

OP-263 [Beekeeping Technology and Quality] Characterization of Slovenian royal jelly

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Background/purpose

Royal jelly (RJ) is known for its diverse biological activities and complex chemical composition. Due to its significant nutritional value and health benefits, the characterization of its main biological properties is of great importance. This multi-year study aims to characterise the Slovenian RJ in order to define a standard composition, assess antioxidant activity, evaluate the sensory properties and establish a comprehensive database.

Problem description

Despite well-established physico-chemical and bioactive profiles of RJ, limited data is available regarding its sensory properties. This research focuses on the full characterization of Slovenian RJ, including defining its sensory profile and standard composition.

Methodology

Between 2017 and 2024, 135 RJ samples were collected from beekeepers from various regions of Slovenia. The colour of RJ was qualitatively described, while a professional sensory panel assessed the odour and aroma using quantitative descriptive analysis. Physico-chemical and bioactive parameters were determined according to ISO standard for royal jelly and AOAC methods.

Results and conclusions

The colour of RJ was light, mostly ivory or various shades of yellow. The overall odour and aroma intensity were moderate to strong. The chemical aroma was most pronounced. Warm and animal aromas were mostly weak, while the floral aroma was very weak. The taste of RJ was very weak to slightly sweet and moderately to strongly acidic. A characteristic feature of RJ is also a moderate to strong astringency. The Slovenian RJ samples correspond to the values specified in the ISO standard in terms of total acidity and the contents of water, sugars, total lipids, proteins and 10-HDA. All RJ samples were able to scavenge free radicals and the correlation between antioxidant activity and total phenolic content was significant.

Practical implications for beekeepers

The identification of natural compositional ranges for Slovenian RJ and the establishment of criteria for authenticity control will help protect local RJ producers. This study contributes to a better understanding of RJ by defining its standard composition and sensory characteristics, fostering better communication between producers and consumers and promoting the consumption of this functional bee product.



Characterization of Slovenian royal jelly

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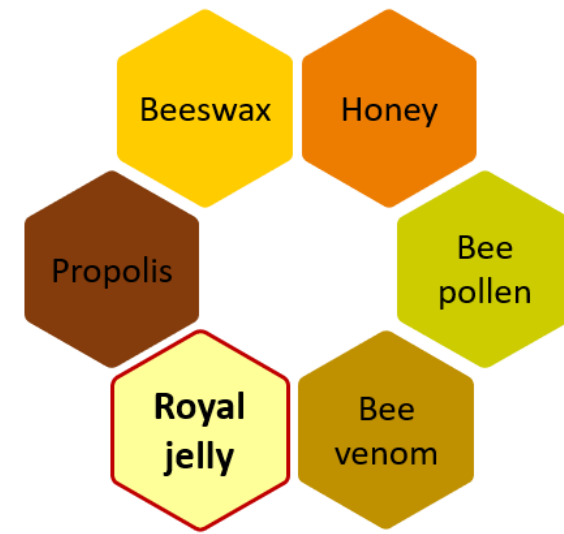
Aljaž Debelak², Andreja Kandolf Borovšak², Urška Ratajc²

Introduction

- Royal jelly is known for its diverse biological activities and complex chemical composition. Due to its significant nutritional value and health benefits, the characterization of its main biological properties is of great importance.
- Our multi-year study aims to characterize the Slovenian royal jelly in order to define a standard composition, assess antioxidant activity, evaluate the sensory properties and establish a comprehensive database.



Characterization of bee products in Slovenia



- Within the framework of the Programme of measures in the beekeeping sector in the Republic of Slovenia.
- Supported by Apiculture programme and financed from the state budget and the budget of the European Union.

The leader: Slovenian Beekeepers Association

Partners: University of Ljubljana, Biotechnical Faculty,
Jožef Stefan Institute, Intertek,
Teaching Institute of Public Health “Dr. Andrija Štampar”



Characterization of Slovenian royal jelly

2017 – 2019, 35 samples

- Basic quality parameters of Slovenian fresh royal jelly: water, protein and lipid content, 10-HDA, ash, total acidity.
- Sugar content, fatty acid composition, pollen analysis.
- Storage conditions (time, temperature).

2020 – 2025, 120 samples

- Water and protein content, total acidity.
- Total phenolic content and antioxidant activity.
- Sensory properties.

