Effects of Processing on the Pollen and Nutrient Content of Honey

Katherine Beals[1], David Ropa[2]

[1]University of Utah, Salt Lake City, UT [2]Ropa Science Research, Madison, WI.

ABSTRACT (#8955)

This pilot study examined the effects of commercial processing on the pollen and nutrient content of honey. From a total of 22, 55-gallon drums of honey, 5 random drums were chosen to obtain 5 random samples of raw honey (pre-blended raw). The 22 drums were blended and heated at 140˚ F and 2 additional random samples were selected (blended raw). The blended honey settled at 130˚ F for 12 hours, was manually skimmed (removing foam and extraneous solids), flash heated to 175˚ F for 7 minutes, filtered using diatomaceous earth (DE) and flash cooled to 130˚ F after which two additional samples were taken (blended (B) filtered). All samples were analyzed by outside laboratories (Covance Labs, Madison, WI and ABC Labs, Gainesville, FL) for micronutrient content, antioxidant (AOX) capacity (ORAC) and pollen content. Processing reduced the pollen content of the honey ($P<0.05$)*, but did not significantly affect the nutrient content indicating that the micronutrient profile of honey is not related to its pollen content and is not significantly affected by commercial processing.

INTRODUCTION

Honey is the substance made when the nectar from plants is gathered, enzymatically modified and stored in the honeycomb by honey bees. During the collection of nectar, bees also pick up some pollen and transfer that pollen from one flower (which is essential for plant fertilization) as well as carry some of the pollen back to the hive. However, honey is not produced from pollen; it is produced from floral nectar.

The color and flavor of honey differ depending on the bees' predominant nectar source (i.e., the flower blossoms). It is estimated that there are more than 300 unique kinds of honey in the United States. In general, lighter colored honeys are mild in flavor, while darker honeys are usually more robust.

Commercial processing of honey involves heating and filtering (generally using diatomaceous earth). This helps delay crystallization and produce a less cloudy appearance (preferred by consumers). There is a widespread belief that unprocessed (raw) honey is more "nutritious" than honey that has been processed, despite a lack of empirical evidence to support such a belief.

PURPOSE

To examine the effects of standard commercial processing (i.e., blending, heating and filtering) on the pollen and nutrient content as well as the antioxidant capacity of honey.

METHODS

Honey Samples: From a total of 22, 55-gallon drums of canola honey (donated by a large honey producer), 5 random drums of the honey were selected to obtain 5 random samples of raw honey (pre-blended (PB) raw). The 22 drums were then blended together and heated to 140˚ F for 18 hours (as is standard process), after which 2 additional samples were selected (blended raw). The entire batch was then allowed to settle at 130˚ F for 12 hours after which the honey was manually skimmed to remove foam and extraneous solids on the surface of the honey. It was then flash heated to 175˚ F for approximately 7 minutes, filtered using diatomaceous earth and flashed cooled to 130˚ F after which 2 additional samples were taken (blended processed honey)

Measures: All samples were analyzed by outside labs. Vitamins (vitamin B12, Folate and vitamin B6)[1,2], minerals (potassium, magnesium, and calcium)[3] and both lipophilic and hydrophilic antioxidant (AOX) capacity (ORAC)[4] were analyzed by Covance Labs (Madison, WI). The selection of vitamins and minerals to be tested on based on the average quantities found in honey nationwide. Pollen analysis (pollen concentration in grains per 10 grams of honey) was conducted by ABC labs (Gainesville, FL).

Statistical Analyses: Descriptive statistics include means and standard deviations. Differences in micronutrient, AOX and pollen contents between blended raw honey and blended processed honey were analyzed using paired T-tests.

[1]Official Methods of Analysis of AOAC INTERNATIONAL, 18th Ed., Methods 952.20 and 960.46, AOAC INTERNATIONAL, Gaithersburg, MD, USA, (2005).
[2]Folic Acid (FOAN_S:13) Official Methods of Analysis of AOAC INTERNATIONAL, 18th Ed., Methods 960.46 and 992.05
[3]Elements by ICP Emission Spectrometry (ICP_S:13) Official Methods of Analysis of AOAC INTERNATIONAL, 18th Ed., Method 984.27 and 985.01, AOAC INTERNATIONAL, Gaithersburg, MD, USA, (2005)
[4]ORAC (ORAC_S:4 & ORLP_S:5)) Journal of Agricultural and Food Chemistry (2003)3272-3279.

