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Effects of Honey on Some Hematological Indices and Lipid Profile in Male Mice

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Abstract

This study was designed to investigate the effect of acute administration of honey on some haematological and biochemical parameters in male mice. Fifteen male mice were divide into five groups of three each and were administered with distilled water, 10%, 20%, 50%, and 100% (v/v) of pure honey daily for seven days in that order. On the eighth day the mice were sacrificed and blood samples were collected for analyses. Total cholesterol, HDL, LDL, Triglyceride level and complete blood counts were determined by automatic analyzer. Low density lipoprotein (LDL) levels in mice treated with 10% (v/v), 20% (v/v), 50% (v/v) and 100% (v/v) showed an increase ($p < 0.05$) as compared to the control group, this was also observed in Total cholesterol levels. However, HDL levels in mice treated with 10% v/v, 50% v/v and 100% v/v were higher ($p > 0.05$) but 20% (v/v) was slightly lower as compared to the control group. Group 5 [100% (v/v)] was higher as compared to group 2 (10% v/v) and group 4 [50% (v/v)]. Triglyceride levels showed decrease ($p > 0.05$) in the rest of the group as compared to the control group. There was increase ($p > 0.05$) MID (monocyte count) with increasing concentration and increase in Platelet count in Group 2 [10% (v/v)] as compared to the other groups. Hb, PCV and RBCs Count were higher ($p > 0.05$) in Group 2 [10% (v/v)] as compared to the rest of the groups. Results from this study suggest that daily consumption of honey might have some positive effects on hematological indices and lipid profile respectively.

Keywords

Honey, Lipid, Haematological, Lipoprotein, Mice

1. Introduction

Honey is a sweet flavorful liquid food of high dietary value [1], and huge health advantages [2]. Honey is produced by honey-bees as “blossom honey” by secreting nectars of flowers, and “honeydew honey” (forest honey) by secreting the exudates of plant sucking nectars insects (Aphids). The constituent of honey is mainly sugars and water. In addition, it also contains several vitamins and minerals, including B vitamins. The other compositions of honey are amino acids, antibiotic-rich inhibine, proteins, phenolantioxidants and micronutrients [1] and the most abundant sugar in honey is fructose. Honey is a complete meal as it contains major components of a meal, and micronutrients that will enhance the digestion and absorption of these major components of a meal and micronutrients that will enhance the digestion and absorption of these major dietary components as well as those required for metabolism and body functions. Medicinally, it has been proven to be a promising antitumor agent with pronounced anti-inflammatory antiangiogenic effect [3], antibacterial, antimetastatic, immune-stimulant, antiulcer and wound/burn healing [4].

The largest portion of the dry matter in honey consists of the sugars. This very concentrated solution of several sugars results in the characteristic physical properties of honey – high viscosity, “stickiness,” high density, granulation tendencies, tendency to absorb moisture from the air, and immunity from some types of spoilage. The average pH of honey is 3.9 (with a typical range of 3.4 to 6.1). Honey naturally contains small amounts of enzymes that are introduced into honey by the bees during various phases of the honey manufacturing process. The predominant enzymes in honey are diastase (amylase), invertase (α-glucosi-dase) and glucose oxidase. Other enzymes such as catalase and acid phosphatase, are generally present in lesser amounts. These nutritional composition of honey (phytochemicals, organic acids, vitamins, and enzymes) may serve as sources of dietary antioxidants [5]. In this study examination of the effect of this nutritious substance on some hematological indices and lipid profile will be carried out.

2. Materials and Methods Location and Duration of Study

The research work was carried in the animal house of the Department of Human Physiology, Ahamadu Bello University, Zaria. It lasted for a period of two (2) week.

2.1. Honey Sample

Honey was purchased from the Department of Biological Sciences, Faculty of Life Science (Physiology Laboratory), Ahamadu Bello University, Zaria.

2.2. Experimental Animals

Fifteen apparently healthy male mice weighing 20 – 25g were obtained from the Faculty of Veternary Medicine, Ahamadu Bello University, Zaria and kept in mice cages in the Animal House of the Department of Human Physiology. They were acclimatized for one week and Pelletized growers feed (vital feed) was obtained and used to feed the animals for the experiment with water at room temperature within a 12-h light and dark [6].

2.3. Experimental Design

The animals were divided into five different groups of three mice n=3 each and treated daily for seven days. Twenty-four hours after the last administration, animals were humanly sacrificed using chloroform [6]. Blood samples were collected, part of the samples were placed in EDTA bottles for hematological analysis and the remaining were centrifuged at 3,000 *rpm* for 8 min to obtain the serum for analyses.

