PROXIMATE AND VITAMINS COMPOSITION OF HONEY IN RIBAH, WASAGU-DANKO LGA OF KEBBI STATE, NIGERIA

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Abstract: The proximate and vitamins composition of honey in Ribah, Wasagu-Danko LGA, Kebbi State Nigeria was investigated. Treatment was replicated three times and the mean was taken. Analysis of the data was done using descriptive statistics using Excel package 2010. The results revealed that Water level in the sample $16.22\pm 0.22\%$, there was no significant difference (P>0.05), crude Carbohydrate obtained in this study is $79.29\pm 0.10\%$, crude protein of $3.14\pm 0.20\%$ was obtained which shows significant difference (P<0.05). There was no significant difference (P>0.05) in crude Lipids ($0.37\pm 0.03\%$) obtained in the study, crude fibre of $0.20\pm 0.21\%$ was obtained, ash content ($0.52\pm 0.11\%$) was not significantly different (P>0.05). While glucose level of 37.64 mg/100g and fructose (30.02 mg/100g), and levels of vitamin A (4.912 mg/ml), vitamin C (0.094 mg/ml) and vitamin (0.29 mg/ml), respectively were obtained in the study. Therefore, honey is a complete diet containing relatively high nutritional composition or profile essentially for survival, growth and development, production and reproduction. Hence, it should be taken in small quantity daily for a healthy living due its preventive and curative power.

Keywords: *Apis mellifera,* carbohydrates, diet, perbiotics, profile, vitamins

Introduction

Honey is a complex mixture of carbohydrates, especially glucose and fructose, organic acids, amino acids, minerals, vitamins, enzymes, pollens, and pigments (Wasagu *et al*., 2013). Honey is produced by honey bees, it is an organic natural substance that is produced from the nectar of flowers especially by *Apis mellifera* and is a sweet, flavorful liquid. It contains sugars, small quantities of proteins, enzymes, minerals, trace elements, vitamins, aroma compounds and polyphones (Arawwawala and Hewageegana, 2017). Among the sugars, the highest amount was found to be fructose (~38%), followed by glucose (~31%), water (17%) and sucrose (~1%). In addition, honey also contains several vitamins (mainly riboflavin, niacin, pantothenic acid, pyridoxine, folate, and vitamin C), minerals, proteins, enzymes (such as catalase, superoxide dismutase, reduced glutathione), flavonoides (such as apigenin, pinocembrin, kaempferol, quercetin, galangin, chrysin and hesperetin), and phenolic acids (such as ellagic, caffeic, p-coumaric, and ferulic acids) (Zulma and Lulat, 1989; Alvarez-Suarez *et al.,* 2010; Eteraf-Oskouei and Najafi, 2013).

Prebiotics are honey ingredients that provide beneficial effects to the host by stimulating the growth and activity of one or more of the digestive bacteria in the colon (Schrezenmeir & de Vrese, 2001). Prebiotics have been defined as components that are metabolized in honey by specific microorganisms of beneficial (*Bacilli, Lactobacilli and Bifidobacteria,* etc.) to the health and growth of the host (Gibson and Roberfroid, 1995). These components of honey act as prebiotics to increases resistance against diseases by increasing immunity of the organism resulting in low mortality and also enhance growth performance and nutrient utilization (Raja *et al.,* 2015).

According to Arawwawala and Hewageegana (2017) honey is accepted as a food source and medicine by both modern and ancient generations, traditions and civilizations. Several researchers also reported that honey is universally utilized (Crane, 1975; Allsop and Miller, 1996; Crane, 1999; Jones, 2001). Honey affect the microbiota of the host in numerous processes including growth, digestion, immunity and disease resistance of the host organism as demonstrated in poultry (Patterson and Burkholder, 2003), other terrestrial livestock and companion animals (Flickinger *et al.*, 2003) as well as in humans (Gibson and Roberfroid, 1995). Honey is also environmental friendly and used as bioindicators to enhance the health of fish (Ponokvar *et al.,* 2005). The main objective of this study is to investigate the nutritional composition of honey in Ribah, Wasagu-Danko LGA, Kebbi state Nigeria.

