# SUMMARY AND CONCLUSION

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Flavour is very important for the acceptability of foods, medicines, confectioneries and drinks. Information relating to aroma components of fruits and fruit products has shown great advances over the past twenty years largely due to analytical developments in the field of gas chromatography.

Flavour in fruits and fruit products, as well as all foods and beverages, results from the combined effect of their constituents on the taste and olfactory organs. When considering flavouring components, it is usual to segregate them into volatiles and non volatiles, the former giving rise to aroma and the latter to taste sensations, but it must be remembered that this division is not clearly cut.

The percentage of different constituents of fruits differs with the degree of ripening, fertilization and environmental conditions prevailing during growth and maturation of fruits.

Mature, ripe and over ripe guava and pear fruits were choosen for this current studies to cover the whole guava and pear season. Separation of flavouring materials and their identification in the three degrees of maturity were also studied. The effect of processing and storage

on ascorbic acid, sugar content and total acidity were monitired for one year.

Following up develop in the volatile components through ripening, beside the distribution of these volatiles in different parts of fruits were achived. The volatile components were obtained by different methods to choose the best one.

Ripening of pear fruits by storage under different temperatures was carried out. Influence of processing and storage on the volatile components of guava juice and pear puree were investigated . Analysis of the fatty acid composition of ripe guava and pear fruits was obtained. Organoleptic evaluation was carried out for mature, ripe ,over ripe, processed and stored guava juice and pear puree.

The results of this study could be summarized in the following :

1- Both weight and size of fruits increase during ripening hence the maximum weight and size was observed at ripe stage, where the specific gravity was 1.006 and 1.001 in guava and pear juice respectively. The maximum content of edible parts was obtained in the ripe stage in guava fruits, where the highest content was obtained

in the over ripe stage in pear fruits.

2-Ripe guava fruits have a high content of total acidity, total soluble solids, total sugars, carotenoids, protein and fat. It has also a low contnt of ash ; fibers and total solids compared to mature stage. Over ripe fruits contain high ascorbic acid, moisture and carotenoids. Its flesh also is characterized by excellent flavour and colour in ripe fruits.

3- An increase was noticed in ascorbic acid, carotenoides, moisture, protein, fat and ash in ripe stage of pear . Also a slight increase was noticed in total soluble solids, total sugars and fibers in over ripe stage of pear fruits.

4- Ripe fruits had the highest content of ester, carbonyl compound, oxygenated terpenes and limonene that reveal strong fruity aroma for guava and pear fruits.

5- Ascorbic acid content of fresh white guava juice which was 85.2 mg./100gm. decreased gradually after processing and storage for 12 months in all treatments.

Ascorbic acid content in fresh pear puree was 4.5 and 5.2 mg/100gm. in peeled and unpeeled fruits respectively. After processing it decreased to 2.57 and 2.97 mg/100gm., and after storage for one year the loss of ascorbic acid was 19.84 % and 16.16 % respectively.

A slight increase was noticed in reducing sugars while a slight decrease was observed in non reducing ones through storage of guava juice and pear puree.

The titrable acidity (calculated as citric acid) decrease to about half during processing, due to addition of water and sugar. The titrable acidity of guava was stable in juices stored at 5°C. and - 15°C ., while those stored at room temperature showed a slight decrease for guava juice and pear puree after storage for one year.

6- Gas liquid chromatographic technique was used to separate and identify volatile components of mature , ripe and over ripe fruits.

a. 40 components were identified in guava fruits representing different groups of organic compounds, 12 aldehyes (3.methyl butanal ; pentanal ; 2-methyl propanal;

hexanal ; 2-hexenal ; heptanal ; octanal ; nonanal ; decanal ; benzaldehyde ; hendecanal ;and dodecanal.) & 13 esters (methyl butyrate ; ethyl butyrate ; methyl valerate ; methyl hexanoate ; linalyl acetate ; methyl heptanoate ; methyl octanoate ; benzyl acetate; B-phenyl ethyl acetate ; methyl cinnamate, ethyl dodecanoate ; ethyl tetradecanoate and cinnamyl acetate.) & 10 alcohols (3-hexanol ; 2-hexanol; 3-methyl-1-pentanol; hexanol ; 3-octanol ; heptanol ; octanol; B-phenyl ethyl alcohol ; $\alpha$-terpeniol and benzyl alcohol.) & 3-Ketones (B-ionone ; 3-heptanone and 3-Octanone.) & and 2-hydrocarbons (caryophellene and P-methyl styrene .).

The components responsible for the fragrant flavour are the ester components which have the highest concentration (44.94 %) for ripe fruits and the lowest for the mature ones (33.68 %) . This result indicates that ripe fruits has the best taste and odour, concerning alcohols, the great variation in their concentration was observed for the ripe fruits as it reached 27.33 % while for the over ripe ones it was 8.95 % .

b. Qualitative and quantitative changes in aroma compounds as a result of ripening were studied in pear essence. 34 components were identified, 4 aldehydes (Propanal ; 3-methyl butanal; decanal and 2,4undecandenal).

