



CHEMICAL CHARACTERISTIC OF SELECTED IMPORTED AND LOCAL HONEY SOLD AROUND KANO METROPOLIS, NIGERIA

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ABSTRACT

In this study, analysis of nine samples of imported honey from Argentina, Italy and Turkey and local honey sourced from Kaduna, Adamawa, Zaria, Jigawa, Bauchi and Hadejia were incorporated in the study. The concentration of reducing sugars, sucrose, free fatty acid, pH, moisture and ash content were determined using standard methods. The imported honey had the highest reducing sugar and ash content. The reducing sugar content follows the order A>B> C. While, the local honey samples had high free fatty acid and moisture. The free fatty acid is in the order I> G> E> D> F> H. The pH and sucrose of all samples are within the national regulations. Reducing sugar ($\geq 65\%$), sucrose ($\leq 5\%$), free fatty acid ($\leq 40\text{meq/kg}$), moisture ($\leq 21\%$), ash ($\leq 1.0\%$) and pH (3.2-4.5). These results indicate that imported honey fall within the Codex Standard regulations in most cases. It has been discovered that some substances in honey prevent colon cancer in animals by shutting down activity of two enzymes, phosphatidylinositol-specific phospholipase and lipoxigenase. Other phytonutrients found in honey have been shown to possess cancer-preventing and anti-tumor properties. Honey is the ideal liver fuel because it contains a nearly 1:1 ratio of fructose to glucose. Fructose "unlocks" the enzyme from the liver cell's nucleus that is necessary for the incorporation of glucose into glycogen (the form in which sugar is stored in the liver and muscle cells). Honey may promote better blood sugar control. Proper fueling of the liver is central to optimal glucose metabolism during sleep and exercise.

Keywords: Chemical, Honey, Reducing sugar, Sucrose.

INTRODUCTION

Honey is a natural sweet produced by honey bees which collect nectars from flowering plants, convert the components of the nectars and place them into combs for maturation (Tosun, 2013). Honey is a natural food with specific flavor, odour and nutritive value. Its composition and quality vary depending on production method, climatic condition of the region, conditions of handling and storage and the source of the nectar (Jennifer *et al.*, 2012). Most commercially available honey is blend of two or more honey of different floral source, color, flavor, density or geographical origin (White, 1975a). Polyfloral honey also known as wild flower honey is derived from the nectar of many types of flowers. The taste may vary from year to year, and the aroma and flavor can be more or less intense, depending on which bloomings are prevalent (Kamal and Klein, 2011). Monofloral honey is made primarily from the nectar of one type of flower. Different monofloral honeys have a distinctive flavor and color because of differences between their principal nectar sources. In order to produce monofloral honey beekeepers keep beehives in an area where the bees have access to only one type of flower (National Honey Board, 2008).

Instead of taking nectar, bees can take honeydew, the sweet secretion of aphids or other plant sap-sucking insects. Honeydew honey is very dark brown in color, with a rich fragrance of stewed fruit or jam and is not as sweet as nectar honey (National Honey Board, 2007). The production of honeydew honey has some complications and

dangers. The honey has a much larger proportion of indigestible than light floral honeys which can cause dysentery to the bees, resulting in the death of colonies in areas with cold winters (Adebiyi *et al.*, 2004).

The main constituents of honey are glucose (dextrose), fructose, sucrose, dextrin, mineral elements, proteins and wax. Pollen is invariably present in comb honey, but may be absent in products which have been finely strained. The enzymes present in honey cause changes in the proportions of the original sugars present and the sucrose may disappear completely on storage. The presence of over about 5% of sucrose may be due to artificial feeding of the bees with the sugar during the winter or during periods of drought (White, 1975a). Most natural honey has a negative optical rotation, but sucrose and glucose syrup both make up the rotation more positive. Technical invert sugar is invariably present in imitation honeys. High fructose glucose syrup contains fructose and glucose in approximately the same ratio as in honey. Therefore, this new sweetener may be used for honey adulteration or the manufacture of imitation honeys (Fennema, 2003).