Materials and Methods

Study area
The study was conducted at Department of Biology, Faculty of Life Sciences, Ahmadu Bello University, Zaria Kaduna State Nigeria. It is located at latitude 11°4' N and 7°58 E. The average annual rainfall is approximately 107.5 cm. The average daily temperature recorded maximally 36.6^{o}C around April and falls to 23.3^{o}C around October. The relative humidity ranges between 70% and 80% in August and minimum around 15 – 20% in December (Hore, 1970).

Source of honey
Undiluted honey was obtained from a Beekeeper in Ribah, Wasagu-Danko Local Government Area of Kebbi State Nigeria and transported to ABU., Zaria, Kaduna State Nigeria.

Experimental design
The treatment/sample was replicated three times and the mean was taken.

Honey analysis
The nutritional composition analysis was done at NOTAP – PZ Upgraded Chemical Laboratory, National Research Institute for Chemical Technology (NARICT) Basawa, Zaria Kaduna State Nigeria.

Determination moisture content
The method described by AOAC (1984) was adopted. The percentage moisture content was calculated thus:
%Moisture = W2 – W3/W2-W1 x 100
Where: W1 = weight of Crucible
W2 = weight of sample
W3 = weight of dried sample in furnace

Determination of crude carbohydrate
The total carbohydrate content was determined by difference was adopted (NRC, 1991). The percentage total carbohydrate content was calculated as:
% Total Carbohydrate = 100 – (%Moisture + %Ash + %Lipids + %CP + %Fibre)

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Determination of crude protein

The method described by AOAC (1984) was adopted. The % crude protein was computed thus:

% N = 14 x M x Vt x Tv x 100/Weight of Sample (mg) x Va

% Crude Protein = % Nitrogen x 6.25

Where: M = Actual morlarity of acid

Tv = Titre volume of HCl used

Vt = Total volume of diluted digest

Va = Aliquot volume distilled

Determination of crude lipids

The method described by AOAC (1984) was adopted. The % crude lipid was calculated:

% Lipid Content = W2 – W1/ Weight of Sample x 100

W2 = weight of dried sample in furnace

W1 = weight of anti-bumping granules

Determination of crude fibre

The method described by AOAC (1980) was adopted. The loss of weight on incineration was calculated thus:

% Crude Fibre = C1 - C2/Weight of Original Sample x 100

Where: C1 = weighed sample in dessicator

C2 = re-weighed after 2 h in furnace

Determination of ash content

The method described by AOAC (1980) was adopted. The % Ash Content was computed as:

% Ash Content = W3 – W1/W2 – W1 x 100

W3 = weight of crucible and sample after 8hour in furnace

W2 = weight of crucible and sample

W1 = weight of crucible

Determination of glucose

The method described by AOAC (1984) was adopted. The concentration of glucose was calculated thus: Glucose (mg/dl)

= Asample/Astandard x Conc. of Standard

= Asample/Astandard x 100 (mg/dl)

Determination of fructose

The method described by AOAC (1984) was adopted. The concentration of fructose was calculated thus: Fructose (mg/ml) = Asample/Astandard x Conc. of Standard

= Asample/Astandard x 100 (mg/ml)

Determination of vitamin A

The method described by AOAC (1990) was adopted. The concentration of vitamin A was calculated thus: Vitamin A (mg/ml) = T2 – T1 x Conc. of Standard Vitamin A

Where: T1 = Blank Solvent; T2 = sample freshly diluted

Determination of vitamin C

The method described by AOAC (1990) was adopted. The concentration of vitamin C was calculated thus: Vitamin C (mg/ml) = T2 – T1 x Conc. of Standard Vitamin C

Where: T1 = Blank Solvent; T2 = sample freshly diluted

Results and Discussion

Nutritional composition of honey

The results in Table 1 shows that water level (16.22%), crude carbohydrate (79.29%), crude protein (3.14%), crude lipids (0.37%), crude fibre (0.20%), and ash content (0.52%) were from proximate analysis, respectively. While the other nutritional composition revealed that glucose (37.64 mg/100g), fructose (30.02 mg/100g). The results in Table 2 revealed the vitamins composition of vitamin A (4.912 mg/ml), vitamin C(0.094 mg/ml), and vitamin E (0.29 mg/ml) recorded in the sample during the study, respectively.

