

EFFECT OF TEMPERATURE ON QUALITY OF HONEY

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Introduction

Honey is the natural sweet substance produced by honey bees from the nectar of plants or from secretions of living parts of plants or excretions of plant sucking insects on the living parts of plants, which the bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in the honey comb to ripen and mature.

There has been an increased interest in wild plants rich in phenolic compounds due to their possible beneficial effects on human health.

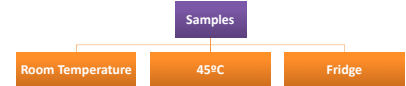
The objective of this work was to study the effect of the storage temperature on the microbiological and physicochemical parameters of monofloral honeys.



Figure 1. Floral origin of honey and location.

Sample origin:

The samples of honeys from different floral origins were collected in 2012, in Trás-os-Montes, Portugal.



Methods

Microbiological characterization:

Microbiological parameters were analyzed based on the Portuguese Standards (NP), European (ISO) and Kits (AOAC official methods).



Results

Physicochemical characterization

Table 1. Physicochemical parameters of the honey after 2 and 4 months of storage at the room temperature, on oven at 45 °C and on the fridge.

	Temperature	Time (months)	Moisture (%)	pH	Conductivity (mS/cm)	Total Ash (%)	Free Acidity (meq.Ac/Kg)	Reducing Sugars (%)	Apparent Sucrose (%)	HMF (mg/Kg)	Diastatic Index (Escala de Gothe)	Color (mmpFund)
Rosemary	Room temperature	0	16,40	3,76	0,39	0,22	33,00	66,24	3,52	29,85	7,19	53,97
		2	16,60	3,72	0,39	0,22	16,00	68,02	2,35	34,36	7,72	63,70
		4	17,80	4,00	0,38	0,22	15,00	68,03	1,81	45,25	7,82	73,42
		0	16,40	3,76	0,39	0,22	33,00	66,24	3,52	29,85	7,19	53,97
	45°C	2	16,30	3,77	0,39	0,23	25,00	62,66	3,89	300,60	2,23	60,83
		4	16,80	3,77	0,39	0,23	17,00	58,82	4,25	782,33	0,83	98,68
		0	16,40	3,76	0,39	0,22	33,00	66,24	3,52	29,85	7,19	53,97
		2	16,80	3,77	0,38	0,23	15,00	65,80	2,81	36,15	7,63	62,40
	Fridge	2	16,90	3,86	0,39	0,23	15,00	65,36	2,10	41,05	8,67	70,82
		4	16,90	3,86	0,39	0,23	15,00	65,36	2,10	41,05	8,67	70,82
		0	16,30	4,38	0,92	0,70	33,00	68,19	1,04	20,12	12,43	145,63
		2	16,40	4,44	0,92	0,67	16,00	67,57	4,15	23,6	11,12	146,05
Heather	Room temperature	0	16,30	4,38	0,92	0,70	33,00	68,19	1,04	20,12	12,43	145,63
