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CHEMICAL COMPOSITION OF HONEYS FROM FARS AND KOHKILUYEH PROVINCES OF IRAN[1]

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ABSTRACT

Twenty honey samples were collected directly from honey producing regions of Fars and Kohkiluyeh provinces, Iran, and were examined for their chemical constituents in order to obtain the characteristics required for Iranian honey standardization. This examination revealed a reasonably low content of moisture, compared to that set by Codex Alimentarius Commission and those of other countries. The contents of other constituents were variable. The ranges for ash, total acidity, diastase level and hydroxymethylfurfural did not meet the limit set by Codex Alimentarius Commission. Therefore, it is necessary to conduct additional surveys on honeys from other parts of Iran to establish the characteristics required for Iranian honey standard legislation.

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ترکیبات شیمیایی عسلهای استان فارس وکهکیلویه

رستم فرجی هارمی وزیبا حسینی

به ترتیب استادیار ومربی بخش صنایع غذایی دانشکده کشاورزی دانشگاه شیراز

خلاصه

تعداد ۲۰ نمونه عسل مستقیما از مناطق تولید عسل استان های فارس وکهکیلویه جمع آوری وبه منظور حصول خصوصیات لازم جهت استاندارد کردن عسلهای ایرانی مورد آزمایش قرار گرفتند. مقدار رطوبت عسلهای مورد آزمایش با مقایسه با آنچه توسط کمیته FAO وکشورهای دیگر مشخص شده نسبتا پائین بود. مقادیر دیگر ترکیبات متغییر بودند. دامنه تغییرات برای خاکستر، اسیدیته کل، دیاستاز و هیدروکسی متیل فورفورال با آنچه توسط کمیته FAO مشخص شده مطابقت نداشت. این تحقیق نشان داد که جهت تدوین خصوصیات لازم جهت استانداردکردن عسلهای ایرانی نیاز به تعیین ترکیبات شیمیایی عسلهای دیگر مناطق مختلف ایران می باشد.

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INTRODUCTION

Different standards for honey quality have been established in many countries of the world. In some of these countries only a few standard characteristics of honey are included, while in others, a long list of honey constituents have been published (Table 1). The principle aim of these quality standards has been to detect any adulteration, such as, addition of invert or any other kind of sugar to the honey, or maltreatments of honey, such as over-heating during processing, packaging and storing.

The amount of honey constituents as well as their ranges are very variable among honeys from different regions. Therefore, establishing a list of characteristics required for the development of a standard for honey for a certain region would be very difficult before examining the honeys from that region. Therefore, many countries of the world have established their own standards for honey quality by examining the honey produced in those countries. Table 1 shows the characteristics required for table honey in 18 countries.

A standard for honey has also been established by a committee of representatives from European FAO members (Table 2). This standard has been sent to all FAO members with the recommendation that it should be adopted as the basis for national legislation (4).

Except for one publication (6), there is no information on chemical composition of different honeys from Iran. Since honey is produced in widely scattered areas of Iran, the possibilities of variation in its composition are enormous. In addition to the cultivars of nectar secreting plants are the effects of local climatic, environmental conditions and soil types, which might affect the composition of honey.

Therefore, it seems necessary to examine honeys from different regions in order to establish the characteristics required for standardization of Iranian honeys.

Table 1. Characteristics required for table honey in 18 countries , and in at least 14 of them (5).

Component or test	Acceptable level in all 18 countries†	Acceptable level in at least 14 of 18 countries
Water content	18% or less	20% or less
Sucrose content	3% or less	8% or less
Reducing sugars as invert sugar	70% or more	n.s.‡
Dextrine	5% or less	n.s.
Acidity as meq kg^{-1}	5 or less	50 or less
Ash	between 0.1 and 0.25%	0.4% or less
Water-insolubles in the solids	0.1% or less	1% or less
Diastase, Gothe value	between 8 and 10	n.s.
Fiehe reaction	negative	n.s.
HMF	40 ppm or less	n.s.
Lund reaction precipitate	between 0.6 and 3%	n.s.
Lugol reaction	negative	n.s.
Trace metals	below certain limits	n.s.
Polarimetry	levorotatory between -21 and -2	n.s.

†Austria, Belgium, Netherlands, Luxembourg, France, West Germany, Italy, Spain, Sweden, Switzerland, United Kingdom, Canada, United States of America, Argentina, Brazil, Mexico, Australia, New Zealand.

‡Not specified

Table 2. FAO standard for composition of honey (4).