Apparently normal healthy mice were used and were randomly alloted into five groups (n=3):

Group 1 - Distilled Water (Control)
Group 2 - 10% (v/v) Honey daily
10% (v/v) Honey ≡10ml of honey in 90ml of distilled water
Group 3 - 20% (v/v) Honey daily
20% (v/v) Honey ≡20ml of honey in 80ml of distilled water
Group 4 - 50% (v/v) Honey daily
50% (v/v) Honey ≡ 50ml of honey in 50ml of distilled water
Group 5 - 100% (v/v) Honey daily
100% (v/v) Honey ≡ 100ml of honey

3. Blood Collection

Blood samples were obtained from the heart (at its apex) during the sacrifice using a 2.5ml syringe and placed in ETDA bottles for hematological analysis and the remaining were centrifuged at 3,000 *rpm* for 8 min to obtain the serum and placed in plane bottles for biochemical analyses (to obtain the lipid profile).

3.1. Determination of Hematological Indices and Lipid Profile

Red Blood cell (RBCs) counts, Differential White blood cell count, Packed cell volume (PCV), Hemoglobin (Hb) levels, Mean Cell Volume (MCV), Mean Cell Hemoglobin (MCH), Hematocrit (HCT) or Packed cell volume (PCV), Mean Cell Hemoglobin Concentration (MCHC) were determined using an Auto Analyzer according to manufacturer’s protocols. The High density lipoprotein (HDL), Low density lipoprotein (LDL), Triglyceride and Total Cholesterol values were also obtained using a reliable Auto Analyzer according to manufacturer’s protocols [6].

3.2. Statistical Analysis

All data were expressed as Mean±. SEM and data were entered and analyzed using statistical package SPSS (version 23) followed by one way analysis of variance (ANOVA) with multiple comparisons. The Tukey’s post-hoc test was used to determine difference between groups. Values of $p<0.05$ was considered as statistically significant [7].

4. Results

Low density lipoprotein (LDL) levels in mice treated with 10% (v/v), 20% (v/v), 50% (v/v) and 100% (v/v) showed an increase ($p < 0.05$) as compared to the control group, this was also observed in Total cholesterol levels. However, HDL levels in mice treated with 10% v/v, 50% v/v and 100% v/v were higher ($p > 0.05$) but 20% (v/v) was slightly lower as compared to the control group. Group 5 [100% (v/v)] was higher as compared to group 2 (10% v/v) and 4 [50% (v/v)]. Triglyceride levels showed decrease ($p > 0.05$) in the rest of the group as compared to the control group. Group 4 was the lowest as compared to group 2, 3 and 5, and Group 5 the highest as compared to 2, 3, and 4. (Table 1) There was increase ($p > 0.05$) MID (monocyte count) with increasing concentration and increase in Platelet count in Group 2 [10% (v/v)] as compared to the other groups. Hb, PCV and RBCs Count were higher ($p > 0.05$) in Group 2 [10% (v/v)] as compared to the rest of the groups (Table 2).

Lipid Profile

Table 1. *Results of lipid profile of mice after administration of Honey.*

Groups	Treatment	Total Cholesterol (mg/dL)	Triglyceride (mg/dL)	HDL (mg/dL)	LDL (mg/dL)
1	Distilled water	$48.13^{abcd} \pm 2.42$	95.48 ± 3.29	20.57 ± 0.28	$8.46^{abcd} \pm 2.53$
2	10% v/v	$56.85^{a} \pm 2.33$	82.03 ± 8.48	21.29 ± 2.34	$19.15^{a} \pm 2.23$
3	20% v/v	$56.01^{b} \pm 1.43$	79.11 ± 10.25	20.20 ± 2.93	$19.99^{b} \pm 0.59$
4	50% v/v	$59.90^{c} \pm 3.40$	68.99 ± 6.18	23.10 ± 3.17	$23.0^{c} \pm 0.98$
5	100% v/v	$65.91^{d} \pm 2.80$	87.04 ± 8.59	32.3 ± 5.91	$16.22^{d} \pm 4.91$

HDL: High Density Lipoprotein, LDL: Low Density Lipoprotein. Values are mean ± SD, n = 3. Values with different superscript along a column are statistically significant ($p < 0.05$). For Total Cholesterol: [Group 1 is lower than 2, 3, 4, and 5, while Group 5 is higher than 1, 2, 3, and 4]. For LDL: [Group 1 is lower than 2, 3, 4, and 5, while Group 4 is higher than 1, 2, 3, and 5].