		2	16,40	4,44	0,92	0,67	16,00	67,57	4,15	23,6	11,12	146,05
		4	17,10	4,92	0,91	0,66	13,00	63,29	5,84	27,08	9,80	195,39
		0	16,30	4,38	0,92	0,70	33,00	68,19	1,04	20,12	12,43	145,63
	45°C	2	16,70	4,38	0,91	0,68	20,00	66,66	2,05	120,51	4,15	170,39
		4	16,90	4,14	0,89	0,65	19,00	61,73	3,05	448,95	1,20	252,17
		0	16,30	4,38	0,92	0,70	33,00	68,19	1,04	20,12	12,43	145,63
		2	16,80	4,63	0,92	0,68	12,00	67,57	1,16	25,56	12,35	146,79
	Fridge	2	17,10	4,66	0,91	0,66	14,00	66,23	1,27	30,99	11,81	180,46
		4	17,10	4,66	0,91	0,66	14,00	66,23	1,27	30,99	11,81	180,46
		0	16,00	4,09	0,64	0,43	36,00	67,70	2,91	24,41	10,08	69,43
		2	16,20	4,09	0,56	0,38	18,00	67,19	1,69	34,54	10,75	78,69
Cherry tree	Room temperature	0	16,80	4,08	0,49	0,32	15,00	66,67	0,42	39,84	4,87	87,94
		2	16,20	4,09	0,64	0,43	36,00	67,70	2,91	24,41	10,08	69,43
		4	16,80	4,09	0,64	0,43	36,00	67,70	2,91	24,41	10,08	69,43
		0	16,00	4,09	0,64	0,43	36,00	67,70	2,91	24,41	10,08	69,43
	45°C	2	16,90	4,01	0,67	0,46	28,00	66,66	2,65	194,01	3,86	118,03
		4	17,10	4,03	0,70	0,49	20,00	63,29	2,38	484,43	1,06	189,82
		0	16,00	4,09	0,64	0,43	36,00	67,70	2,91	24,41	10,08	69,43
		2	16,20	3,99	0,54	0,36	18,00	67,11	3,14	26,06	11,2	76,03
	Fridge	2	16,80	3,89	0,50	0,33	15,00	64,94	3,37	27,71	6,46	82,67
		4	16,80	3,89	0,50	0,33	15,00	64,94	3,37	27,71	6,46	82,67
		0	16,00	4,65	1,16	0,87	45,00	65,79	1,83	10,91	16,00	132,51
		2	16,60	4,63	1,17	0,88	19,00	64,52	3,45	24,45	17,35	134,37
Chestnut tree	Room temperature	0	16,90	4,49	1,13	0,85	22,00	62,50	3,13	37,99	13,83	165,49
		2	16,00	4,65	1,16	0,87	45,00	65,79	1,83	10,91	16,00	132,51
		4	16,00	4,65	1,16	0,87	45,00	65,79	1,83	10,91	16,00	132,51
		0	16,00	4,65	1,16	0,87	45,00	65,79	1,83	10,91	16,00	132,51
	45°C	2	16,30	4,50	1,19	0,89	26,00	60,24	1,79	209,57	5,01	171,51
		4	16,80	4,21	1,11	0,83	35,00	59,52	1,74	408,23	0,86	296,06
		0	16,00	4,65	1,16	0,87	45,00	65,79	1,83	10,91	16,00	132,51
		2	16,80	4,70	1,17	0,88	33,00	65,79	1,76	22,79	18,46	129,91
	Fridge	2	16,80	4,73	1,18	0,89	20,00	65,79	1,69	34,66	21,07	165,60
		4	16,80	4,73	1,18	0,89	20,00	65,79	1,69	34,66	21,07	165,60
		0	16,00	4,65	1,16	0,87	45,00	65,79	1,83	10,91	16,00	132,51
		2	16,20	4,70	1,17	0,88	33,00	65,79	1,76	22,79	18,46	129,91

Microbiological characterization

Table 2. Microbiological parameters of the honey after 2 and 4 months of storage at the room temperature, on oven at 45 °C and on the fridge.