Compound	Limit
Apparent reducing sugar	minimum 65%
Sucrose	maximum 5%
Moisture	maximum 21%
Acidity	maximum 40 meq kg^{-1}
Ash	maximum 0.6%
HMF	maximum 40 mg kg^{-1}
Diastase	minimum 8 (if HMF exceeds 15 mg kg^{-1})
	minimum 3 (if HMF is less than 15 mg kg^{-1})

MATERIALS AND METHODS

Twenty honey samples were collected directly from the combs in honey producing stations of different regions of Fars and Kohkiluyeh provinces (Table 3). The honeys were collected in plastic vessels and transferred to the laboratory and extracted at room temperature. The extracted honeys were kept at -20°C until examinations.

Carbohydrates, ash, pH, acidity, lactone and moisture contents were determined as described by AOAC (1). Hydroxymethylfurfural and diastase levels were determined using the methods described by Codex Alimentarius Commission (4).

RESULTS AND DISCUSSION

The chemical constituents of the 20 honeys from respective regions are indicated in Table 3. The chemical compounds examined in this survey were as follows:

Moisture Content

The variation for moisture content of the honeys was found to be from 13.0% (No. 11) to 16.0% (No. 12) with an average of 14.3%. The relatively low content of moisture, compared to honeys examined in other countries, such as 26.2% in Japanese honey (2) may be due to dry weather of these two provinces. Whereas high water content of honey is probably attributed to high rainfall and wet weather (8). The importance of honey moisture content in relation to microbial stability has long been recognized (7). However, the surprisingly high moisture content (21%) set by Codex Alimentarius Commission (4) was easily met by the honeys examined in this study.

Ash

The ash content varied from 0.07% for honey No. 18 to 0.99% for honey No. 13 with an average of 0.25%. These results are in agreement with those of White *et al.* (9) who showed a range of 0.02-1.05% with an average of 0.17% for American honeys and Chandler *et al.* (3) who found an average of 0.17% for Australian honeys. The ash content of the honeys in this study showed a reasonably higher value than other honeys of the world (5). Three samples, (Nos. 13, 15 and 16) with ash contents of 0.99, 0.77 and 0.88% exceeded the maximum limit of FAO standard (0.6%).

pH and Acidity

From the results presented in Table 3, it is apparent that the pH ranged from 3.50 (No. 15) to 4.30 (No. 4) with an average of 3.91. Free acidity varied from 20.0 meq kg^{-1} (No. 8) to 39.7 meq kg^{-1} (No. 12) with an average of 28.2 meq kg^{-1}. Total acidity varied from 24.5 meq kg^{-1} (No. 8) to 43.5 meq kg^{-1}

Table 3. Chemical constituents of 20 honeys from different regions of Fars and Kohkiluyeh provinces.

Chemical Compound / Sample No.	Moisture %	Ash %	pH	Free acidity meq kg^{-1}	Lactone meq kg^{-1}	Total acidity meq kg^{-1}	Diastase No.	HMF mg kg^{-1}	Apparent reducing sugar %	Apparent sucrose %	Undetermined material %	Region
1	14.2	0.21	3.60	37.8	2.7	40.5	7.5	35.0	74.0	2.65	8.94	Roniz (Sofla)
2	13.4	0.19	4.10	28.0	2.3	30.3	40.3	3.9	76.0	0.76	9.65	Sepidan (Shakarak)
3	13.4	0.12	4.05	25.0	1.0	26.0	18.4	3.6	71.0	2.74	12.74	Sepidan (Zargari)
4	15.8	0.15	4.30	24.5	4.2	28.7	30.1	1.9	79.8	0.50	13.70	Yasooj (Parkadoon)
5	14.0	0.09	3.85	24.2	3.3	27.5	11.2	11.1	73.3	2.04	10.57	Estahban (Bege 1)
6	15.0	0.16	3.75	29.5	0.5	30.0	31.4	5.6	70.7	0.50	13.64	Sepidan (Roodbeshar)
7	14.4	0.25	4.25	36.0	4.0	40.0	70.0	1.9	71.1	2.59	11.66	Sepidan (Homayjoon)
8	13.4	0.11	4.05	20.0	4.5	24.5	16.3	6.8	72.9	1.32	12.27	Roodbar (east)
9	15.4	0.13	4.20	25.5	3.5	29.0	15.9	14.2	73.0	1.57	9.90	Estahban (Bege 2)
10	15.8	0.11	3.65	29.0	2.7	31.7	15.6	5.3	71.1	2.09	10.90	Yasooj (north 1)
11	13.0	0.12	3.80	27.5	1.3	28.8	25.7	2.0	72.5	3.10	11.28	Yasooj (north 2)
12	16.0	0.22	3.80	39.7	3.8	43.5	10.8	5.1	72.2	0.50	11.08	Fasa (south)
13	15.4	0.99	3.60	30.0	3.3	33.3	15.5	5.9	70.0	1.18	12.43	Darab (Hasanabad)
14	14.0	0.13	4.10	22.0	3.5	25.5	17.4	4.8	73.1	0.10	12.65	Fasa (north 1)
15	13.8	0.77	3.50	29.0	1.3	30.3	20.9	8.2	73.0	1.83	10.60	Darab (Hoseinabad)
16	14.6	0.88	3.75	29.5	3.5	33.0	15.2	14.2	74.6	1.83	8.09	Darab
17	14.2	0.12	3.80	27.5	2.5	30.0	12.9	6.1	73.3	2.05	10.33	Badjgah 1
18	14.0	0.07	3.95	26.5	3.2	29.7	12.7	6.0	69.3	2.88	13.75	Badjgah 2
19	13.4	0.16	4.10	26.2	5.0	31.2	8.5	19.6	71.4	2.11	12.93	Fasa (north 2)
20	13.4	0.12	3.95	27.0	4.7	31.7	26.1	9.4	73.1	1.88	11.50	Fasa (north 3)
Average	14.3	0.25	3.91	28.2	3.0	31.2	21.1	8.5	72.8	1.71	11.43	
Upper range	16.0	0.99	4.30	39.7	5.0	43.5	70.0	35.0	79.8	3.10	13.75	
Lower range	13.0	0.07	3.50	20.0	1.0	24.5	7.5	1.9	69.3	0.10	8.09	