This research work is aimed at analyzing six chemical parameters (reducing sugars, sucrose, free fatty acid, moisture, pH, and ash) in local and imported honeys to verify their quality for human consumption and these chemical parameter are used as quality control standards to accept or reject honey for commercialization (CAA, 2004).

MATERIALS AND METHODS

Sample Collection

Nine honey samples were purchased from Kano Metropolis for the analysis (Table 1). Three samples were purchased from Sahad, Zango and Jujin Labbu stores (imported honey) while the other six samples

were purchased from Kurmi market, Kofar Wambai, Fagge, Yankaba, B.U.K central mosque and Abubakar Rimi market, (local honey), respectively. The honey samples were stored in clean labeled bottles and immediately transferred to the laboratory for analysis.

Table 1: Imported and Locally Sourced Honey Samples

Sample	Sampling Site	Source
A	Zango stores	Argentina
B	Sahad stores	Italy
C	Jujin labbu stores	Turkey
D	Kurmi market	Kaduna
E	Kofar wambai	Adamawa
F	Fagge	Zaria
G	Yankaba	Jigawa
H	Bayero University Kano central mosque	Bauchi
I	Abubakar Rimi market	Hadejia

Chemical Analysis

All the chemical analyses were carried out using Official Methods of Analysis (AOAC, 1990). In all cases; three replicates were analyzed per sample. The pH was determined using digital pH meter (Lab. Tec. 3320).

STATISTICAL ANALYSIS

Results were compared by analysis of variance (ANOVA) at 0.05 level of significance as described by Oyeka (1996).

RESULTS AND DISCUSSION

Honeydew honeys, due to their higher mineral content, have a higher pH value, varying between 4.5 and 6.5. Honeydew honeys contain the trisaccharides melezitose and raffinose. The main acid is gluconic

acid, a product of glucose oxidation by glucose oxidase. The principal oligosaccharides in blossom honeys are disaccharides: sucrose, maltose, turanose, erlose. The following acid has been found in minor amounts: formic, acetic, citric, lactic, maleic, malic, oxalic, pyroglutamic and succinic (Mato *et al.*, 2003). Honey contains Bacillus bacteria, causing the dangerous bee pests, but these are not toxic for humans. That is why, in order to prevent bee pests, honey should not be disposed in open places, where it can easily be accessed by bees. Honey, is a very concentrated sugar solution with a high osmotic pressure, making impossible the growth of any microorganisms. Recent extensive reviews covered the main aspects of honey microbiology and the possible risks (Cliver, 2000; Snowdon and Cliver, 1996; Zucchi *et al.*, 2001).

Table 2: % of Reducing Sugars, Sucrose and the Concentration of Free Acid obtained From the Studies.

Sample	Reducing Sugars (%)	Sucrose Content (%)	Free Acid (meq/kg)
A	91.1	1.48	17
B	83.8	1.59	27
C	81.5	1.57	37
D	86.1	1.52	59
E	79.5	1.77	60
F	81.5	1.50	59
G	81.5	1.58	61
H	83.8	1.53	58
I	79.5	1.64	66
Mean	83.7	1.57	44
S.D	3.8	0.08	6.4
Ranges	79.5 - 91.1	1.48 - 1.77	17- 66

Values are reported as mean of triplicate determinations per sample.

Tables 2 shows result of reducing sugars, sucrose and the concentration of free acid of both imported and local natural honey samples, with mean and standard deviation. Reducing sugar of imported honey and local honey ranges, 81.5-91.1% and 79.5-86.1% respectively, which are all in agreement with the Codex (2001) that reported reducing sugars of honey should not be less than 65%. White (1975b) reported the reducing sugars of United States honey to be in

the range 69.50-80.0%. A range of 85.0-94.9% was reported for various honeys from various sources by Gustavo (2008). ANOVA at P<0.05 shows no significant difference was noted between the local and imported honeys. The finding of this study indicated that the honey sold around Kano Metropolis are comparable in reducing sugar content with that obtained elsewhere and are in compliance with the Codex (2001).

Sucrose in imported honeys ranged 1.48-1.59 %; these results are slightly different from those obtained in local honeys 1.50-1.77%. Both values are in agreement with the Codex (2001) that reported not more than 5% sucrose for normal honey. The average percentage of 1.0% was reported by Gustavo, (2008). White (1975a) obtained the sucrose range of values from United States honey as 0.2-7.6%. No significant difference occurred between the local and imported honey ($P < 0.05$).

