Application of optical methods for studying the composition of fruit puree mixtures for baby food

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INTRODUCTION

Nutrition of children is an important factor in the formation and development of a growing organism. The baby food market is constantly growing,so there is a risk of encountering unscrupulous manufacturers. Fruit puree is a popular product. The problem of the quality of baby food is relevant nowadays, since the composition depends on the health and full development of the child and the receipt of the necessary amount of nutrients and vitamins. The method of Raman spectroscopy helps to determine the biochemical composition of food and obtain unique spectra for each substance. These spectra provide information about the chemical composition of the samples being studied, including primary and secondary metabolites.
Objective: to evaluate the biochemical composition of baby fruit puree using optical methods.

MATERIALS AND METHODS OF RESEARCH

The six groups of purees were the subjects of the stidy

Purchased purees:
Group 1 - apple-peach puree
Group 3 - apple puree
Group 5 - banana puree

Homemade purees:
Group 2 - apple-peach puree
Group 4 - apple puree
Group 6 - banana puree

Figure 1. Example of purchased puree

Figure 2. Example of homemade puree

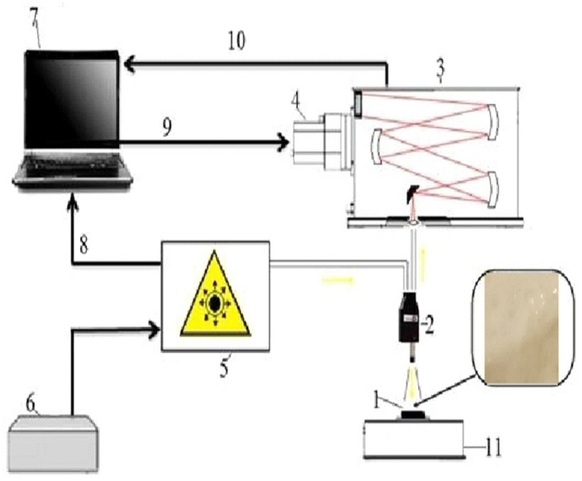


Figure 3. 1 – object under study;
2 – Raman probe RPB785;
2 – Shamrock sr-303i spectrometer;
2 – built-in DV420A-OE cooled camera;
2 – LuxxMasterRamanBoxx-785.0 RB04 laser module; 6 – power supply of the laser module; 7 – computer;
8, 9, 10 – information electrical cables;
11 – coordinate table

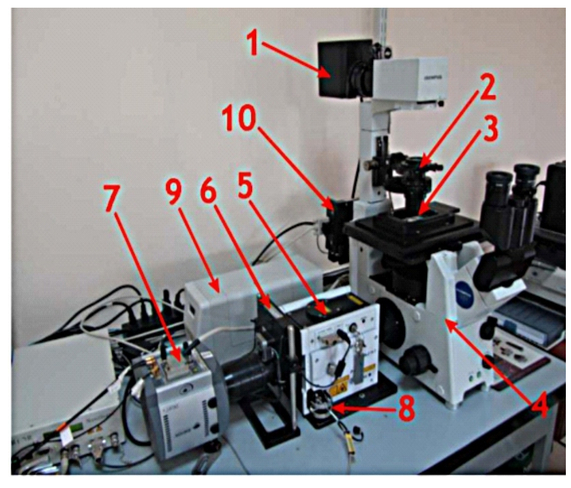


Figure 4. 1 – halogen lamp;
2 – condenser; 3 – object;
2 – microscope OlympusIX71; 5 – confocal block;
2 – the filter unit; 7 – camera;
2 – fiber output of the laser unit;
2 – mercury lamp;
10 – the fibrous output of a mercury lamp

RESULT OF RESEARCH

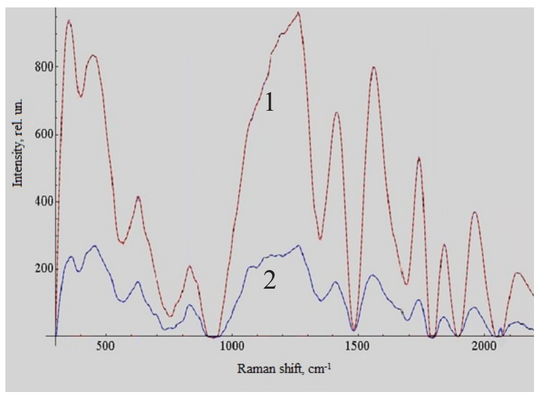


Figure 5. Average Raman spectra of purchased and homemade apple-peach puree
1 - group 1 (red spectrum)