(No. 12) with an average of 31.23 meq kg^{-1}. Lactone content varied from 1.0 meq kg^{-1} No. 3 to 5.0 meq kg^{-1} No. 19 with an average of 3.0 meq kg^{-1}. The presence of lactone in honeys is probably a product of glucose oxidase action on glucose (9).

pH is rarely indicated as a standard for honey quality. However, total acidity appears in almost all honey standards. According to FAO honey standard the maximum limit for total acidity is 40 meq kg^{-1}. In the case of this survey two samples (Nos. 1 and 12), with a total acidity of 40.5 and 43.5 meq kg^{-1} respectively, exceeded this limit.

Diastase and Hydroxymethylfurfural (HMF)

In this study the levels of diastase activity were found to be quite variable among different honeys, with the values ranging from a high of 70 diastase number (D.N.) in No. 7 to a low of 7.5 D.N. in No. 1 with an average of 21.1 D.N. HMF varied from a low level of 1.9 mg kg^{-1} No. 7 to a high range of 35 mg kg^{-1} in No. 1 with an average of 8.5 mg kg^{-1}. The levels of diastase activity and HMF in honey are considered to be indicative of heat treatment and storage of honey. However, with respect to the wide variation of these two constituents in different honeys, it is obvious that diastase level alone is not a satisfactory indication of heat treatment. Therefore in current honey standard legislation, diastase value is used with combination of indices (HMF, invertase, etc.; Table 2). Accordingly, the FAO quality standard for honey states that the minimum diastase level for honey containing more than 15 mg kg^{-1} HMF should not be less than 8 D.N. Sample No. 1 had an HMF content of 35 mg/kg^{-1} with diastase level of 7.5. FAO standards were met for HMF content/diastase activity in all the other honeys examined.

Carbohydrates

The values obtained for total reducing sugars ranged from 69.4% (No. 18) to 79.8% (No. 4) with an average of 72.8%. The minimum level of reducing sugar in the FAO standards of

honey is 65%. All the honeys tested from the two provinces met this minimum. The range for sucrose contents showed a minimum of 0.10% (No. 10) to a maximum of 3.10% (No. 11) with an average of 1.71%. These values did not exceed the maximum level of 5% set by Codex Alimentarius method (4).

The rest of honey constituents, indicated as undetermined materials ranged from 8.09% (No. 16) to 13.75% (No. 18) with an average of 11.43%. Undetermined materials are not included in most standards for honey quality. However, in some standard legislations dextrine has been indicated as a quality factor which may relate to this constituent (5).

From this investigation it is concluded that there is a wide variation of the tested chemical constituents among different honeys. However, the moisture contents of all honeys met Codex standards and it is unlikely that the honeys from two regions of Iran would have bacterial growth problems due to the low moisture content. The ash contents of 85% of the honeys, total acidity of 90% of the honeys, diastase/HMF of 95% of the honeys, sucrose and reducing sugars of all honeys met the limits set by Codex standards. This investigation showed that the honeys tested from the two regions met FAO standards favorably. It is therefore recommended that honeys from other regions be tested to promote the markets of Iranian honey.

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