

# Assessment of banana quality and shelf-life during ripening by generating prediction models

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## Abstract

The fruits and vegetables' quality in relation to the ripening degree is one of the most important issues to be investigated in order to ensure consistent quality for consumers and to minimize post-harvest spoilage. Therefore, the aim of the present study was the predictive models' development in order to assess the ability of textural features, from image analysis on banana peel, to predict shelf life and fruit quality parameters during ripening. More specifically, textural features calculated from images of banana peel [a\* (redness/greenness), b\* (yellowness/blueness), mean value, standard deviation (std), skewness, contrast (con), dissimilarity (dis), energy, homogeneity, Angular Second Moment (ASM), Short Run Emphasis (SRE), Long Run Emphasis (LRE), and Run Length Non-Uniformity (RLN)] [1] were correlated with physicochemical quality parameters of banana flesh [Brix, firmness, total phenolic content (TPC), titratable acidity (TA), moisture and water activity (aw)], to estimate banana shelf life and ripening process, during storage throughout a period of 21 days. The results showed that the a\* and b\* values of banana peel are good indicators of Brix and firmness values of banana flesh (R2 > 0.7). Moreover, the gradient boosting regressor model was employed to predict the banana ripening degree in relation to storage day, from textural and physicochemical features multiple regression, with R2 0.999. Furthermore, using the same regressor model the quality of banana flesh was predicted, through Brix, firmness, TPC, and TA values during ripening, from the values of textural features of the banana peel by multiple regression, with R2 >0.98. The predictive model application, using image analysis resulting features, may be used as a tool for estimating the quality and shelf life of fruits.

# Materials and Methods

**Quality Parameters' Extraction** Measurement of Total Soluble Solids (TSS) Total Phenolic Content (TPC) and Titratable Acidity (TA) estimation Textural analysis (Firmness determination) Image analysis (extraction of textural features and color

Algorithm

**Banana Samples** 

**Prediction Models** Training Day 1 Day 4 Day 7 Day 9 Day 11 Day 14 Day 17 Day 21

# **Results and Discussion**

#### Prediction of quality parameters



Figure 1. <sup>o</sup> Brix and firmness estimation from color values a\*and b\* of banana peel

#### Prediction of storage days

parameters L\*, a\*, b\*)



Figure 2. Prediction of quality parameters' by image textural features

### Conclusions

- $\checkmark$  It was achieved high accuracy prediction of both quality parameters (total soluble solid content, firmness, total phenolic content, acidity) and actual storage days of banana samples.
- $\checkmark$  Image analysis is a non-destructive method, which could give information for parameters of the flesh by analysing the peel of banana.
- $\checkmark$  The predictive models may be used as a useful tool for estimating

quality and shelf life of fruits and vegetables.

Figure 3. Prediction of day of storage of banana by image textural features

#### References

[1] V. J. Sinanoglou, T. Tsiaka, K. Aouant, E. Mouka, G. Ladika, E. Kritsi, S. J. Konteles, A.-G. Ioannou, P. Zoumpoulakis, I. F. Strati and D. Cavouras, Applied Sciences, 13(6) (2023), 3533. Acknowledgment

This work is supported by the Postgraduate Studies (MSc) in "Food innovation, quality and safety", which is organised by the Food Science and Technology Department of University of West Attica.