

Effect of a liquid diet with protein, vitamins and probiotic on physical-chemical and sensory quality of honey in *Apis mellifera iberica* and *Apis mellifera ligustica* honey bees

Pedro Díaz Molins¹, Antonio Martínez Mateo¹, Raffaele Dall'Olio², José Serrano Marino³

¹ Zukán S.L.U. (Spain) ² BeeSources, beekeeping consultancy, Bologna (Italy) ³ Zoology Department. Faculty of Veterinary. University of Murcia. (Spain) jserrano@um.es

INTRODUCTION

The aim was to evaluate the influence of feeding honey bees with a new liquid containing 2% of protein, vitamins and probiotics, on the quality parameters of honey.

METHODOLOGY



LOCATIONS

- Murcia, Spain (experimental apiary at the University of Murcia).
- Bologna, Italy (experimental apiary at BeeSources, Bologna).



TYPES OF CLIMATE

Average temperature ranged between 12°-26°C in Murcia and 13°-25°C in Bologna.



TYPE OF BEE

Apis mellifera iberica and *Apis mellifera ligustica*, 10 hives in each location, randomly placed.



PHYSICO-CHEMICAL ANALYSIS OF HONEY (DIRECTIVE 2001/110/EC)

Once the honeys were extracted, the quality parameters were analyzed according to the standards established in the European Honey Directive. We determined the following parameters: sugar profile, hydroxymethylfurfural, diastatic activity, °Brix, color, conductivity, pH, ashes and free acidity. The sensory quality (16 attributes) was analyzed by a trained panel (10 assessors) using an unstructured scale (10 cm).

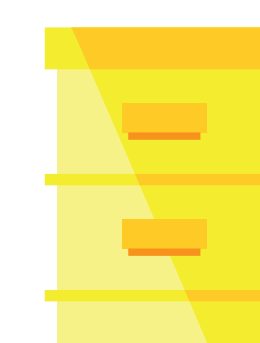
GROUPS OF HONEY SAMPLES

10 hives at each place were distributed randomly into two groups:



GROUP 1

5 hives



Control group, no supplementary feed



GROUP 2

5 hives



Fed with liquid diet

These were fed each two weeks with liquid diet: enzymatic inverted sugar syrup (75% d.s.), 2% of protein (hydrolyzed yeast), vitamins (B1, B2, B3, B4, B5, B6, C and K) and probiotics (*Bacillus subtilis* and *Enterococcus faecium*).

Starting date of feeding was **8th October 2021** (Bologna) or **5th November 2021** (Murcia) up to **August 2022**.

Total food consumption was **10,5kg/hive** in Murcia and **7,9kg/hive** in Bologna.

RESULTS

Significant differences ($p < 0.05$) were detected in °Brix, color, conductivity, diastatic activity and glucose content between control and feeding groups in both locations. However, values of these parameters are within the admitted range for human consumption by the EU Directive. The sensory analysis showed that properties of the honey were similar in both groups although significant differences ($p < 0.05$) were detected in some attributes as color, turbidity, odor and flavor. Again, the values were within the admitted range for commercial honey.

- °Brix
- pH
- Free Acidity (meq/kg)
- Conductivity (25°Brix) ($\mu\text{S}/\text{cm}$)
- Diastatic Activity
- HMF (mg/Kg)
- Ashes (%)
- Color Pefund (mm)
- Glucose (g/100g)
- Fructose (g/100g)
- Sacarose (g/100g)
- Maltose (g/100g)

MURCIA

BOLOGNA



82.4 ± 0.2	82.0 ± 0.5	79.3 ± 0.3 ^b	81.3 ± 0.4 ^a
3.5 ± 0.1	3.7 ± 0.2	4.0 ± 0.2	4.0 ± 0.3
19.0 ± 0.2	19.0 ± 0.6	30.5 ± 0.5	33.0 ± 0.8
232.0 ± 1.9 ^a	183.0 ± 1.5 ^b	726.0 ± 2.1	723.0 ± 1.6
24.0 ± 0.8 ^a	30.0 ± 0.9 ^b	61.7 ± 1.3 ^a	54.8 ± 0.7 ^b
5.4 ± 0.2	5.3 ± 0.3	1.7 ± 0.5	2.0 ± 0.3
0.24 ± 0.1	0.2 ± 0.1	0.3 ± 0.1	0.3 ± 0.1
47.0 ± 1.6 ^a	24.0 ± 0.9 ^b	44.0 ± 0.6 ^b	53.0 ± 1.5 ^a
32.2 ± 0.9 ^a	28.9 ± 1.6 ^b	28.1 ± 0.9	27.9 ± 0.9
35.8 ± 0.1	34.3 ± 2.4	41.8 ± 0.1	41.9 ± 1.0
4.9 ± 1.9	4.3 ± 0.9	1.3 ± 0.1	1.6 ± 0.6
1.9 ± 0.2	2.0 ± 0.4	0.9 ± 0.1	1.1 ± 0.1

Values with different letters differ significantly ($P < 0.05$).

CONCLUSIONS

It is concluded that **it is adequate** to feed the hives with the liquid diet with protein, vitamins and probiotics, as it **raises honey production** (see complementary poster to this communication) and **it doesn't affect the overall quality of the honey**.