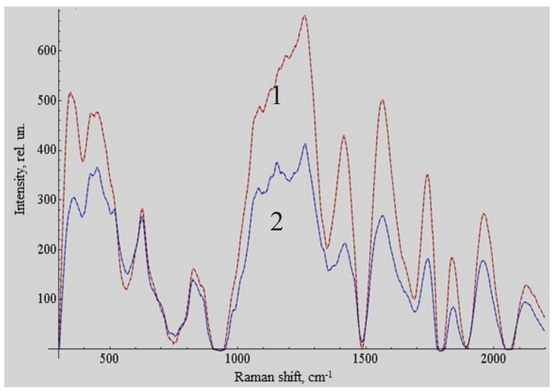


Figure 6. Average Raman spectra of purchased and homemade apple puree
1 - group 3 (red spectrum)
2 - group 4 (blue spectrum)

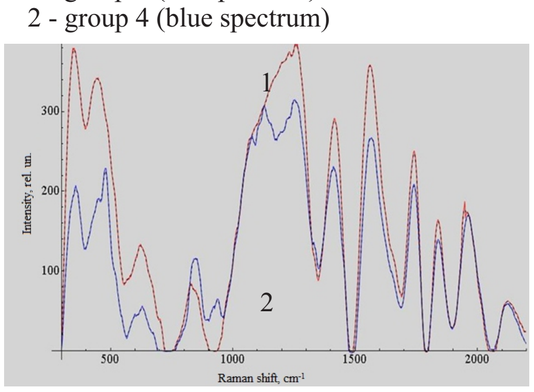
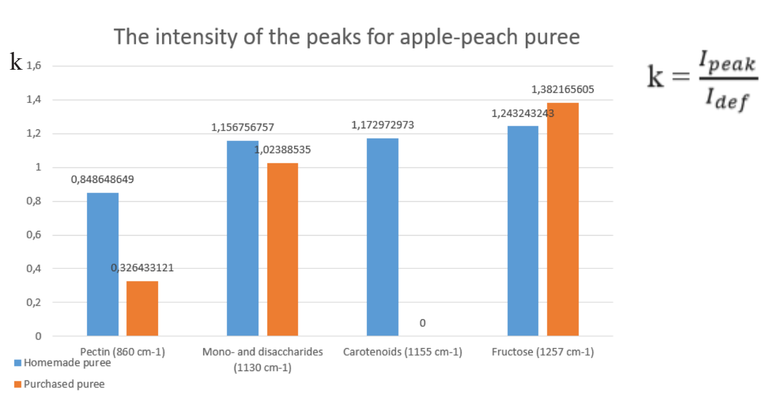


Figure 7. Average Raman spectra of store-bought and homemade banana puree
1 - group 5 (red spectrum)
2 - group 6 (blue spectrum)



$$k = \frac{I_{peak}}{I_{def}}$$

Figure 8. The intensity of the Raman spectra peaks of purchased and homemade apple-peach puree

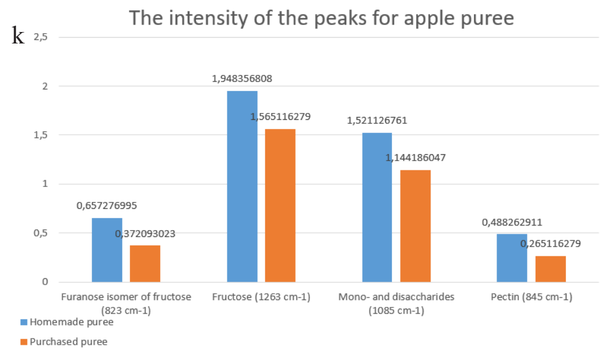


Figure 9. The intensity of the Raman spectra peaks of purchased and homemade apple puree

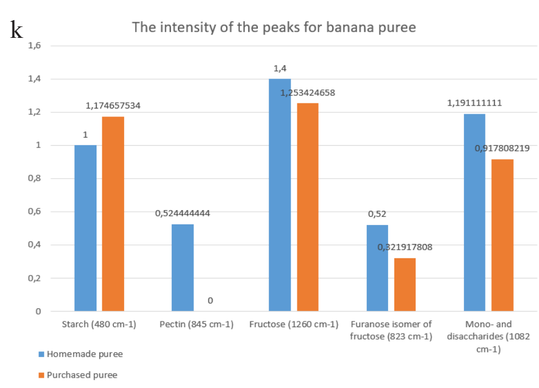


Figure 10. The intensity of the Raaman spectra peaks of purchased and homemade banana puree

