L-Università ta' Malta
Faculty of Medicine & Surgery
Department of Pharmacy

Physicochemical Properties Of Products Obtained From The Local Carob Tree Varieties

Luca Galea[1], Everaldo Attard[2], Anthony Serracino-Inglott[1]

[1]Department of Pharmacy, Faculty of Medicine and Surgery, University of Malta, Msida, Malta.

[2]Rural Sciences and Food Systems, Institute of Earth Systems, University of Malta, Msida, Malta.

email: luca.galea.14@um.edu.mt

INTRODUCTION

The carob is one of the most useful native Mediterranean trees. The fruit of the carob tree is the pod, which is rich in sugars and polyphenols. Various products are derived from the carob pod, that are mainly used for animal feed and to make foodstuffs. Products include carob syrup, carob honey, carob candy amongst others. These products have potential health benefits such as treatment for coughs, prevention of diseases such as cardiac and neurodegenerative diseases and also prevent cancers[1].

AIMS

The purpose of this study is to compare the physicochemical parameters, antioxidant activity and quality of various products derived from the local carob tree in Malta. The study is focused on carob pod samples, carob honey, carob syrup and carob candy. Differences in the phytochemical characteristics may distinguish one variety of carob from another. Through the findings, one may valorise the local carob tree for the wide variety of products that are obtained from it, as these might have a potential use for medicinal purposes.

METHOD

- **Physicochemical properties of carob products including carob syrup, carob honey and carob candy were analysed through the following:**

  Polyphenolic Content: Evaluated by using the Folin-Ciocalteu method and analysed using Gen 5 software.

  UV Analysis: Performed by calculating tonality ratio, colour density, flavonoid ratio and anthocyanin content.

  Antioxidant Activity: Determination of the radical scavenging activity of the methanol extracts was carried out using the DPPH (1,1-diphenyl-2 picrylhydrazyl) assay.

  Colour Index: Determined by the absorbance measurement at 560nm using the UV-Vis-Spectrophotometer.

  Brix & Moisture Content: Determined by using a Digital Refractometer.

  pH & Free Acidity: Analysed by using a pH meter and acidity is analysed by titrating the carob sample with 0.1M NaOH solution until a pH of 8.30 is reached.

  5-Hydroxymethylfurfural (HMF): Concentration of HMF in the carob syrup, honey and candy samples was determined spectrophotometrically by using the method after White.

  Proline: Determined spectrophotometrically by using the UV-Vis spectrometer.

  Sugar Content: Analysed spectrophotometrically using a UV-Vis spectrometer.

  Conductivity: Determined by using the conductivity meter.

  Diastase Activity: Analysed using the Amylazyme tablet test and the absorbance was measured using the UV-Vis spectrometer.

  Heavy Metal Analysis: Microwave plasma-atomic emission spectroscopy was used for the determination of heavy metal content.

- **11 carob pod samples were subject to morphometric analysis, polyphenolic content analysis, antioxidant activity, UV visible analysis and heavy metal analysis.**
- **Data analysis was conducted using One-Way ANOVA with Bonferroni Post-hoc test using the software Prism 5. The morphometric, physicochemical and metal results were assessed using multivariate analysis.**

RESULTS

- **The mean total polyphenolic content of carob syrup, carob candy and carob honey were 0.17% w/w, 0.11% w/w and 0.10% w/w respectively. The mean total polyphenolic content of carob pods was 0.16% w/w.**
- **UV-Vis spectrometry showed a peak at 280 nm indicating the presence of flavonols in carob pods and products.**
- **The antioxidant activity at LC50 for carob honey was 8.98 mg/100g, while the mean values for the carob syrups and carob candy are 0.089 mg/100g and 0.154 mg/100g respectively. The mean antioxidant activity value of carob pods was 0.184 mg/100g.**
- **The darkest colour observed was that of the carob syrup (176.25 mm Pfund), whilst the lightest colour was that of the carob honey (80.21 mm Pfund), followed by the carob candy (83.41 mm Pfund).**
- **The mean brix values of Carob honey, carob syrup and carob candy were 78.78%, 73.4% and 56.4% respectively whilst the mean percentage moisture content were 41.2%, 24.2% and 19.64% respectively.**
- **The mean pH for the carob syrup, carob candy and carob honey were 4.29, 4.68 and 4.15 respectively. The mean acidity value of carob syrup, carob honey and carob candy were 30.8 mM/Kg, 40.2 mM/Kg and 9.0 mM/Kg respectively.**
- **The mean HMF content for the carob syrup, honey and candy were 2.8 mg/Kg, 7.0 mg/Kg and 15.60 mg/Kg respectively.**
- **The mean proline content of carob syrup was 0.140 g/Kg, whilst that of carob candy was 0.079 g/Kg and 0.80 g/Kg for the carob honey.**
- **The mean sucrose content for the carob syrup, carob candy and carob honey were those of 1.78%, 12.0% and 2.49% respectively, whilst the mean fructose and glucose percentage were those of 54.19% for the carob syrup, 13.0% for the carob candy and 68.47% for the carob honey.**
- **The mean conductivity value of carob syrup was that of 887.6 mg/kg. Carob candy had a mean conductivity value of 169%, while carob honey had a mean value of 2455 mg/kg.**
- **The diastase activity of carob honey was 14.1 Schade units, whilst that of carob syrup and carob candy were 0.62 Schade units and 0.41 Schade units respectively.**
- **Carob syrup, carob honey and carob candy had high levels of zinc (84.37 ±0.14 ppm, 86.56 ±0.15 ppm and 83.93 ±0.14 ppm respectively) and tin (58.92 ±0.79 ppm, 58.75 ±0.46 ppm and 55.85 ±1.075 ppm). High concentrations of lead were also observed in carob syrup and carob honey (6.85 ±0.76 ppm and 14.629 ±0.156 ppm respectively). Carob pods contained significantly high levels of arsenic (12.36 ±7.68 ppm), copper (2.03 ±0.01 ppm), tin (81.03±0.84 ppm), chromium (4.24 ±0.09 ppm), zinc (87.34 ±0.18 ppm) and lead (8.88±1.17 ppm).**