Table 1: Proximate composition of honey

Ingredients	Percentage (%)	*Control (%)
Water	16.22 ± 0.22	17.02
Crude Carbohydrate	79.29 ± 0.10	80.09
Crude Protein	3.41 ± 0.20	2.49
Crude Lipids	0.37 ± 0.03	0.33
Crude Fibre	0.20 ± 0.21	0.2
Ash	0.52 ± 0.11	0.54
Glucose	37.64 ± 0.02 mg/100g	32 mg/100g
Fructose	30.02 ± 0.13 mg/100g	37 mg/100g

Source: *NRC (1991)

Table 2: Vitamins composition of honey

Vitamin A	4.912 ± 0.05 mg/ml	4.84 mg/ml
Vitamin C	0.094 ± 0.01 mg/ml	0.069 mg/ml
Vitamin E	0.29 ± 0.18 mg/ml	0.23 mg/ml

Source: *NRC (1991)

The results in Table 1 showed that the mean water level (16.22%) was lower than 17 and 17-21% reported by Arawwawala and Hewageegana (2017) in Sri Lanka and Martins *et al.* (2012) in the Netherlands, respectively and Alvarez-Suarez *et al.* (2010) also reported 17% moisture content. However, the water level (16.22%) obtained was higher than 13.3% as reported by the findings of Wasagu *et al.* (2013) in their study in Sokoto. This could that the honey was not adulterated by the beekeeper and hence proven to be original. Crude carbohydrate obtained in this study is 79.29%, which means that there are high amount of energy source in the sample analysed. This is in line with the findings of Martins *et al.* (2012) also reported 79 – 83% carbohydrates. The result was bit higher than the findings of Eteraf-Oskouei and Najafi (2013) who reported 70% total sugars in honey sample. The crude protein (3.14%) was obtained which shows significant difference (P<0.05) compared to 0.4 and 0.3% reported by Martins *et al.* (2012) and Arawwawala and Hewageegana (2017), respectively. There was no significant difference (P>0.05) in crude lipids (0.37%) obtained in the study compared to report of Arawwawala and Hewageegana (2017) with 0.2% while Martins *et al.* (2012) reported 0.00% lipids. Crude fibre of 0.20% obtained from the analysis was similar to Arawwawala and Hewageegana (2017)'s report of 0.2% dietary fibre.

The ash content (0.52%) obtained was similar to the findings of Wasagu *et al.* (2013) who reported 0.55% in light amber honey, although there was no significant difference (P>0.05), but higher than 0.1 and 0.2% reported by Martins *et al.* (2012) and Arawwawala and Hewageegana (2017), respectively. Glucose level of 37.64 mg/100g and Fructose 30.02 mg/100g was higher than the findings of Arawwawala and Hewageegana (2017) who reported 28.54 – 31.3 and 32.56 – 38.2 mg/100g in Sri Lanka. This shows an inverse relation between glucose and fructose obtained in Sri Lanka and Nigeria indigenous honey. Alvarez-Suarez *et al.* (2010) also reported 38% fructose and 31% glucose, respectively. White and Doner (1980) also reported that honey consists of fructose (41%) and glucose (35%) in their study in USA, although glucose level (37.64 mg/100g) obtained from this study was not significantly different (P>0.05). This could be attributed to the kind of pollen grain or source of nectar often visited by bees Ribah, Kebbi State Nigeria.

The levels of Vitamin A (4.912 mg/ml), C (0.094 mg/ml), and E (0.29 ml) in this study showed that honey to contain relatively high amounts of vitamins A, C, and E indicating possession of antioxidant properties by both samples, as well

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as good for maintenance of normal vision. This was also in line with the findings Wasagu *et al.* (2013) who reported vitamin A (4.42 mg/dL), C (0.06 mg/dL) and E (0.26 mg/dL) in dark amber honey in Sokoto state Nigeria. This conforms to Satyanarayana and Chacrapani (2008) report, that honey contains high amounts of vitamin A, respectively.

Conclusion and Recommendation

Honey is a complete diet containing high nutritional composition or profile essentially for survival, growth and development, production and reproduction. Hence, it should be taken in small quantity daily for a healthy living due its preventive and curative power.

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Conflict of Interest

Authors have declared that there is no conflict of interest in this study.

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