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Evaluation of the Kidney Following Administration of Unprocessed Honey in Wistar Rats

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ABSTRACT: In most ancient cultures, honey has been used for both nutritional and for medicinal purposes and it also contains sugars and trace amounts of several vitamins and minerals. The quantity of these substances in honey depends on the type of flowers on which the bees feed on. The effect of unprocessed honey on the kidney was examined. 20 rats were randomly divided into 4 groups of 5 each and tested as follows:- Group O (Control) – water orally, Group A – 0.1ml/kg of unprocessed honey orally, Group B – 0.15ml/kg of unprocessed honey orally, Group C – 0.2 ml/kg of unprocessed honey orally. The unprocessed honey was given once a day for forty two days (six weeks). At the end of the treatment, all the rats were sacrificed. Blood was taken for biochemical analysis. The kidneys were dissected for histological examination. Creatinine estimation which is a kidney marker was carried out; the result showed slight elevation in the groups administered with 0.15ml/kg and 2ml/kg of unprocessed honey. There was no statistical difference when compared with the control. Urea was elevated in the group administered 0.2ml/kg of the honey and was statistically different from the control. Honey contains several types of sugars and high sugar intake has been reported to cause kidney damage in man and may ultimately lead to nephropathy in rats.

Keywords: Creatinine, histology, honey, kidney, urea.

ORIGINAL ARTICLE

INTRODUCTION

The first written reference to honey was on a Sumerian tablet, dating back to 2100-2000 BC, which stated that honey could be used as a drug and as an ointment (Crane et al., 1975).

In most ancient cultures honey has been used for both nutritional purposes and for medical purposes (Crane ET AL., 1975; Jones et al., 2001; Allsop et al., 1996; Abdul-salam et al., 2008). Honey contains trace amounts of several vitamins and minerals (Standifer et al., 2008). As with all nutritive sweeteners, honey is mostly sugars and is not a significant source of vitamins or minerals. The specific composition of any batch of honey will depend largely on the mix of flowers available to the bees that produced the honey. Typical honey analysis shows the following: Fructose: 38.0%, Glucose: 31.0%, Sucrose: 1.0%, Water: 17.0%, maltose: 9.0%, Ash: 0.17% and others: 3.38% (Erguder et al., 2008).

Honey also contains tiny amounts of several compounds thought to function as antioxidants, including chrysin, pinobanksin, vitamin C, catalase, and pinocembrin (Martos et al., 2000).

Honey is considered as a medicine (Kamaruddin., 1993; Abdel-Moneim et al., 2007; Al-Waili et al., 2003) and has a long history in traditional medical system; it was used by the ancient Greeks, Sumerians and the Egyptians (Al-Waili et al., 2003; Zumla et al., 1989; Molan et al., 1995). Reports show that honey is not only used as a dietary supplement but also effective for treating/healing of wound infections (Molan et al., 1995; Noori et al., 2011; Giangiacomo et al., 2010) and post-radiotherapy mucosal trauma (Abdelhafiz et al., 2008).

It is an antibacterial, anti-inflammatory, immune-stimulant, antiulcer (Kamaruddin, 1993; Ghazali et al., 2009; Fiorani et al., 2006; Aljady et al., 2000) anti-fungi (Al- waili et al., 2001) and as an antioxidant (Well et al., 1978). Honey increases antibody titer against T-dependent and T-independent antigens during primary and secondary immune responses. Beretta et al. (2005) stimulates proliferation of B and T lymphocytes in cell cultures and acts on monocytes to release cytokines, which activate immune responses (Aduharfeil et al., 1999). In addition, honey shows antitumor and antimetastasis effects and potentiates the antitumor effects of cytotoxic drugs (Tonks et al., 2001). Hippocrates recommended honey and

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vinegar for pain, a mixture of honey, water and other substances to treat acute fevers, as well as recommending its use to treat ulcers (Efem et al., 1992). It can also be used for the treatment of diarrhea as well as a preservative for herbal medicines (Kandil et al 1987). Honey collection is an ancient activity; humans apparently began hunting for honey at least 8,000 years ago, as evidenced by a cave painting in Valencia, Spain (Eva et al., 1983). The Greater Honey guide guides humans to wild bee hives (Isack et al., 1989) and this behavior may have evolved with early hominids (Short et al., 2003; Dean et al., 1981). So far, the oldest remains of honey have been found in Georgia. Archaeologists have found honey remains on the inner surface of clay vessels unearthed an ancient tomb, dating back to some 4,700 - 5,500 years ago (Eliso et al., 2006). The use of honey for medicinal purpose cuts across a wide range of diseases and ailments globally; there has been little or no information on the constituents of unprocessed Nigerian honey and its effect on the biochemistry and histology of the kidney. Hence the aim of this work was to evaluate the histopathological and biochemical parameters of Wistar rats administered with different doses of unprocessed honey.