RESULTS

Table 1

Micronutrient and Pollen Contents and Antioxidant Capacity (ORAC) of Pre-Blended (PB) Raw Honey Samples

	PB #1	PB #2	PB #3	PB #4	PB #5	PB (mean ± sd)
Calcium (mg)	3.64	3.94	3.44	3.32	3.37	3.54 ± 0.25
Magnesium (mg)	1.4	1.52	1.31	1.31	1.35	1.38 ± 0.88
Potassium (mg)	13.5	15.1	11.9	11.6	10/8	12.58 ± 1.72
Pyridoxine (mg)	0.015	0.019	0.02	0.015	0.014	0.017 ± 0.003
B12 (ug)	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	--
Folate (ug)	< 6	< 6	< 6	< 6	< 6	--
Pollen (grains/10 g)	76,933	57,178	53,684	123,112	61,427	74466.8 ± 28606.4
ORAC (umol TE/g) hydrophilic lipophilic	1.17 1.00 0.168	1.34 1.14 0.195	1.42 1.22 0.199	1.30 1.11 0.185	1.41 1.22 0.188	1.33 ± 0.01 1.14 ± 0.91 0..187 ± 0.012

It is worth noting the variability in micronutrient content, AOX activity and especially pollen from samples drawn from drums all derived from the same source.

Table 2

Micronutrient and Pollen Contents and Antioxidant Capacity (ORAC) of Blended Raw Honey vs. Blended Processed Honey

	Blended Raw Honey (mean ± sd)	Blended Processed Honey (mean ± sd)
Calcium (mg)	3.47 ± 0.04	3.57 ± 0.06
Magnesium (mg)	1.33 ± 0.00	1.5 ± 0.00
Potassium (mg)	13.00 ± 0.14	14.40 ± 0.65
Pyridoxine (mg)	0.016 ± 0.000	0.015 ± 0.014
B12 (ug)	< 0.012	< 0.012
Folate (ug)	< 6	< 6
Pollen (grains/10 g)	70863.5 ± 11614.2	0*
ORAC (umol TE/g) hydrophilic lipophilic	1.38 ± 0.09 1.10 ±0.00 0.221 ± 0.018	1.44 ± 0.03 1.23 ± 0.04 0.215 ± 0.004

* $P<0.05$

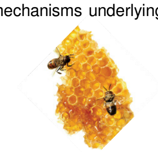
Processing significantly reduced the pollen content of the honey ($P<0.05$), but did not significantly affect the micronutrient content or AOX activity.

DISCUSSION

This pilot data indicates that processing honey does not result in the destruction of the key vitamins, minerals and antioxidants found in honey. In fact, processing actually increased the mineral content and AOX capacity of the honey. On average, honey's calcium, magnesium and potassium levels increased 0.8%, 14.1% and 8.9%, respectively after processing. Additionally, total antioxidant capacity increased an average of 8.4%, while hydrophilic rose 7.6% and lipophilic rose 15%. In contrast, vitamin content tended to show either no change or a slight decrease. Folic acid and Vitamin B12 experienced no measurable change during heating and filtration, and pyridoxine dropped 9.6%. As expected, pollen was completely eliminated after processing.

There are a number of possible reasons for the increases seen in mineral content and AOX capacity after processing including:
1. The inherent variability of micronutrient content and AOX capacity in honey samples may make the use of averages unsuitable in a study of this type.
2. The process of heating honey may eliminate moisture, thereby increasing the concentration of minerals and antioxidants**.**
3. Diatomaceous earth (used for filtration) may increase the concentration of minerals and antioxidants in honey.

Additional research is warranted to examine the mechanisms underlying the effects of processing.



CONCLUSION

Traditional commercial processing significantly reduced the pollen content of honey but did not significantly impact the vitamin or mineral content or AOX activity, indicating that the micronutrient and antioxidant profile of honey is not related to its pollen content.

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