Hematological Indices

Table 2. *Results of Hematological indices of mice after administration of Honey.*

Groups	Treatment	Hb (g/dL)	RBC (mill./µL)	PCV (%)	MCV (fl)	MCH (pg)	MCHC (g/dL)
1	Distilled Water	14.03 ± 1.14	7.13 ± 0.69	39.43 ± 5.20	56.9 ± 0.52	19.77 ± 0.57	34.7 ± 1.13
2	10% v/v	15.07 ± 0.07	7.67 ± 0.54	44.30 ± 2.90	57.77 ± 0.67	19.70 ± 0.71	34.13 ± 0.88
3	20% v/v	13.2 ± 0.97	6.66 ± 0.44	38.7 ± 3.93	57.93 ± 3.81	19.77 ± 0.23	34.4 ± 1.95
4	50% v/v	14.1 ± 0.57	6.57 ± 0.94	37.5 ± 4.00	56.83 ± 0.45	18.5 ± 1.42	32.6 ± 2.76
5	100% v/v	12.83 ± 0.09	6.42 ± 0.20	34.2 ± 1.95	55.23 ± 1.22	20.0 ± 0.49	36.3 ± 1.19

Table 2. *Continued.*

Groups	Treatment	WBC ($\times 10^9$/L)	LYM ($\times 10^9$/L)	GRAN ($\times 10^9$/L)	MID ($\times 10^9$/L)	PLT ($\times 10^9$/L)
1	Distilled Water	$8.13^{abcd} \pm 0.22$	4.73 ± 1.10	0.57 ± 0.17	0.33 ± 0.19	242.67 ± 91.53
2	10% v/v	$6.63^{a} \pm 0.29$	3.93 ± 0.52	0.50 ± 0.06	0.20 ± 0.06	424.67 ± 16.18
3	20% v/v	$6.73^{b} \pm 0.33$	3.97 ± 0.69	0.17 ± 0.07	0.27 ± 0.03	254.33 ± 110.63
4	50% v/v	$6.63^{c} \pm 0.03$	2.43 ± 0.47	0.5 ± 0.10	0.27± 0.07	244 ± 87.18
5	100% v/v	$5.67^{d} \pm 0.32$	4.0 ± 1.36	0.5 ± 0.21	0.40 ± 0.15	149 ± 30.19

Hb: Hemoglobin, RBC: Red Blood Cell, PCV: Packed Cell Volume, MCV: Mean Cell Volume, MCH: Mean Cell Hemoglobin, MCHC: Mean Cell Hemoglobin Concentration, WBC: White Blood Cell, LYM: Lymphocyte, GRAN: Granulocytes, MID: Monocytes, PLT: Platelets. Values are mean ± SD, n = 3. Values with different superscript along a column are statistically significant ($p < 0.05$), Group 1 is higher than the 2, 3, 4, and 5, while Group 5 is lower than 1, 2, 3 and 4.

5. Discussion

The primarily component of honey are sugars such as monosaccharides, disaccharides, oligosaccharides and polysaccharides [8, 9]. The common uses of honey are in cooking, baking, as a spread on bread, and as an addition to various beverages, such as tea, and as a sweetener in some commercial beverages. It contains enzymes such as glucose oxidase, diastase, invertase, catalase and peroxidase [8]. Honey also contains other bioactive constituents such as organic acids, ascorbic acid, trace elements, vitamins, amino acids, proteins and Maillard reaction products [8]. Being rich in carbohydrates like glucose and fructose when ingested could be metabolized to generate energy and help in tissue repair. This study reports the effect of honey on hematological indices and lipid profile at various concentrations using mice.

A decrease in Triglyceride levels and an increase in HDL levels is in concordance with a study which stated that honey intake have the ability to modulate some of the cardiovascular risk factors [10, 11] because antioxidants in honey, in addition to their role in lowering blood cholesterol and low density lipoprotein levels, are also advantageous by inhibiting the formation of atherogenic plaques. Inhibition of atherogenic plaque formation is also determined by a variety of trace elements, minerals, vitamins, contained in honey. Some trace elements that prevent the formation of atherogenic plaques are copper and zinc. Meanwhile, some of the vitamins contained in honey that play a role in preventing oxidative stress and atherosclerotic plaque formation are vitamin E (niacin), vitamin C, vitamin B, and vitamin A). However an increase in total cholesterol and Low density lipoprotein were indicators of cardiovascular risks [12].

An increase in Hemoglobin (Hb) levels, Packed Cell Volume (PVC) and Red blood cell count (RBCs) in mice treated with honey 10% (v/v) shows that honey as an anti-anemic property similar to a study by [5]. This can also be said about an increase in mean corpuscular hemoglobin in group 5 [100% (v/v)]. An increase in monocyte count (MID) in Group 5 [100% (v/v)] and Platelet count (PLT) in Group 2 [10% (v/v)] shows that honey is an immune-stimulant agent similar to a study by [5].

6. Conclusion

The results from the research work showed that Honey irrespective of the dosage, showed tendencies of increasing HDL level with a reduction in Triglyceride levels. Also increase in red blood cell count, hemoglobin levels, packed cell volume, mean corpuscular hemoglobin, platelet and monocyte counts at different concentration shows its advantage to increasing hematological indices.

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