CARD International Journal of Agricultural Research and Food Production (IJARFP)
ISSN: 2536-7293 (Print): 2536-7307 (Online)
Volume 2, Number 2, June 2017
http://www.casirmediapublishing.com

Physicochemical Assessment of Umunnochi and Nsukka Honey Samples for Possible Health Benefits

Nwaneri T. U.; Offurum J. C.; Dike M. C.; Uwazie M. C. & Akuchie C. J.
Department of Chemical Engineering
Imo State Polytechnic, Umuagwo-Ohaji
E-mail: jullyengine@yahoo.com

ABSTRACT

This research work was focused on the physicochemical assessment of two honey samples (from Umunnochi in Abia State and Nsukka in Enugu State both of the Eastern part of Nigeria) for possible health benefits. Some people consume honey for a number of health benefits, while others dislike it for (possibly) a number of side effects. It, thus, becomes important to inherent components of honey (especially the mineral contents) to actually establish the true position of honey for human consumption. Spectrophotometric method was used to determine the Calcium (Ca), Iron (Fe), Magnesium (Mg), Potassium (K) and Sodium (Na) contents of the study samples. The pH of the samples was analysed using a standard digital pH meter. From the experimental results, the ash and moisture contents of Umunnochi honey was found to be *0.083%* and *0.18%*, while those of Nsukka extraction were *0.065%* and *0.30%*. The Umunnochi honey was, also, found to be more acidic (with pH of *4.43*) when compared with that of Nsukka (with *5.09* pH), and both samples maintained the sweet taste and brownish colour of natural honey. The specific gravity and the refractive index were respectively found to be *1.40* and *1.4977* (for Umunnochi honey) and *1.38* and *0.7721* (for Nsukka honey). The ferric, potassium, calcium, magnesium and sodium contents for Umunnochi honey were *0.18, 195, 3.8, 0.6 and 0.6g/L*, while those of Nsukka honey were *0.3, 150, 3.0, 0.8 and 0.2g/L* respectively. The results generally suggest that Umunnochi honey has higher mineral contents than its Nsukka counterpart. Though results obtained from both samples all fall within the stipulated Codex Standard (of 2001), except the refractive index of the Umunnochi honey; this, however, gives the Nsukka honey an age over its Umunnochi counterpart as it represents a better dietary provision for anaemic patients and menstruating women, while the later is preferred for hypertensive patients.

Keywords: Physicochemical, Assessment, Honey, Health Benefit

INTRODUCTION

Honey is a sweet and viscous fluid produced by honeybee from the nectar of flowers. Nectar is a thin, easily spoiled sweet liquid that is changed (ripened) by the honeybee to a stable, dense and high-energy food. Honey is produced by honey bees from the nectar blossoms or secretions on living plants, which the bees collect, transform and store in combs (White and Landis, 1980). Honey can be characterized according to its geographical origin. Many scientists have reported that there is regional variation in the physicochemical properties of the honey samples (such as the ash contents, enzymes activities, hydroxymethylfurfural (HMF), electrical conductivity and pH) from various locations (Buba *et al,* 2013; Sharquie *et al,* 2004). Not only does the property of honey depend on the plant nectar, but it also depends on the species of the honey bee.

Honey is nature's original sweetener. It has been used as a food for at least six thousand years and for much of that time was the sole source of sweet for much of the world's population (David, 2007). Honey is produced by six to eleven of the approximately 20,000 species of bees, with the exact number depending on the authority consulted. Collectively, however, these species produced over 174 million pounds of honey in the United States in 2005 (Buba *et al*). In addition to producing honey, a variety of crops (such as apples, avocados, blueberries, cherries, cranberries, sunflowers, alfalfa, cucumbers, kiwi fruit, melons, and vegetables) are dependent on honey-bees for pollination. Interestingly, without honeybees, there would be virtually no almond crop.