Free acid ranged 17-37meq/kg in imported honeys which is in accordance with the Codex Standard that

reported not more than 40meq/kg; lower than in local honeys, with 58-66meq/kg. These values are higher than in previous works, with 16.61meq/kg (Turhan, 2007) and 7.22meq/kg (Terrab *et al.*, 2005). The free acid values were significantly different ($P < 0.05$). The higher values are excellent indicator of fermentation process (Bogdanov *et al.*, 2008). The finding may indicate some level of fermentation in the local honey. This may be due to crude way of processing the local honey.

Table 3: Moisture, Ash and pH Values of the Different Honey Samples Studied

Samples label	Moisture (%)	Ash (%)	pH
A	19	0.32	4.88
B	24	0.27	3.94
C	17	0.05	4.25
D	25	0.23	4.36
E	29	0.19	4.40
F	36	0.20	3.89
G	29	0.10	4.27
H	31	0.22	4.31
I	21	0.36	4.34
Mean	24	0.21	4.31
S.D	4.37	0.11	0.33
Ranges	17-36	0.05-0.36	3.89-4.88

Values are reported as mean of triplicate determinations per sample

Imported honeys show the moisture content to be in the range 17-24% and local honey 21-36% (Table 3); this variable depends on climatic factors, season of production and maturity of honey. Only one of the imported honey samples has more than 21% of moisture which can allow fermentation (Codex Standard, 2001). Adebisi *et al.* (2004), Gustavo (2008) and White (1975b) showed honey to contain 16.38-30.82%, 13.4-29.0% and 15.7-26.7% moisture respectively. ANOVA ($P < 0.05$) showed moisture to be statistically higher in local honeys than in the imported honeys, it shows significant difference in the moisture content. Honeys with high levels of water tend to ferment more easily. If water is mixed with honey it loses its low water activity, and therefore no longer possesses antimicrobial property (Bogdanov *et al.* 2008). The high moisture content may either be due to crude processing methods or adulteration of the product.

Ash range in imported honey was 0.27-0.52 % (Table 3) and it represents the mineral content of honey. The range is higher in comparison with that obtained in samples from local market, 0.10-0.36%. The mean ash content of United States honey is 0.167%, with a range of 0.020-1.020% as reported by White (1975b). The value obtained for imported honey is within the range of 0.04-0.93% reported by Gustavo (2008). The results are in agreement with the reported data by Codex (2001) that reported not more than 1.0%. No significant difference ($P < 0.05$) occurred between the local and imported honey samples.

The pH of both imported and local honey samples range from 3.89-4.88 (Table 3). These values are within the range of the pH values of honey from

U.S. (range 3.6-5.6) reported by White (1975a,b). Bogdanov *et al.* (2008) and Cantarelli *et al.* (2008) reported pH range of honey as 3.2-4.2. Gustavo (2008) reported the pH range as 3.4-6.1. ANOVA at $P < 0.05$ shows that there is no significant difference between the local and imported samples. This relatively acidic pH prevents the growth of many bacteria. The lowest pH is recorded among the local honey which may support the occurrence of fermentation.

CONCLUSION

The low moisture content helps to protect honey from microbiological activity and thus it can be preserved for longer periods of time. In addition to its reputation as nature's nutritive sweetener, honey's unique composition makes it useful as an antimicrobial agent and antioxidant. The body's tolerance to honey is significantly better than to sucrose or glucose alone. All the quality parameters determined agree in general, with the codex standard regulation for honey. Different varieties of honey possess a large amount of friendly bacteria, which may explain many of the "mysterious therapeutic properties of honey. Some of the parameters were found to be a little higher or lower compared to the standard range in the local samples. Consumption of honey may improve blood sugar control and insulin sensitivity compared to other sweeteners. When raw honey is extensively processed and heated, the benefits of phytonutrients are largely eliminated. Therefore this wonderfully rich golden liquid is the miraculous product of honey bees and a naturally delicious alternative to white sugar.

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