MATERIALS AND METHODS

Honey collection

The unprocessed honey was bought in the month of January, 2012 from a honey trader, in Bayelsa State, Nigeria.

Animals

Twenty male albino rats were used for the experiment. The rats were grouped into 4 of 5 each and maintained under standard laboratory conditions of 27 ± 2 °C, relative humidity 50 ± 15% and normal photo period (12h dark/12h light) , and were supplied with standard pellet food with tap water. All rats received human care according to the criteria outlined in the "Guide for care and use of laboratory animals" prepared by the National Academy of Science and published by The National Institutes of Health.

Experimental design

Twenty male albino rats were used for the experiment. The rats were randomly divided into 4 groups of 5 each and tested as follows:-

Group O (Control) – water orally
Group A – 0.1ml/kg of unprocessed honey orally
Group B – 0.15ml/kg of unprocessed honey orally
Group C – 0.2ml/kg of unprocessed honey orally

The unprocessed honey was given once a day for forty two days (six weeks). At the end of the treatment; all the rats were sacrificed. Blood was taken for biochemical analysis. The kidneys were dissected for histological examination.

Biochemical analysis

Blood was obtained from the rats through cardiac puncture and allowed to clot. Serum samples were extracted by centrifuging the clotted blood at 3000g for 10min. The serum samples were analyzed for Urea and Creatinine using automated Medical analyzer.

Histopathology

Immediately after dissection, the sections of the kidneys were placed in a tissue cassette and fixed in 10% buffered formalin for 24 h after which they were processed using standard histopathological methods. The processed tissues were then embedded in paraffin. Sections of 6 µm thickness were cut on a rotary microtone and stained with haematoxylin and eosin for microscopic assessment (Av wioro et al., 2012).

Statistical Analysis

Values were represented as mean ± SD. Data were analysed using one-way analysis of variance (ANOVA) and group means were compared using the Tukey-Kramer Multiple Comparison Test using Graph Pad Instat® software.

RESULTS

Creatinine estimation which is a kidney marker was carried out; the result showed slight elevation in the groups administered with 0.15ml/kg and 2ml/kg of unprocessed honey although there was no statistical difference when compared with the control. Urea was elevated in the group administered 0.2ml/kg of the honey and was statistically different from the control (Table 1).

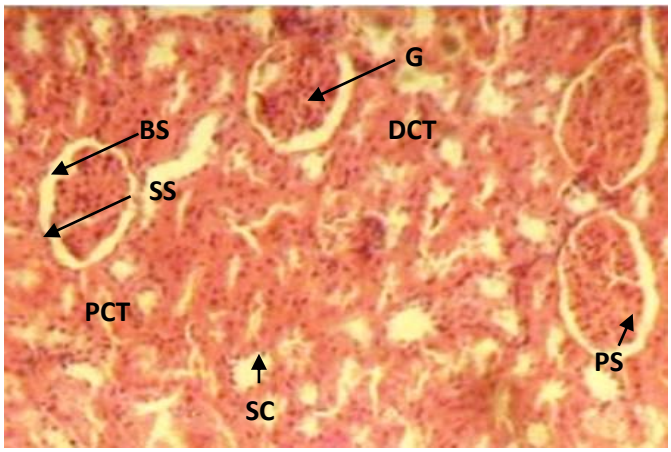
The gross Anatomy of the kidney did not show any variance when compared with the control. The histological evaluation of the tissues of the kidney did not show any notable distortion in the tissue architecture when viewed under the light microscope (Slides 1-4).

Each value represents the mean ± standard deviation (n = 5), values are statistically different from control at $p< 0.05$* one way analysis of variance (ANOVA) + Tukey Multiple Comparison Test, using Graph PadInstat® software.

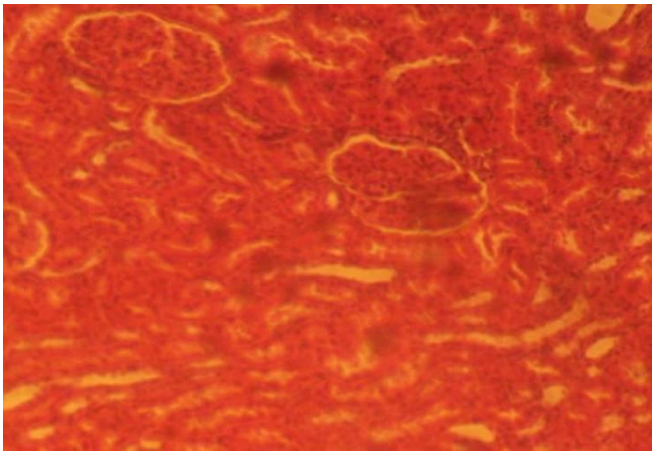
The tissue architecture of the treatment groups (A-C kidney) did not show any notable change or damage when compared with the control.

