

# Impact of Different Roasting Parameters on Proteins, Lipids and Volatile Flavor Profile in *Pistacia vera* L.

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## CONTEXT

The consumption of pistachios (*Pistacia vera* L.) has increased globally in recent years due to their nutritional and health benefits, which are attributed to beneficial phytochemical compounds, high levels of polyunsaturated fatty acids, and low carbohydrate content.

Pistachios are consumed in various forms, including raw, roasted, and as a cream (Mateos et al., 2022).

For these reasons, the evaluation of several industrial process parameters with innovative assays has become crucial to guarantee the preservation of nutritional properties, taste, colour, flavour, and several other characteristics (Pedron et al., 2025).

The aim of this work was to investigate the influence of different time of roasting on proteins, fatty acids, and flavour.

## MATERIALS & METHODS

To evaluate the effect of roasting time, raw pistachios (UNIGRA' s.p.a.) were roasted at 145 °C for varying durations: 20, 40, 60, 80, and 100 minutes. Prior to roasting, pistachios were uniformly ground and sampled. Roasting was performed in a static laboratory oven. Immediately following each roasting time point, samples were sealed in vials for time-resolved flavour profile analysis of pistachios using GC-MS and GC-IMS provided by (G.A.S. Dortmund).



Fig. 1 Colour evolution of powdered raw pistachios during roasting at 145 °C for 20, 40, 60, 80, and 100 min.