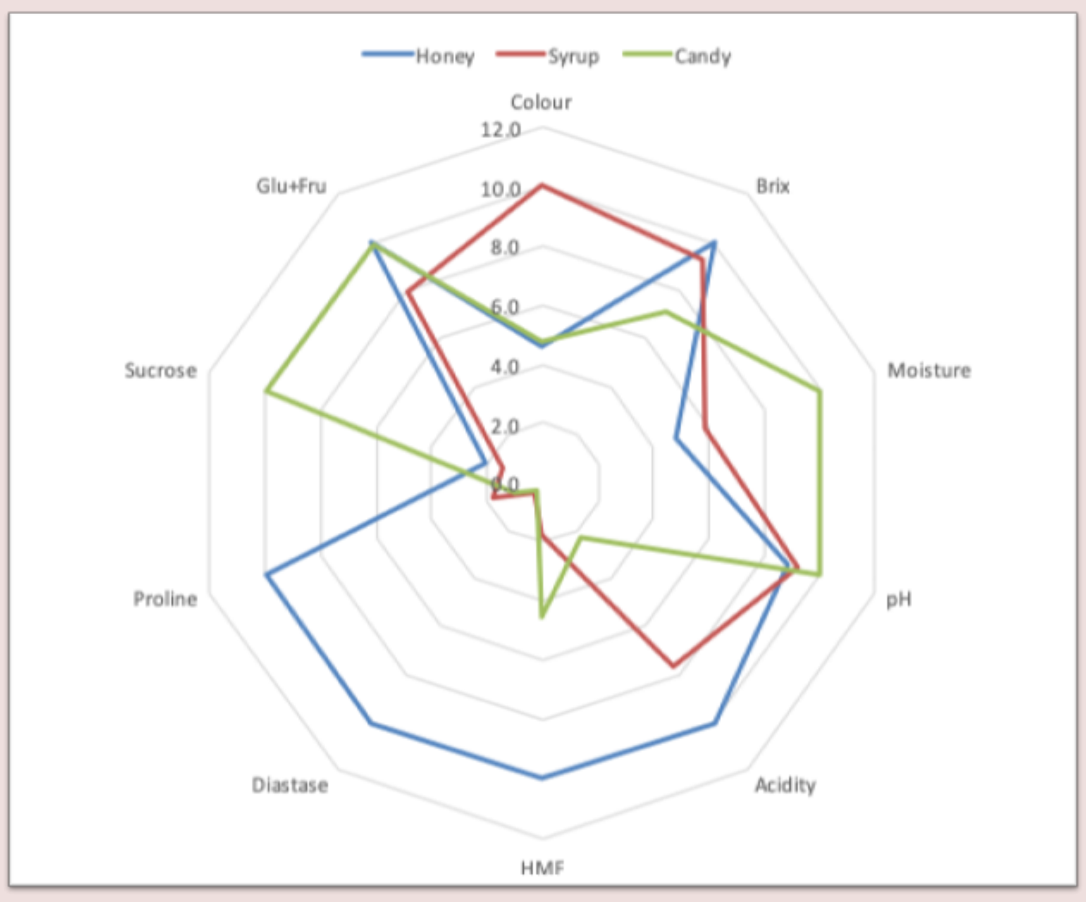

Figure 1: Radial plot of typical physicochemical parameters of carob honey, carob syrup and carob candy

CONCLUSION

Carob pods from the Northern District of Malta, were found to contain higher polyphenolic content than the Western and Southern Districts. The polyphenolic content of carob syrup, carob honey and carob candy was not significantly different. However, carob honey contained the highest antioxidant properties. Carob honey and carob syrup are two distinct products due to their distinct physicochemical parameters. Both carob pods and carob products were found to have high levels of heavy metals, thus these may not be recommended for consumption. This study encourages further research to investigate the physicochemical parameters of carob products derived from different carob tree varieties to evaluate further if any association with the physicochemical parameters and carob tree localities can be made.

REFERENCES

1. Arslan E, Yener M, Esin A. Rheological characterization of tahin/pekmez (sesame paste/concentrated grape juice) blends. Journal of Food Engineering. 2005;69(2):167-172