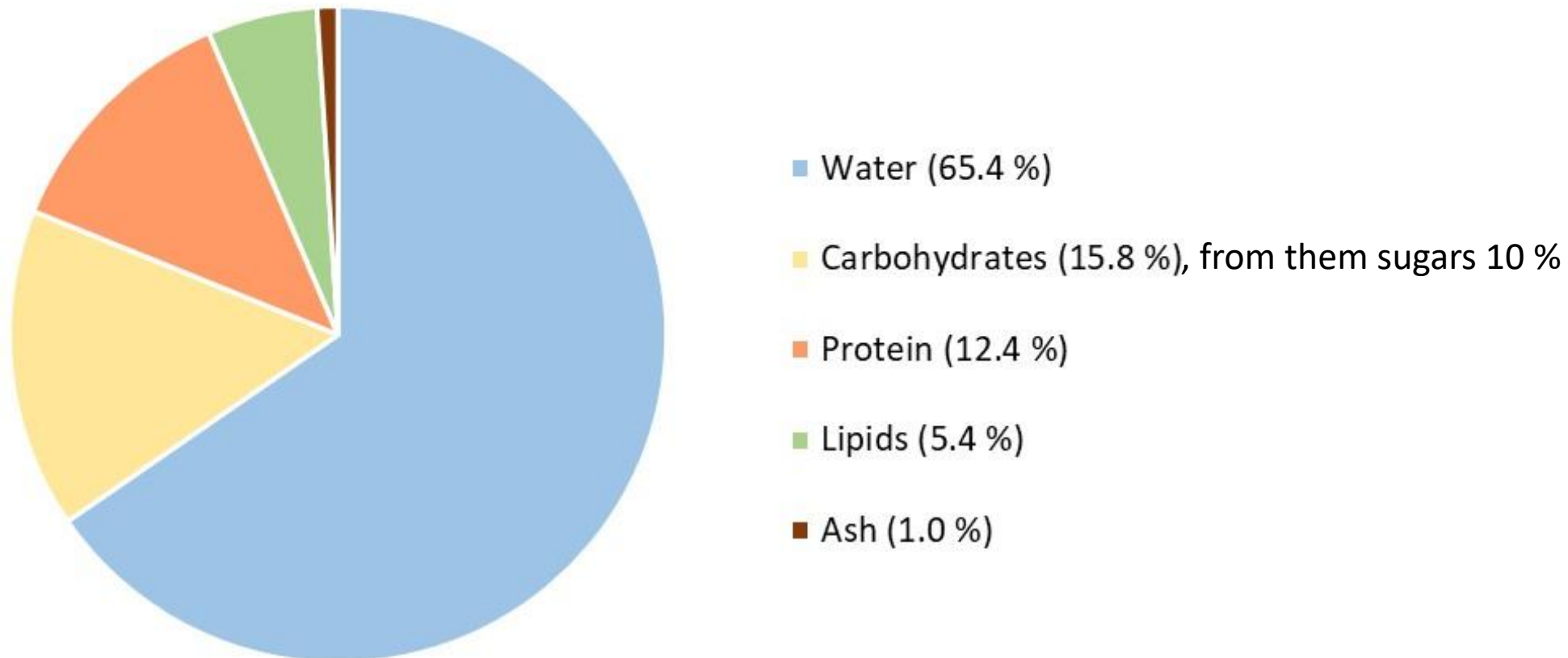
Creation of
Slovenian royal
jelly database

Methodology

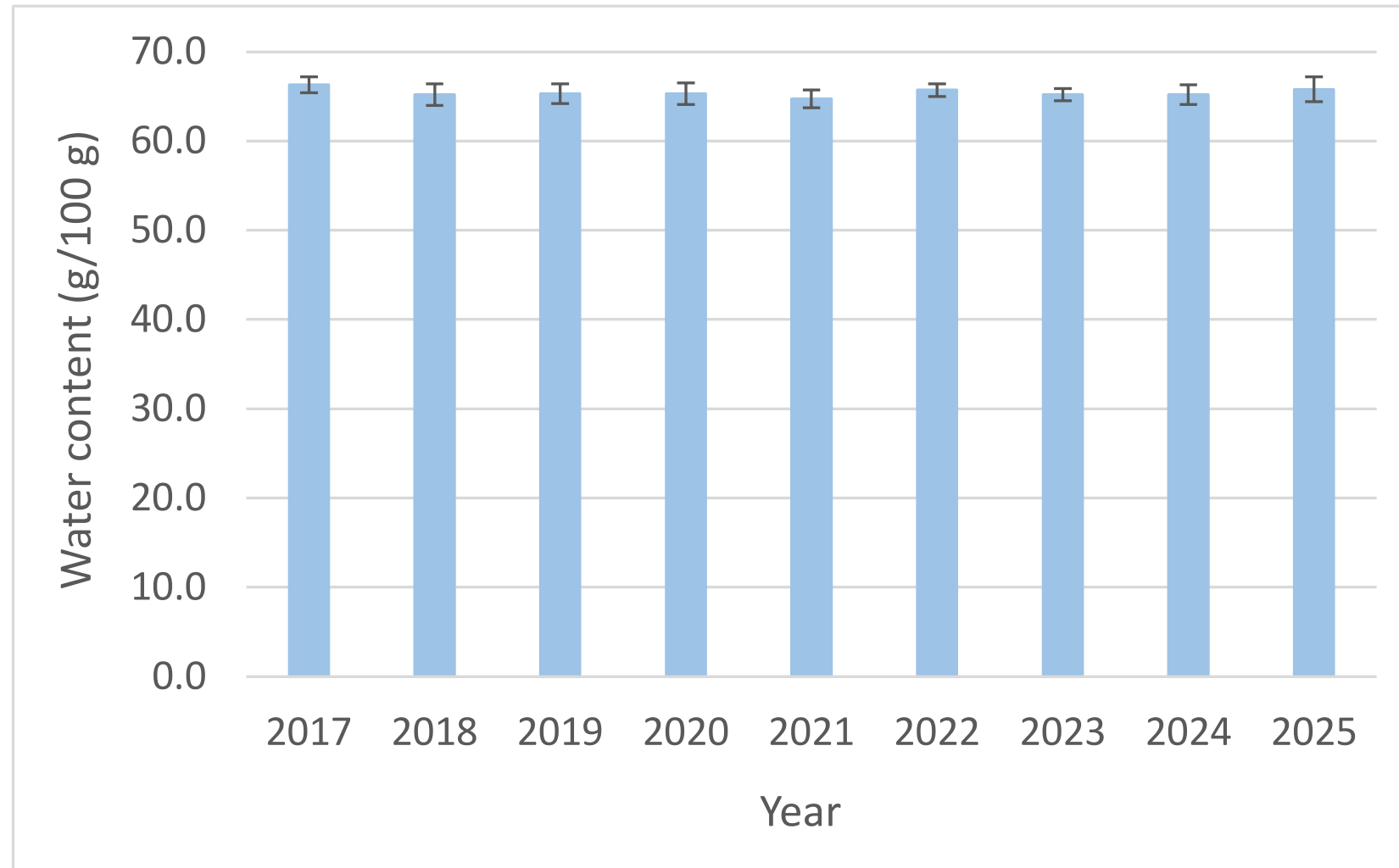
- Between 2017 and 2025, 155 samples of fresh royal jelly were collected directly from beekeepers from different regions of Slovenia.
- Physico-chemical and bioactive parameters were determined according to the ISO standard for royal jelly and AOAC methods.
- The sensory properties of royal jelly were evaluated by a professional sensory panel. The colour was described qualitatively, while the odour and aroma were evaluated with a quantitative descriptive analysis.