## RESULTS

### GC - Ion Mobility Spectrometry (IMS)

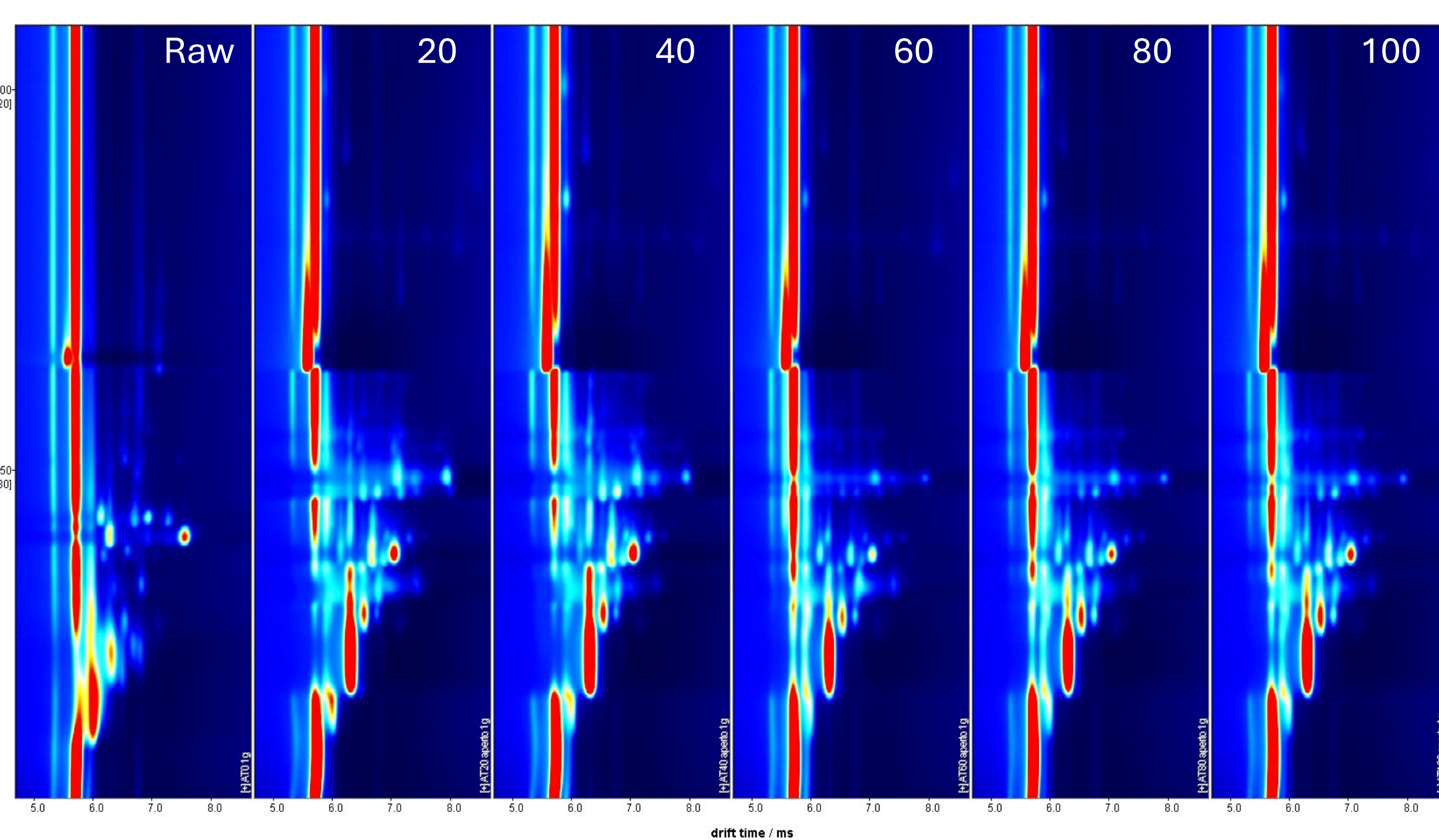


Fig. 2 Aroma and flavor profile evolution of roasted pistachios analyzed by GC-IMS.