20 esters (propyl acetate ; butyl acetate ; amyl acetate; hexyl acetate ; methyl heptanoate ; methyl octanoate ; ethyl octanoate ; octyl acetate ; ethyl trans : 2-octanoate ; methyl cis: 4-decenoate ; ethyl decanoate ; ethyl cis:4-decenoate : methyl trans: 2-decenoate ; methyl trans: 2: cis:4-decadienoate ; ethyl trans :2-decenoate ; methyl trans: 2: trans:4-decadienoate ;ethyl-3-hydroxy octanoate ; ethyl trans: 2cis:4-decadienoate ; ethyl trans: 2: trans:4-decadienoate and methyl dodecanoate.) , 8 alcohols (3-hexanol; propyl alcohol ; 2-hexanol; 1-hexenol ; linalool; 3-octanol; n-heptanol; and n-octanol.) and 2 ketones (3-octanone and 3-nonanone.).

Both short chain and long chain fatty acid esters play a significant role in the ripening of fruits. These results agree with those mentioned by Creveling and Jennings (1970).

7- a. Esters of guava give the fruit its characteristic fruity aroma.They reached 42.27 % in the whole fruit and 32.02 % in pulp. Cinnamyl acetate increased to 10.46 % in pulp because other components overlap its characteristic odour. The ketonic compounds reached 21.49 % in seeds and 14.84 % in peels.

b. Results of pear fruits explain that most of the characteristic flavour of pear developed mainly in peels,

while pulp have only sweet flavour. The short chain alcohols were 4.27 % ; 4.14 % ; 0.46 % and 2.26 % for the whole fruit; pulp ; peels and cores respectively. This explains that the peel has lowest concentration of alcohols of a grassy flavour. The percentage of alcohols in seeds may contribute to the pressence of lipid in seeds which may be oxidized to give those short chain alcohols.

8-a. Extraction by organic solvents depends upon the polarity of both, solvent used and flavour components. Using ether, aliphatic aldehydes showed the highest concentration in guava fruits. Also by using pentane, alcohols had the highest concentration. Using ether to extract the distillate of guava juice gave the highest concentration of esters (44.94 %), alcohols (27.33 %) and the lowest content of aldehydes (6.51%).

b. Steam distillation of flavour components of pear fruits followed by ether extraction is better than even direct ether extraction which shows a good result than pentane or (ether: pentane) extraction.

9-a. Both chemical and physical methods can be used for reducing enzyme action . Guava fruits treated with

11- Low temperature of 5°C encouraged the production of unsaturated fatty acid esters rather than saturated ones . On the other hand, storage at room temperature decreased unsaturated long chain fatty acid esters in relation to their saturated homologs. Cold storage of pear fruits is the best condition to obtain good taste and flavour.

12-a. An obvious increase in the alcohol concentration which may be due to the reversible reaction between esters and water to form alcohols and acids.

b. The concentration of low boiling point components decreased, a fact which might be due to escape of low boiling point components during the processing, then other components increased.

c. The concentration of the volatile components of canned guava juice stored at room temperature in aluminium foil containers and stored at 5°C especially enhanced the aldehydes by the addition of sucrose. Cold storage of aluminium foil containers of guava juice stored at 5°C . and - 15°C. showed high content of B-ionone at 10.77 % and 23.86% respectively.

d. Processing of pear puree under different treatments revealed a wide variation in the concentration of

individual volatile components of pear.

The storage of pear puree at room temperature for one year lead to a high change in the concentration of alcohols in most stored samples , which may be due to the begining of fermentaion through the browning reactions.

13-a. Oleic, linoleic and linolenic acids formed the major part of the fatty acids (56 %) . This explains the forming of 3-alkanones, long chain aldehydes and long chain esters which are believed to be derived from $\alpha$-B-oxidation of these unsaturated fatty acids and also explains the variation observed by storage or by another treatment for guava fruits.

b. On the other hand the unsaturated acids,namly oleic,linoleic and linolenic constitute the major part of the acids, (62 . 54%) . This may explain the presence and the change of the unsaturation isomers decodienoates. The development of these decadienoates are due to $\alpha$ & B-oxidation of these unsaturated fatty acids during ripening of the fruits or under technical processing.

14-a. Changes that occurred in the chemical properties and flavouring materials of guava and pear

fruits during ripening affected the taste and aroma of fruits . The acceptability grade of guava and pear fruits was unacceptable in mature stage. It increased to excellent (natural) in ripe stage, then decreased to acceptable in the over ripe ones.

b. It could be seen that the most apparent difference is the average desication time required between samples prepared under different conditions and stored at different temperatures. This range from about 6 months for samples stored at room temperature to about 9 months for those stored at 5°C and -15°C before the development of detecteable organoleptic change.

c. Pear puree processed from ripe fruits under all different treatments and stored at room temperature had longer relative storage durability. Samples prepared with different treatments and stored at room temperature for 12 months had the same loss of score.

As generally this effect was enhanced by increasing temperature of storage, which resulted in reduction of acceptability grade of guava juice and pear puree, from very good to acceptable in most samples of this work.