Results

Basic composition of Slovenian fresh royal jelly:



Water content



155 samples:

2017: 12

2018: 12

2019: 11

2020: 20

2021: 20

2022: 20

2023: 20

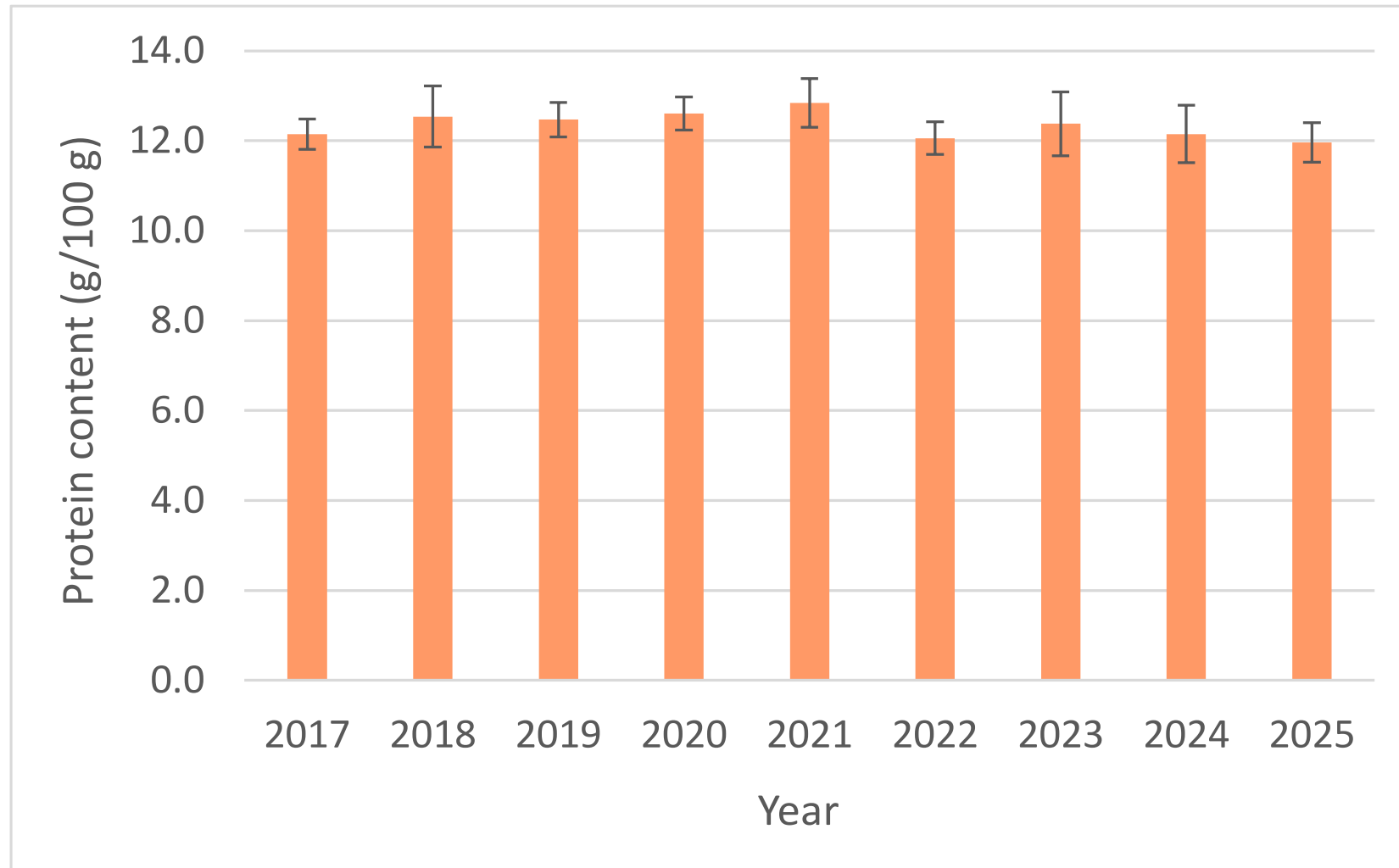
2024: 20

2025: 20

ISO standard:

62.0 – 68.5 g/100 g

Protein content



155 samples:

2017: 12

2018: 12

2019: 11

2020: 20

2021: 20

2022: 20

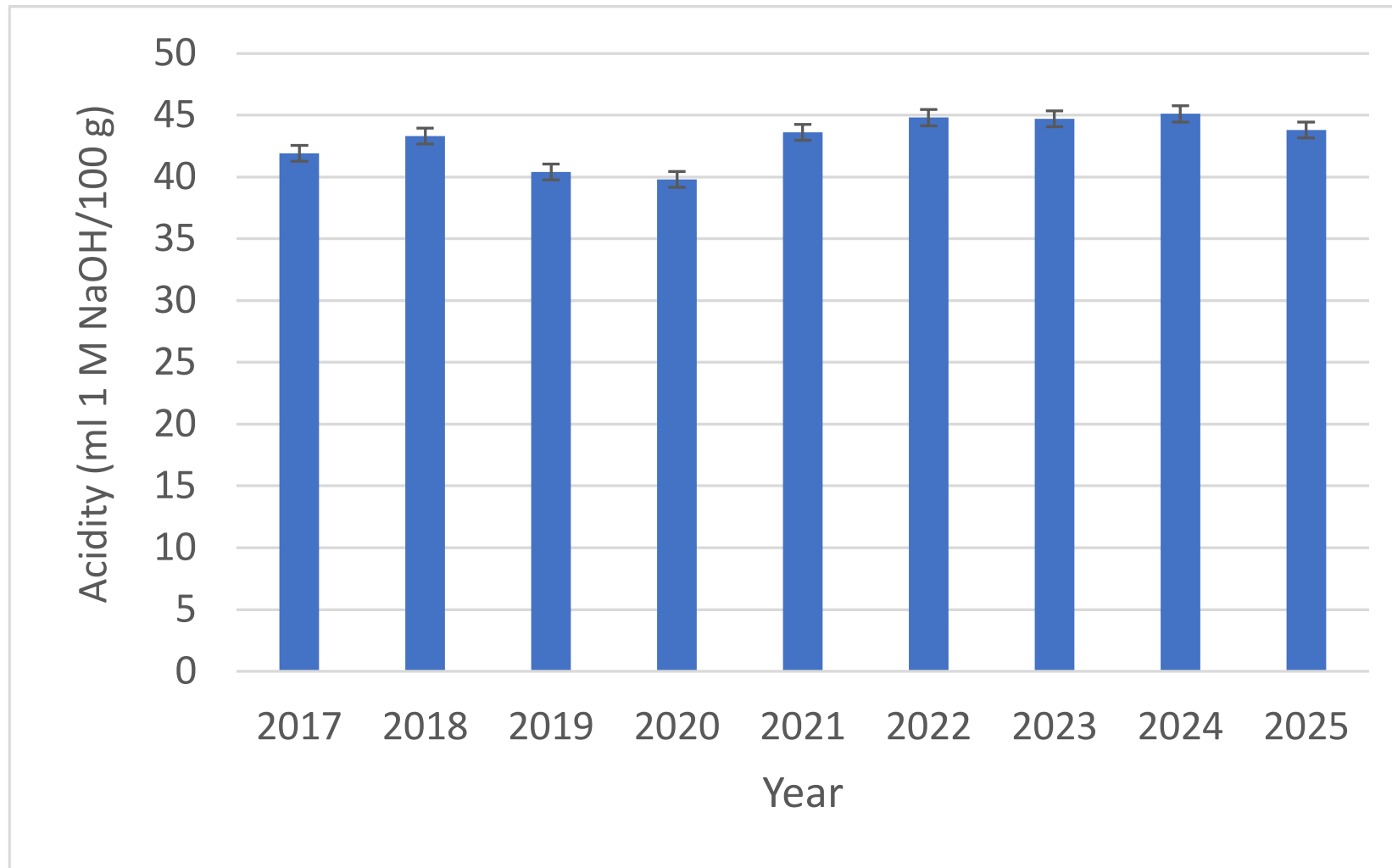
2023: 20

2024: 20

2025: 20

ISO standard:
11 – 18 g/100 g

Total acidity



155 samples:

2017: 12

2018: 12

2019: 11

2020: 20

2021: 20

2022: 20

2023: 20

2024: 20

2025: 20

ISO standard:

30.0 – 53.0 ml 1 M
NaOH/100 g

Total carbohydrate content and total sugar content

35 samples:

2017: 12

2018: 12

2019: 11

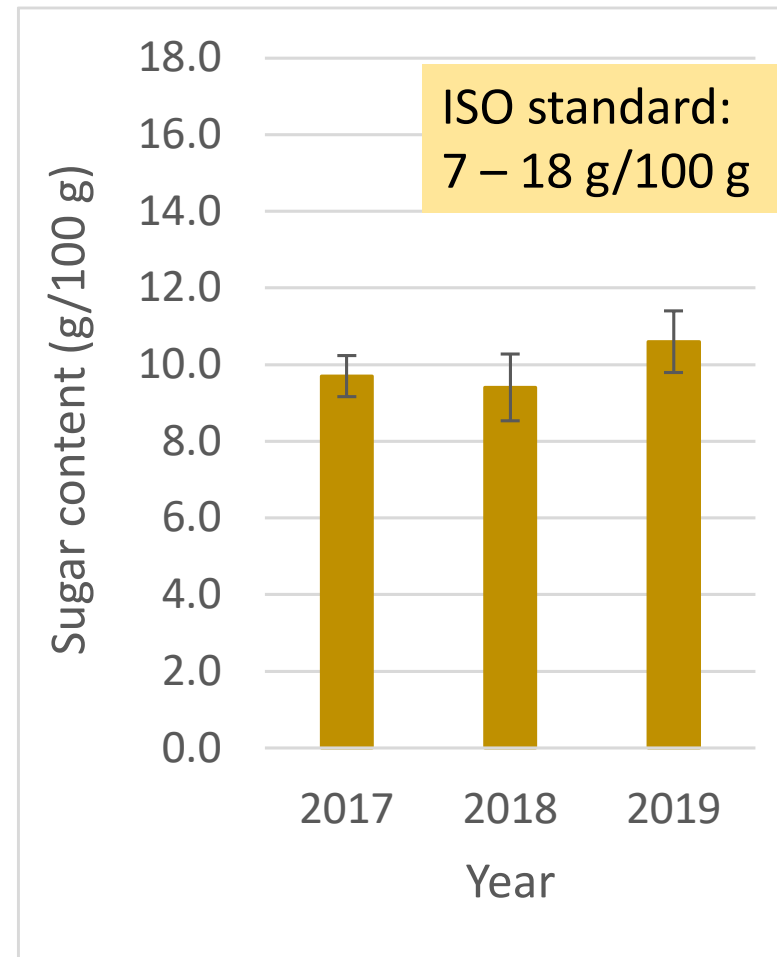
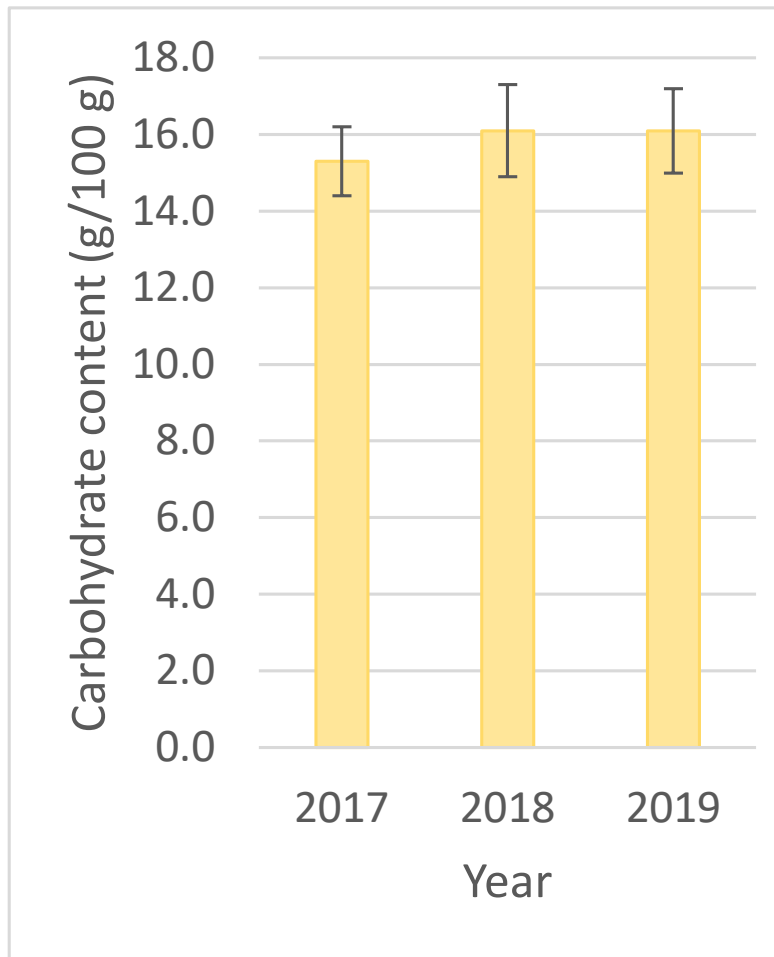
Individual sugar
content (g/100 g):