### SDS - PAGE

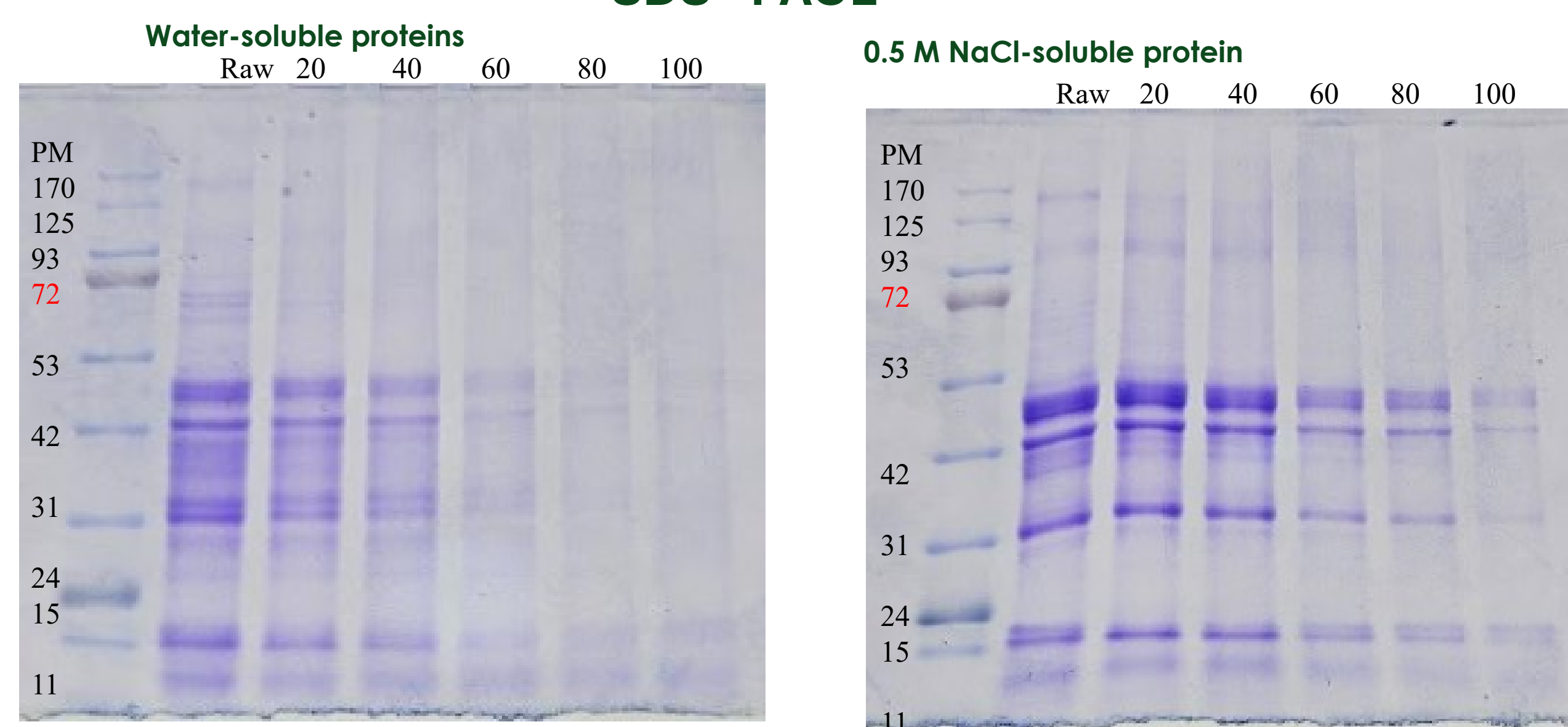


Fig. 5 Time-dependent evolution of water-soluble proteins during roasting, as visualized by SDS-PAGE.

Fig. 6 Temporal evolution of the 0.5 M NaCl-soluble protein fraction during roasting, analyzed by SDS-PAGE.

