room temperature and refrigerated temperature during 180 days storage. This score corresponded to rated between ‘liked moderately’ to ‘liked slightly’. 

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(iv) Honey toffee was found at par in various organoleptic characteristics with papaya toffees.

(v) The microbial characteristics were found to be increasing during 180 days of storage at room temperature and refrigerated temperature. However with respect to microbial characteristics refrigerated storage was better as compared to storage at room temperature with TPC, yeast and mould being in safe limits. No coliform count was detected during 180 days storage.

(vi) A small industry can be set up for production of honey toffee with the investment of Rs. 1,30,320 with a production target of 10kg/hr. The cost of processing works out to be Rs 108/kg and with a sell price of Rs 120/kg, the net annual profit of Rs 3,06,578 can be obtained with a return on investment of 227.5%.

Recommendations

(i) Out of five different types of products developed in this study, Honey Carrot Candy, Honey Aonla Murabba, and Honey Toffee have found greater response from a large section of society who were served these products. Similar other products from other fruits and vegetables may be developed and evaluated.

(ii) The technologies developed in this project may be transferred to entrepreneurs for large and small scale adoptions particularly in rural areas.

(iii) Media needs to be informed about the potential use of honey in various foods. So that mass awareness of people can be created about the antimicrobial, antifungal, antioxidant and medicinal properties.

(iv) As the fruits and vegetables used in this study have therapeutic value and uses. The product developed by this study can be taken on clinical trail for combating various specific nutritional deficiencies.

(v) The products developed in this study if properly incorporated, may lead to income generation to control poverty level and helps in overall National development.

(vi) Studies related to packaging of different products apart from method used in this study needs to be carried out in future.

(vii) Possibility of incorporation of honey in place of white sugar in development of other sweet products needs further R and D studies.