Fructose: 2.3 – 4.5

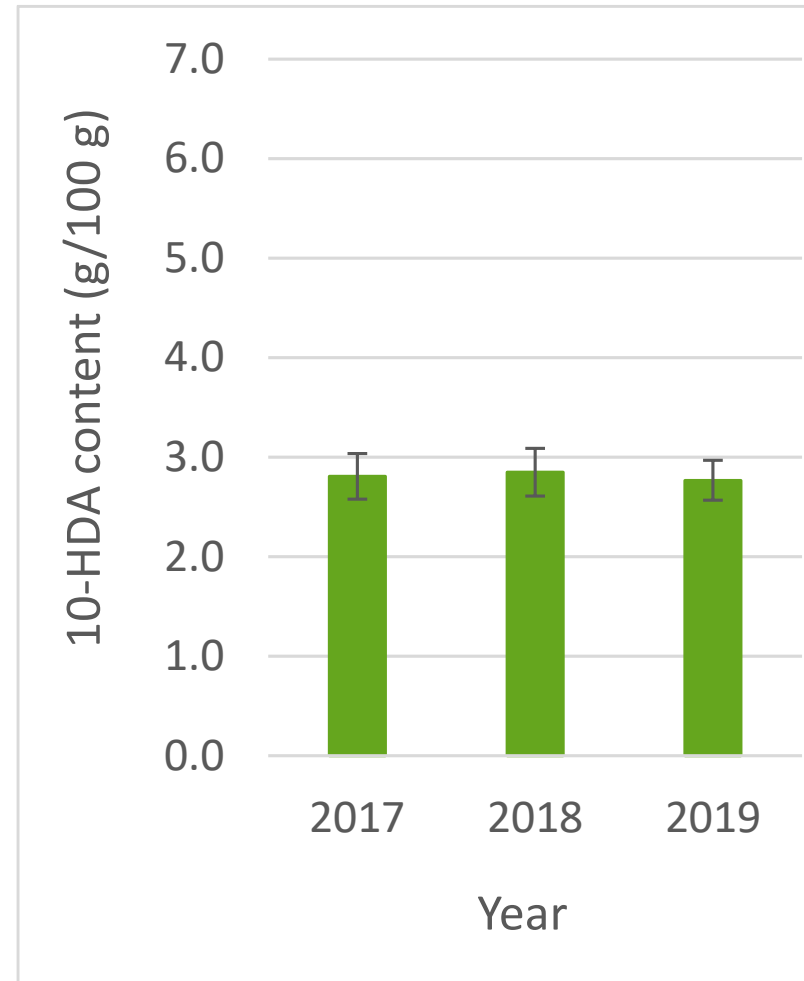
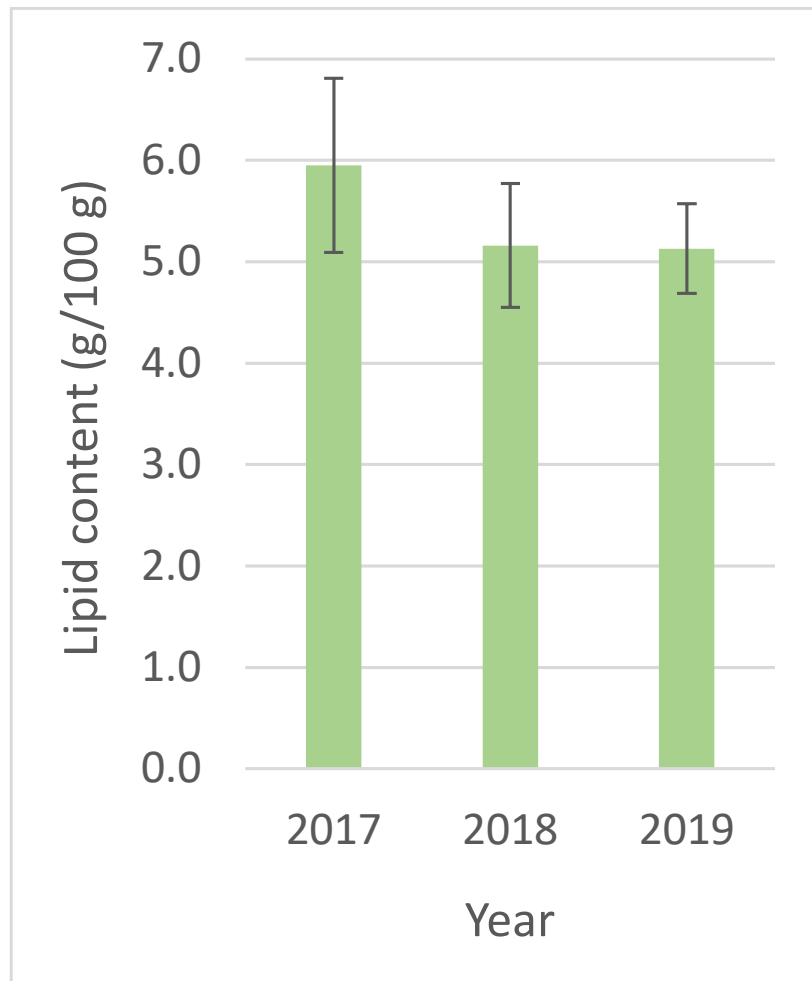
Glucose: 3.4 – 6.2