### FTIR-ATR

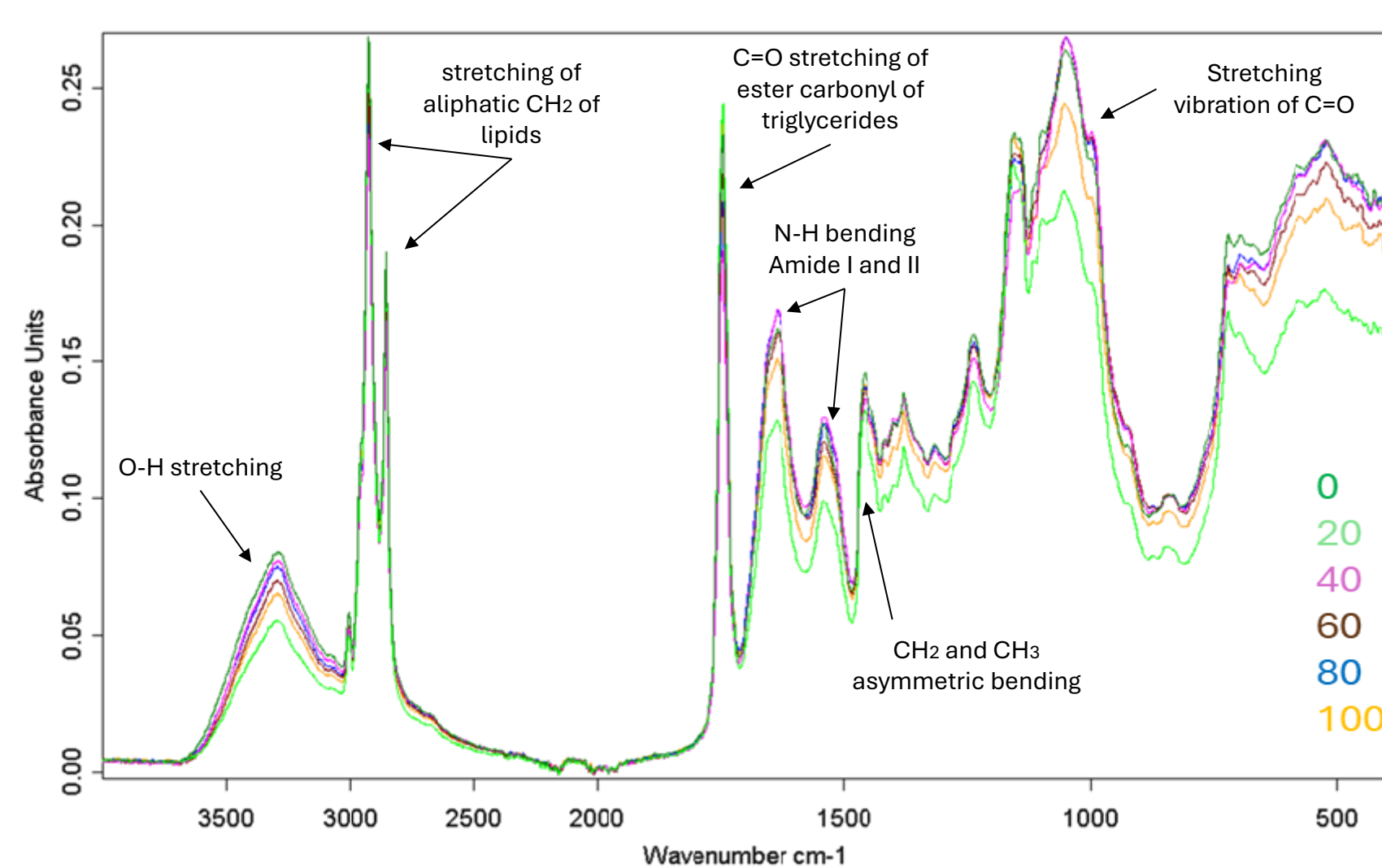


Fig. 8 Analysis of functional group transformations during roasting using time-dependent FTIR-ATR spectroscopy (Salinas et al., 2021).

### GC - MS

Table 1

Exanal GC-MS	
Time	ng/g
0	0
20	0
40	1,17
60	1,21
80	1,13
100	1,33

**Table 1** Hexanal quantification by GC-MS as a lipid oxidation marker during roasting, using a calibration curve.



Fig. 3 GC-MS vial containing the analyzed sample.

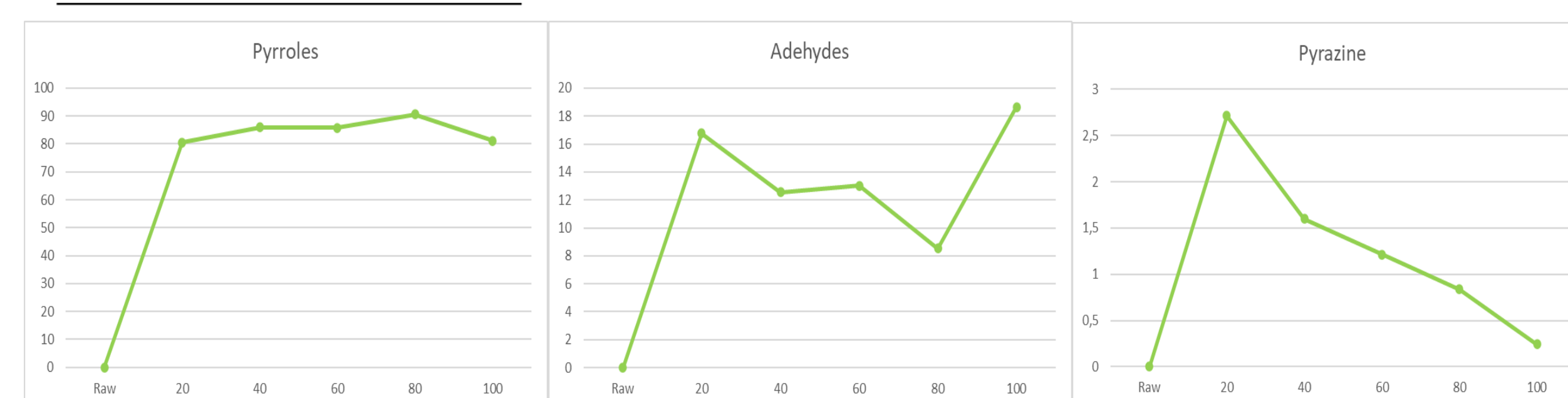


Fig. 4 Relative percentages of the evolution of volatile compounds such as pyrroles, pyrazines, and aldehydes during roasting, as determined by GC-MS.