	Temperature	Time (months)	Mesophilic (UFC/g)	Moulds and yeasts (UFC/g)	S. aureus (UFC/g)	Total coliforms(UFC/g)	E. coli (UFC/g)	Sulphite-reducing Clostridia (em 0,01g)
Rosemary	Room temperature	0	1,90x10 ³	<10	<10	<10	Absent	Absent
		2	<10	<10	<10	<10	Absent	Absent
		4	<10	<10	<10	<10	Absent	Absent
		0	1,90x10 ³	<10	<10	<10	Absent	Absent
	45°C	2	<10	<10	<10	<10	Absent	Absent
		4	<10	<10	<10	<10	Absent	Absent
		0	1,90x10 ³	<10	<10	<10	Absent	Absent
		2	<10	<10	<10	8,00x10 ³	Absent	Absent
	Fridge	2	<10	<10	<10	8,00x10 ³	Absent	Absent
		4	<10	<10	<10	8,00x10 ³	Absent	Absent
		0	1,55x10 ³	<10	<10	2,00x10 ³	Absent	Absent
		2	1,73x10 ³	<10	<10	4,00x10 ³	Absent	Absent
Heather	Room temperature	0	1,55x10 ³	<10	<10	2,00x10 ³	Absent	Absent
		2	1,73x10 ³	<10	<10	4,00x10 ³	Absent	Absent
		4	1,91x10 ³	<10	<10	8,00x10 ³	Absent	Absent
		0	1,55x10 ³	<10	<10	2,00x10 ³	Absent	Absent
	45°C	2	1,36x10 ³	<10	<10	4,00x10 ³	Absent	Absent
		4	<10	<10	<10	6,00x10 ³	Absent	Absent
		0	1,55x10 ³	<10	<10	2,00x10 ³	Absent	Absent
		2	1,46x10 ³	<10	<10	<10	Absent	Absent
	Fridge	2	1,36x10 ³	<10	<10	<10	Absent	Absent
		4	1,36x10 ³	<10	<10	<10	Absent	Absent
		0	<10	<10	<10	4,00x10 ³	Absent	Absent
		2	<10	<10	<10	4,00x10 ³	Absent	Absent
Cherry tree	Room temperature	0	<10	<10	<10	4,00x10 ³	Absent	Absent
		2	<10	<10	<10	4,00x10 ³	Absent	Absent
		4	<10	<10	<10	4,00x10 ³	Absent	Absent
		0	<10	<10	<10	4,00x10 ³	Absent	Absent
	45°C	2	1,91x10 ³	<10	<10	<10	Absent	Absent
		4	1,91x10 ³	<10	<10	<10	Absent	Absent
		0	<10	<10	<10	4,00x10 ³	Absent	Absent
		2	<10	<10	<10	2,00x10 ³	Absent	Absent
	Fridge	2	<10	<10	<10	2,00x10 ³	Absent	Absent
		4	<10	<10	<10	2,00x10 ³	Absent	Absent
		0	2,32x10 ³	7,91x10 ³	<10	<10	Absent	Absent
		2	<10	<10	<10	<10	Absent	Absent
Chestnut tree	Room temperature	0	<10	<10	<10	<10	Absent	Absent
		2	<10	<10	<10	<10	Absent	Absent
		4	<10	<10	<10	<10	Absent	Absent
		0	2,32x10 ³	7,91x10 ³	<10	<10	Absent	Absent
	45°C	2	<10	<10	<10	<10	Absent	Absent
		4	<10	<10	<10	<10	Absent	Absent
		0	2,32x10 ³	7,91x10 ³	<10	<10	Absent	Absent
		2	1,21x10 ³	7,50x10 ³	<10	6,00x10 ³	Absent	Absent
	Fridge	2	<10	7,09x10 ³	<10	2,00x10 ³	Absent	Absent
		4	<10	7,09x10 ³	<10	2,00x10 ³	Absent	Absent
		0	2,32x10 ³	7,91x10 ³	<10	<10	Absent	Absent
		2	1,21x10 ³	7,50x10 ³	<10	6,00x10 ³	Absent	Absent

- Physicochemical parameters may be useful as indicators of heating or storage of honey to high temperatures, especially the HMF and diastatic index.
- The honey storage in the refrigerator was effective in reducing the rate of formation of HMF, but accelerated the cooling crystallization of the product.
- Mesophilic aerobic microorganisms and yeasts and molds, were within the legal limits, with the exception of chestnut honey that exceed the limits established for yeasts and molds when stored in the refrigerator.
- Regarding health quality (total coliforms, *E. coli*, and *S. aureus*) only total coliforms were detected at low levels.
- Safety indicators (sulphite-reducing clostridia) were absent in all samples analyzed indicating that this product is safe for the consumer.
- We can conclude that the data presented in this study show the importance of checking the conditions in which the honey is stored and maintained, to ensure honey safety for consumers.

Conclusion