Sucrose: n.d. – 3.3

Small amounts of
maltose, erlose and
melezitose: n.d. – 0.8



Lipid content and 10-HDA content



35 samples:

2017: 12

2018: 12

2019: 11

ISO standard:

Total lipid

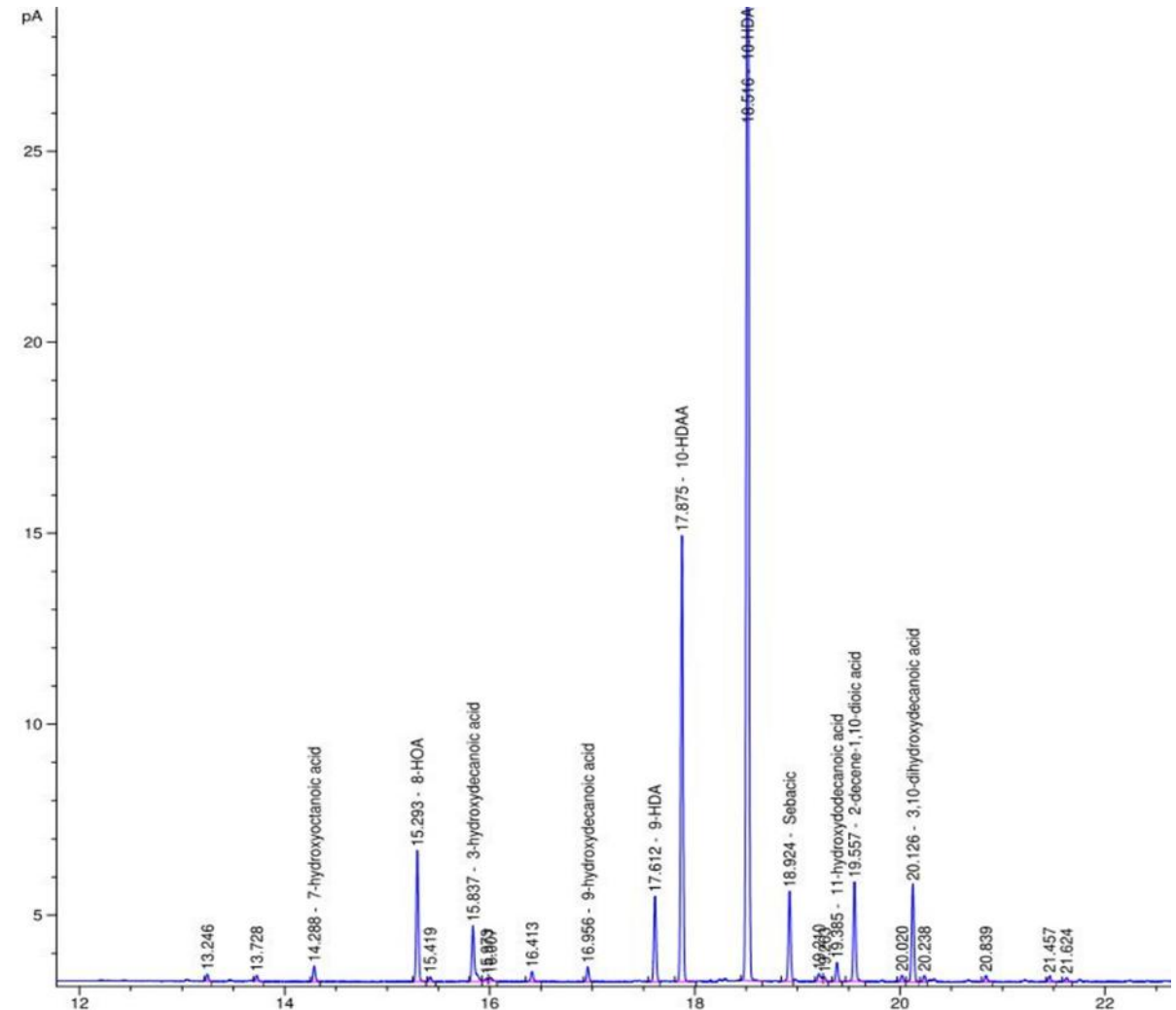
2 – 8 g/100 g

10-HDA

min 1.4 g/100 g

Fatty acid composition of royal jelly

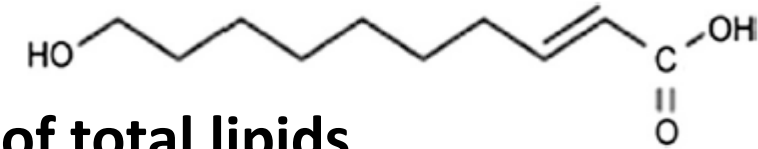
- Royal jelly contains specific short-chain mono- and dihydroxy fatty acids with 8 – 10 carbon atoms, or dicarboxylic acids.