Table 1. Biochemical analysis of rats administered with unprocessed honey for 42 days

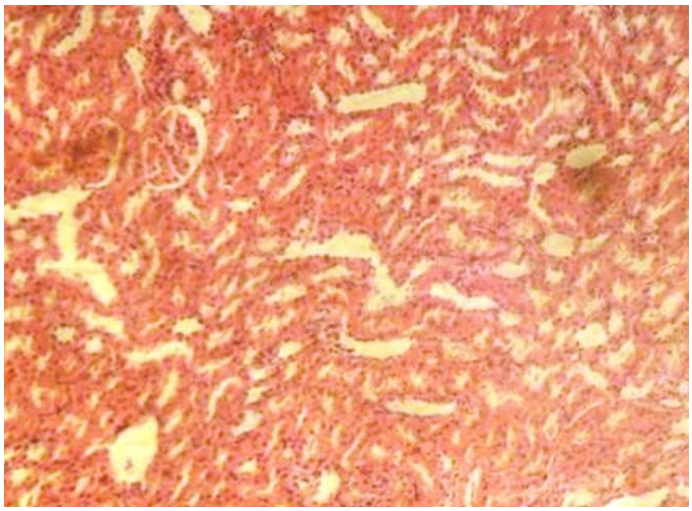
Parameters	Control	0.1 ml/kg	0.15 ml/kg	0.2 ml/kg
Creatinine	79.3±12.19	69.9±7.45	80±14.42	82±14.56
Urea	6.9±0.76	4.4±1.65	5.7±2.20	10.25±2.79*



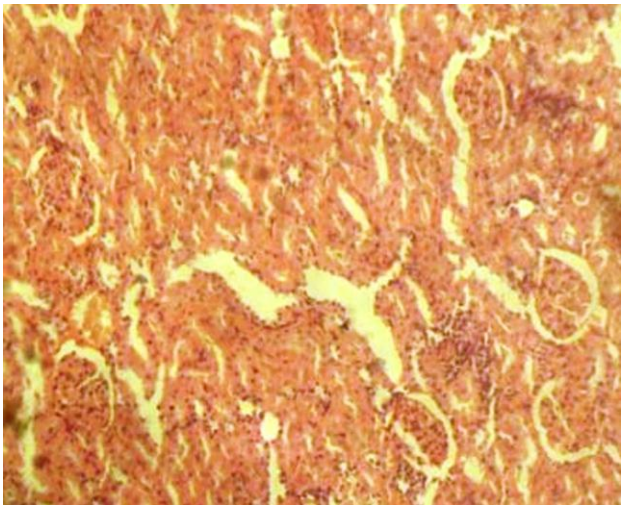
Slide 1. Control group Kidney; (G= Glomerulus, PCT= Proximal convoluted tubule, DCT= Distal convoluted tubule BS=Bowman's space, SS= Simple Squamous, SC= Simple Cuboidal, PS =Podocyte)



Slide 2. Group A Kidney (0.1ml/kg)



Slide 3. Group B Kidney (0.15ml/kg)



Slide 4. Group C Kidney (0.2ml/kg)

DISCUSSION

Serum creatinine and urea are established markers of Glomerular Filtration Rate (GFR) (Perrone et al., 1992). Urea is useful in evaluating kidney function in conjunction with creatinine which originates from the muscle and is filtered by the kidney. Causes of creatinine and urea elevation may be Pre-renal (ie resulting from fever, infection, tissue necrosis and corticosteroid administration and circulatory changes), Renal (resulting from non-functional nephrons) or post-renal (result of obstruction of the urinary tract and may reach very high values). This implies that the elevation of both urea and creatinine in this research could be connected to one or more of the above as caused by unprocessed honey. Histologically using a light microscope there was no notable distortion. It was reported by Cameron and Greger (Cameron et al., 1998) that serum urea increased due to acute and chronic intrinsic renal disease and also when there is decreased effective circulating blood volume with decreased renal perfusion.

Our research agrees with the research of Moshtaghie et al. (Moshtaghie et al., 1991) where there were elevation of both urea and creatinine following the disability of kidney to excrete serum urea and creatinine. It was also in line with the research of Arise and Malomo (Arise et al., 2009) where they reported malfunction in the glomerular filtration results in the retention of substances including urea and creatinine and which may be responsible for the high serum levels in their research.

Honey contains several types of sugars and high sugar intake has been reported to cause kidney damage in man and may ultimately lead to nephropathy in rats (Kang et al., 1980). Therefore, in addition to an earlier recommendation by Avwioro et al, which advised that regulatory bodies in charge of food and other substances should check the level of fructose in products before it is approved for use (Avwioro et al., 2012). This should cut

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across all sugars and if possible a daily dosage for honey should be provided depending on the type and constituent of the type of honey.

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