At first approximation, honey is a supersaturated sugar solution, but subsequently, honey became much more than that. The unique (though variable) combination of components of honey makes it a prized addition to the diet (David, 2007).

Honey produced by honeybees has been traditionally recognized as valuable source of energy, which contains antimicrobial and antioxidant characteristics (Alnaqdy, *et al,* 2005; Obi *et al,* 1994; Bansal *et al,* 2005; Haffejee *et al,* 2010). It is a concentrated aqueous solution of invert sugar that contains mixture of other carbohydrates, amino and organic acids, minerals, aromatic substances, pigments, waxes and pollen grains; all these added up to make it complex (De Ferrer *et al,* 2004). White (1980) reveals that there exist a number of unstable compounds (such as enzymes, substances of hormonal character, some vitamins and a few minor compounds) in honey. The colors of honey form a continuous range from very pale yellow through ambers to a darkish red amber to nearly black (or dark brown). The variations are almost entirely due to the plant source of the honey, even though climate may also modify the color somewhat through the darkening action of heat. The flavour and aroma of honey vary even more than the color. Although there seems to be a characteristic "honey flavour," almost an infinite number of aroma and flavour variations exist. The colour variations appear to be governed by the floral source. In general, light-coloured honey is mild in flavour, while a darker honey has a more pronounced flavour. Exceptions to the rule sometimes endow a light honey with very definite specific flavours. But since flavour and aroma judgments are personal, individual preference will vary, but with the tremendous variety available, everyone should be able to find a favorite honey (White, *et al,* 2007).

MATERIALS AND METHOD

pH Analysis

The pH analysis of the honey samples was done using a digital pH meter (of model: *PHS-3C*) at the ratio of 1:10 sample-to-water measurement, that is, 10g of each of the oil samples was weighed into a beaker and 200g of distilled water was added to it. Then the pH and conductivity electrodes were dipped into the solution, and the reading was taken.

Specific Gravity

The density bottle was used to determine the density of the honey in each case. A clean and dry bottle of 25ml capacity was weighed empty (W_O) by means of analytical weighing balance (of model: *FA-2104*), and then filled with the honey. The honey-in-bottle was then reweighed to obtain W_1. The bottle was filled again with water after washing and drying, and weighed to obtain W_2. The results obtained from the mass evaluation were used to calculate the specific gravity as stated in *equation 1*.

$$S.P. = \frac{W_1 - W_O}{W_2 - W_O} = \frac{\text{Mass of Substance}}{\text{Mass of equal Vol. of Water}} \quad (1)$$

Determination of Moisture Content of the Sample

The moisture content was determined using the Oven-drying techniques (Indirect Distillation). Silica crucibles were used. 10g of each the samples was weighed into a pre-weighed, pre-dried and cooled crucible (dish). It was then dried in the oven at 70°C for two (2) hours, as well as and at 100°C (usually at 105°C) until a constant weight is obtained. The crucible was cooled, and its content (dried sample) was removed and weighed. The percentage moisture content is given by equation 2.

$$\%age\ Moisture\ Content = \frac{W_2 - W_1}{W_3 - W_1} \text{ X } \frac{100}{1} \quad (2)$$

Where: W_1 = Initial weight of empty crucible

W_2 = Weight of empty crucible + weight sample before drying

W_3 = Weight of empty crucible + weight of sample after drying

Determination of Ash Content

Two crucibles (one for each sample) were thoroughly washed, cleaned and placed in a hot air-circulation Oven for 2 hours, after which they were cooled to room temperature (in a desicator. The empty crucibles were then transferred to the muffle furnace to burn off all organic matter and also to stabilize the weight of the crucibles at high temperature (of

500°C) The pre-weighed crucibles were later transferred into a preheated furnace and ashed for 3hours at 600°C. The crucible was cooled and its content (ash) in a desicator taken and reweighed. The percentage ash content is given by equation 3.