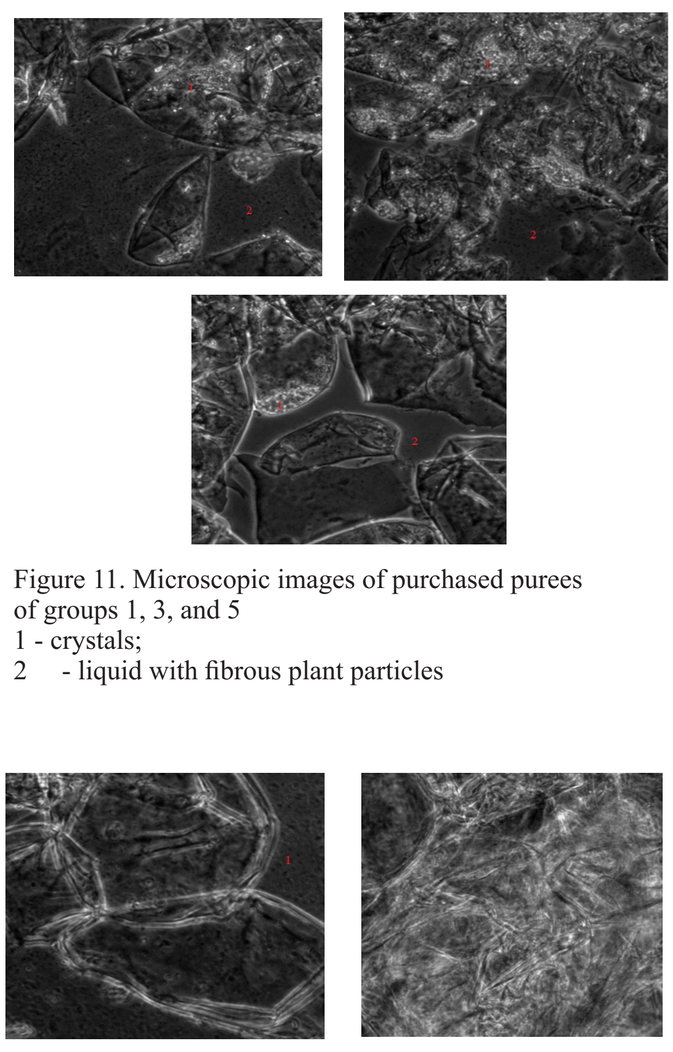


Figure 11. Microscopic images of purchased purees of groups 1, 3, and 5
1 - crystals;
2 - liquid with fibrous plant particles

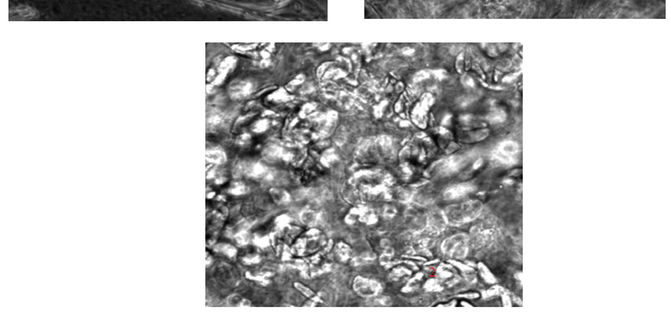


Figure 12. Microscopic images of homemade purees of groups 2, 4 and 6
1 - liquid with fibrous plant particles;
2 - starch grains

CONCLUSION

It was found that the spectra of the studied objects had a similar character in the entire studied range, except for the region of ~1000-1300 cm-1, where Raman lines characteristic of starch were noted, which was most pronounced in store-bought puree. Perhaps, in these puree samples, starch was used as a thickener.
As a result of microscopic analysis, in the photographs of all samples of store-bought puree, crystals of citric acid were noticed, which was presumably used as a preservative. The presence of a large amount of liquid with fibrous particles was noted in the samples of store-bought puree, which is possibly characterized by the addition of fruit juice to the puree.
Thus, using optical methods, it is possible to carry out express analysis of product composition.