### Free Fatty Acids

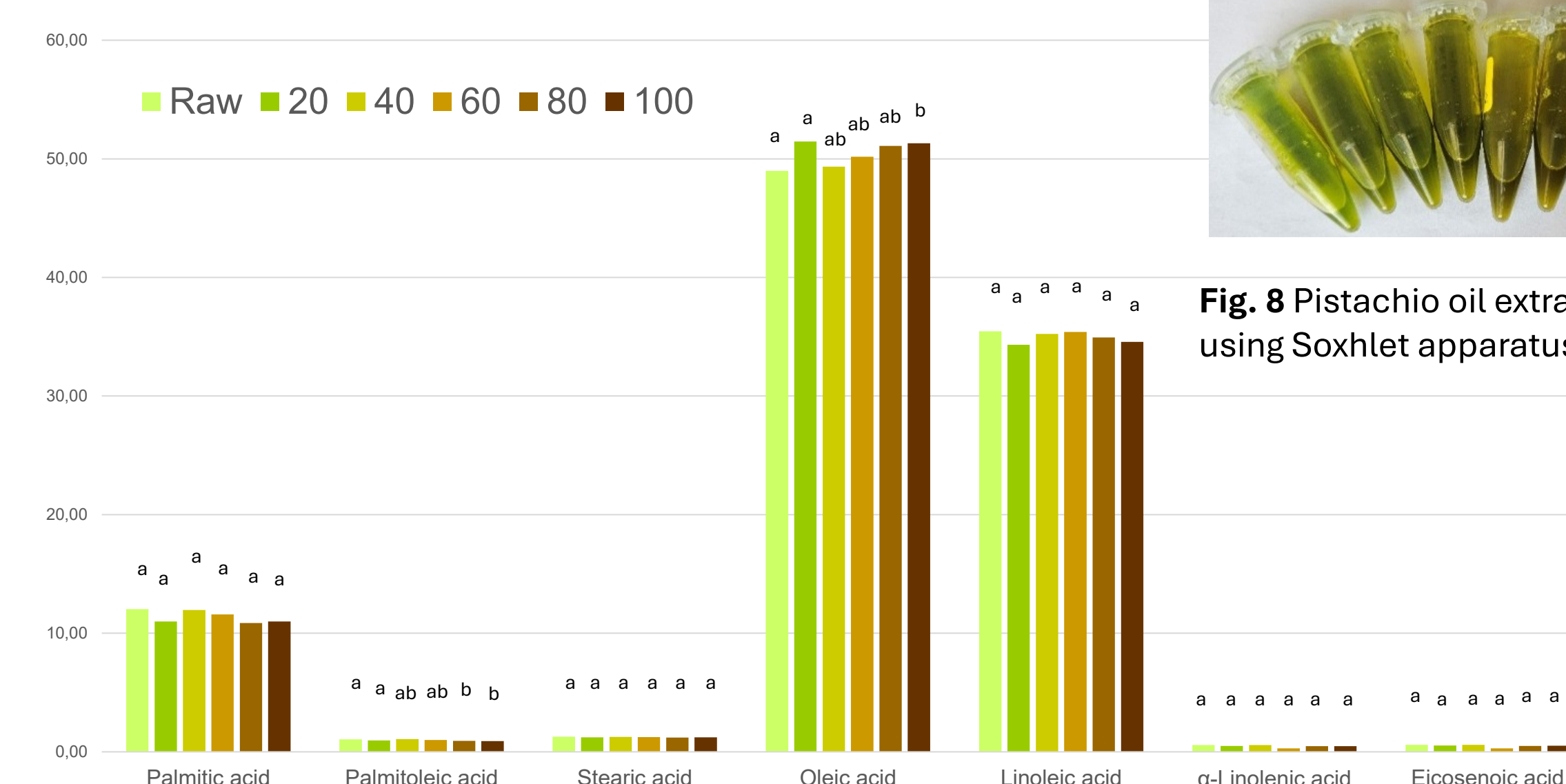


Fig. 8 Pistachio oil extracted using Soxhlet apparatus

Fig. 7 Relative percentages of fatty acids determined by GC-FID following FAME derivatization (Locatelli et al., 2015).

## DISCUSSION & CONCLUSION

GC-IMS analysis revealed a greater abundance of volatile compounds in pistachios roasted for 20 and 40 minutes compared to raw samples. Conversely, prolonged roasting resulted in a lower concentration of detectable volatile compounds. Flavor analysis in GC-MS indicated an increase in pyrroles and a decrease in pyrazines during roasting. Furthermore, hexanal concentration showed a slight increase with the roasting process.

The findings from the SDS-PAGE analysis (Fig. 5 and 6) highly interesting results such as the degradation of the protein profile upon roasting. Regarding the free fatty acid profile (Fig. 7), we observed a slightly different in oleic acid and palmitoleic acid.

Future research will delve into the intricate processes underlying optimal flavor and taste development in pistachios. Specifically, investigations will focus on elucidating the complex interactions between lipids, proteins, and other key molecules that contribute to their distinctive flavor profile.

## References

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