$$\%age\ Ash\ Content = \frac{W_3 - W_1}{W_2 - W_1} \text{ X } \frac{100}{1} = \frac{\text{Weight of Ash}}{\text{Weight of Sample}} \qquad (3)$$

Where: W_1 = Weight of empty crucible

W_2 = Weight of empty crucible + Sample before ashing

W_3 = Weight of empty crucible + Ash

Dry Digestion Analysis for Heavy Metal

5g of each of the honey samples was digested in a 50ml crucible in a muffle furnace at 500°C for about 3hrs; the process continued until a white ash was obtained. The Ash was digested using 1M HCl, and was filtered using What-man filter paper. The volume of the filtrate was then made up to the mark of 100ml in volumetric flask, and was then stored in a plastic container for AAS analysis.

Principle of atomic Adsorption Spectrophotometer

The working principle of the Atomic adsorption spectrophotometer (AAS) is based on the sample being aspirated into flame and atomized. When the AAS is turned on, light beam is directed through the flame into monochromator, and onto the detector that measures the amount of light absorbed by the atomized element in the flame. Since metals have their own characteristics absorption wave length, a source lamp composed of that element is used, and this makes the method relatively free from spectral or radiation interferences. The amount of energy of the characteristic wavelength absorbed in the flame is proportional to the concentration of the element in the sample. As it applies to the present study, the procedure used was as documented by Tuzen and Soylak, (2005), as well as Rodriguez-Otero *et al* (2002). The honey was thoroughly mixed through gentle, but continous swirling, and 100ml of

the mixture was transferred into a glass beaker of 250ml volume. The sample is aspirated into the oxidizing air-acetylene flame. When the aqueous sample is aspirated, the sensitivity for *1%* absorption was observed recorded accordingly.

Generally, the results of the assessments conducted during this work were compared with *CODEX-2001* Standards to check any possible deviation from the threshold.

RESULTS AND DISCUSSION

The results of analysis of the honey samples for the various physicochemical parameters are presented in *Table 1*. The values obtained were placed side-by-side the standard specifications for natural honey (*Codex 2001 standard*).

Table 1: Results of Physicochemical Analysis of the Study Samples

S/N	PARAMETER	Result on Sample from Umunnochi	Result on Sample from Nsukka	Codex (2001) Standard
1	Taste	Sweet	Sweet	Sweet
2	Appearance	Light Brown	Dark Brown	Brown
3	Moisture Content (%)	6.67	12.94	> 20
4	Ash Content (%)	0.083	0.065	0.7721
5	pH	4.43	5.09	3.42 – 6.1
6	Refractive Index	0.7721	1.4977	1.400 – 1.9000
7	Specific Gravity	1.40	1.38	1.38 – 1.45.
8	Iron Content (g/L)	0.18	0. 30	0.3
9	Potassium Content (g/L)	195	150	Not Applicable
10	Calcium Content (g/L)	3.5	3.0	Not Applicable
11	Magnesium Content(g/L)	0.8	0.6	Not Applicable
12	Sodium Content(g/L)	0.6	0.2	Not Applicable

The taste and appearance of the study samples fall within the standard specifications, even though there exist slight discrepancy in the appearance. This could be due to the technique employed during the