Fatty acid composition of royal jelly

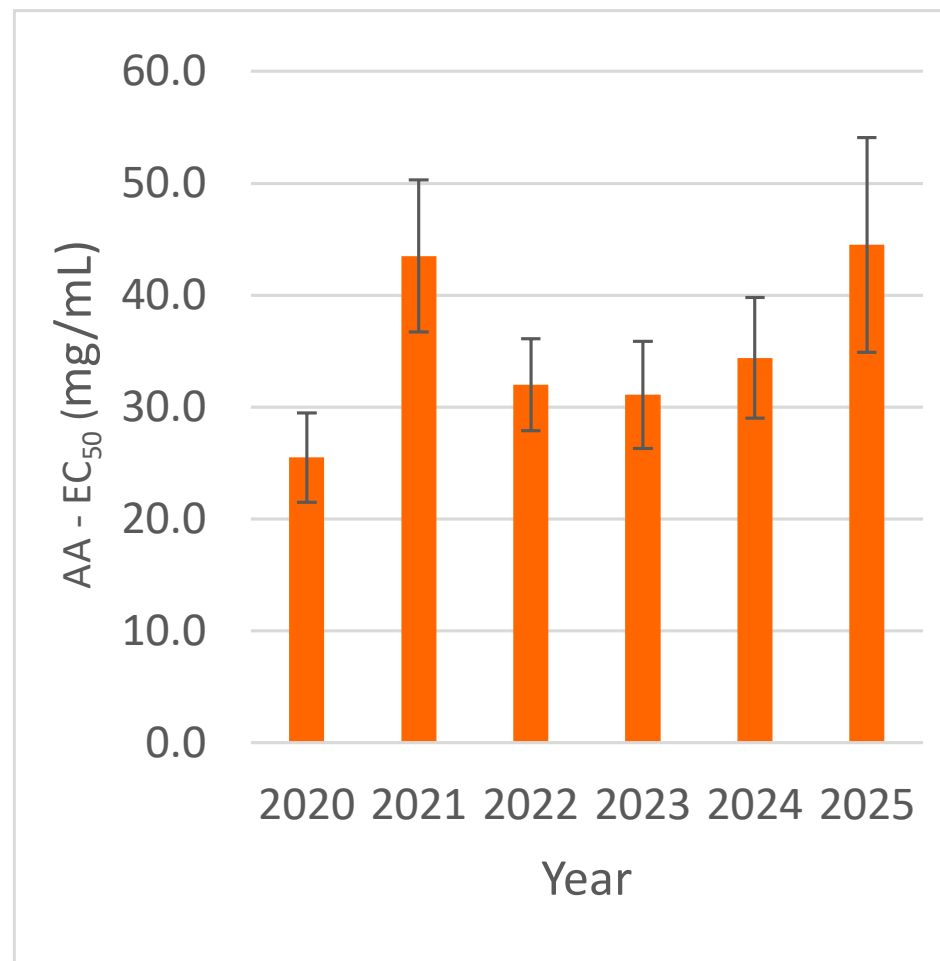
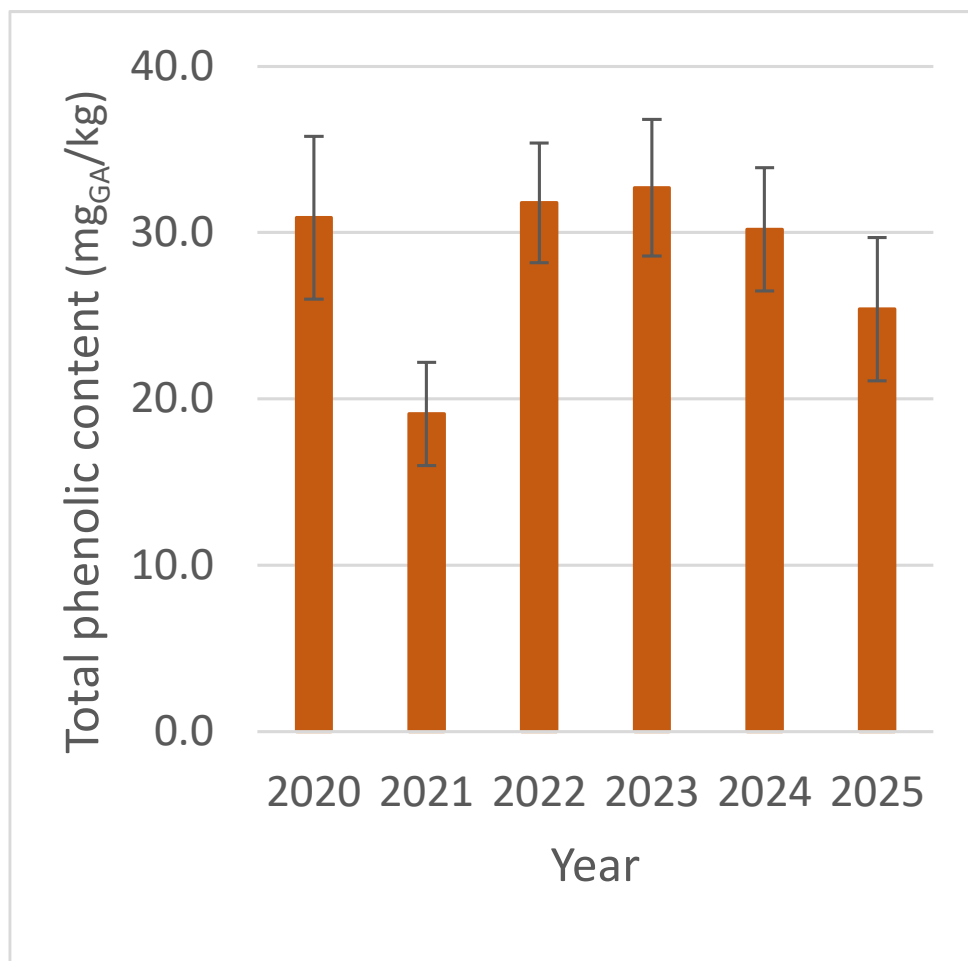
Quantified fatty acids (averages):

- 8-hydroxyoctanoic acid 0.21 g/100 g
- 3-hydroxydecanoic acid 0.13 g/100 g
- 9-hydroxy-2-decenoic acid (9-HDA) 0.14 g/100 g
- 10-hydroxydecanoic acid (10-HDAA) 0.90 g/100 g
- **10-hydroxy-2-decenoic acid (10-HDA) 3.03 g/100 g $\approx$ 50 % of total lipids**
- sebacic acid 0.15 g/100 g
- 2-decene-1,10-dioic acid 0.17 g/100 g
- 3,10-dihydroxydecanoic acid 0.17 g/100 g



Only identified fatty acids: 7-hydroxyoctanoic acid, 9-hydroxydecanoic acid, 11-hydroxydodecanoic acid.

Total phenolic content and antioxidant activity (EC_{50})



120 samples:

2020: 20

2021: 20

2022: 20

2023: 20

2024: 20

2025: 20

Sensory properties of royal jelly

- Professional sensory panel.
- The colour of royal jelly was described qualitatively.
- The odour and aroma profile was defined using quantitative descriptive analysis (QDA). Trigeminal sensation was also evaluated.
- Colour: light, most often ivory or in various shades of yellow.
- Mouthfeel: smooth to grainy.



Intensity (0 – 1 – 2 – 3 – 4)

- Overall odour intensity
- Overall aroma intensity
- Warm (waxy)
- Floral
- Chemical (pungent)
- Animal
- Rancid
- Basic tastes (sweetness, sourness, bitterness)
- Astringency

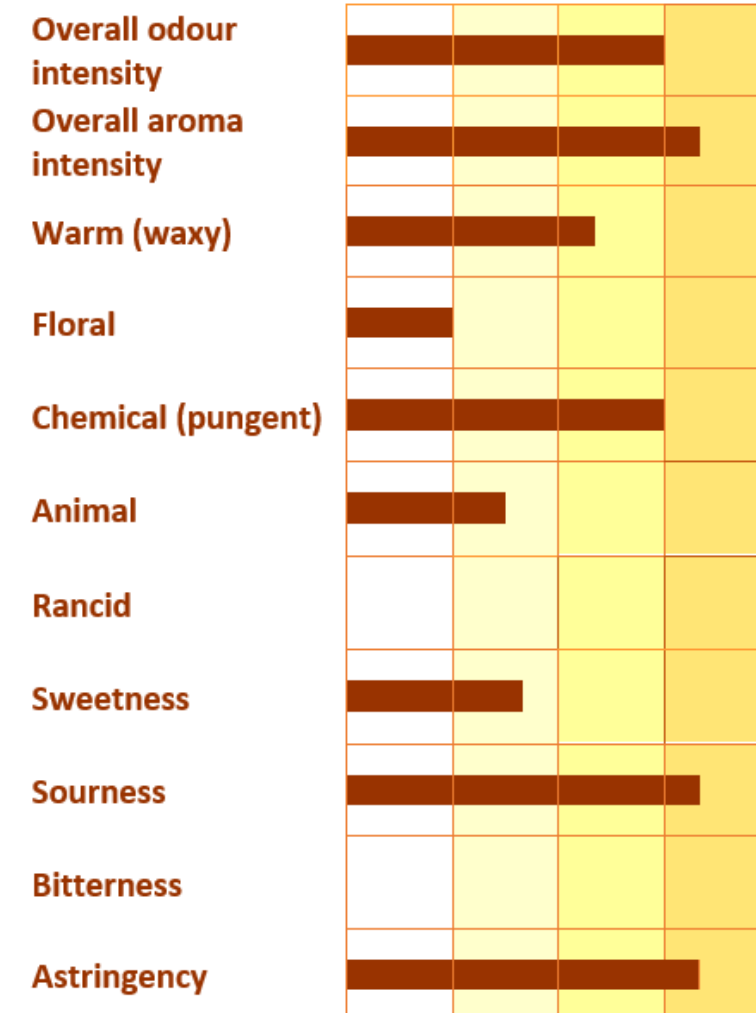
0: not detected
1: barely perceptible
2: weakly intense
3: moderately intense
4: very intense

ISO 4121:2003



Sensory properties of royal jelly

- The overall odour and aroma intensities were moderate to strong. The most expressed was chemical aroma (pungency). Warm (waxy) and animal aroma were in majority weak, while the floral aroma was on average very weak.
- The taste of royal jelly was weak to slightly sweet and moderately to intense sour.
- A characteristic feature of royal jelly is also astringency, which intensity was medium to strong.



Practical implications for beekeepers

- The identification of natural compositional ranges for Slovenian royal jelly and the establishment of criteria for authenticity control will help protect local producers.
- This study contributes to a better understanding of royal jelly by defining its standard composition and sensory characteristics.
- A comprehensive database on the characteristics of Slovenian royal jelly enables better communication between producers and consumers and can promote the consumption of this functional bee product.



Thank you!



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