harvest that may have exposed the Umunnochi honey to radiations, thus the light brown colour. The moisture content for the Nsukka honey is almost double of the Umunnochi honey (with higher refractive index value), which indicates that the former contains more hydratable ions; greater hydratable ions in honey sample increase its nutritive value and, in turn, greater level of acceptance for consumption (David, 2007). However, care must be applied in the judgment of honey that is based only on the moisture content (without the refractive index value), as this could imply possible adulteration of the sample. Adulteration of honey, as reported by White (1980), is the addition of other sugars, syrups or compounds into the honey to change its flavour and viscosity, thereby making it cheaper to produce, or to increase the fructose content (to stave-off crystallization). This method is, sometimes, used as a method of deception when buyers are led to believe that the honey is pure. The Umunnochi honey indicated lower pH than the Nsukka honey. This shows that the Nsukka honey contains higher glyceric acid than its counterpart, and in turn contributes to state of the refractive index. Like the mineral contents, the ash content of the Umunnochi sample (which represents the total matter remaining after oxidation of organic compounds in the honey) was higher when compared with that of Nsukka honey. This is expectant of the outcome, as the mineral elements in food substances (including honey) constitutes the chemical elements contained in the ash of the foodstuff (White and Landis, 1980). Generally, the composition of Nsukka honey sample (especially in terms of Moisture content and refractive index) makes it better for consumption by anaemic patients and menstruating women, while the high mineral contents (and, of course, the ash content) makes the Umunnochi honey sample necessitates its recommendation for consumption by hypertensive patients.

CONCLUSION

The two honey samples analyzed reflected, generally, the composition of natural honey, even though there were little discrepancies observed in

the parameters. The Umunnochi sample was more acidic, with less moisture content and refractive index than the Nsukka honey. On the other hand, the ash and the mineral contents of the Umunnochi sample were higher than those of the Nsukka sample. However, the general judgment (from information in the literature) recommends the Nsukka honey for anaemic patients and menstruating women, while the Umunnochi honey is more preferable for hypertensive patients.

REFERENCES

Alnaqdy A., Al-Jabri A., Al Mahrooqi Z., Nzeako B. and Nsanze H. (2005). Inhibition Effect of Honey on the Adherence of Salmonella to Intestinal Epithelial Cells in Vitro; *International Journal of Food Microbiology,* 10(3): 347-351.

Bansal V., Medhi B. and Pandhi P. (2005) . Honey -A Remedy Rediscovered and its Therapeutic Utility; *Kathmandu University Medical Journal,* 3(1): 305-309.

Buba F., Gidado A. and Shugaa A., (2013) . Analysis of Biochemical Composition of Honey Samples from North-East Nigeria; *Bicochem Journal of Analytical Chemistry;* 2(3): 1-7.

David,W. B. (2007) . Chemical Composition of Honey; *Journal of Chemical Education;* 84(10): 23-31.

De Ferrer O., De Rodriguez J., Pena J. and Martinez M. (2004) . Mineral Content of Honey Produced in Zulia State, Venezuela; *Archivos Latinoamericanos de Nutricion,* 54 (3): 346–348.

Haffejee I. and Moosa A.E. (2010) . Honey in the Treatment of Infantile Gastroenteritis; *Brazilian Medical Journals,* 29(2):1866–1867.

Obi C.L., Ugoji E.O., Edun S.A., Lawal S.F. and Anyiwo C.E. (1994). The Antibacterial Effect of Honey on Diarrhoea-Causing Bacterial Agents Isolated in Lagos, Nigeria; African Journal Medical Sciences, 23(3): 257–260.

Rodriguez-Otero J., Paseiro P., Simal J. and Terradillos L (2002) . Determination of Na, K, Ca, Mg, Cu, Fe, Mn and Total Cationic Milliequivalents in Spanish Commercial Honeys; *Journal of Apicultural Research,* 31(4): 65-65.

Singh M., Chourasia H., Agarwal M., Malhotra A., Sharma M., Sharma D. and Khan S. (2012) . Honey as Complementary Medicine - A Review; *International Journal of Pharmaceutical and Biochemical Sciences;* 3(2): 12-32.

Tuzen M. and Soylak M. (2005) . Trace Heavy Metal Levels in Microwave Digested Honey Samples from Middle Anatolia, Turkey; *Journal of Food and Drug Analysis,* 13(4): 343–347.

White J.W. (1980) . Detection of Honey Adulteration by Carbohydrate Analysis; *JAOAC,* 63(1):11-18.

White J.W., and Landis W.D. (1980). United States Agricultural Handbook on Honey Composition and Properties; Wailan Inc., U.S.A.