



Comparative Study of Effect of Honey on Blood Pressure and Heart Rate in Healthy Male and Female Subjects

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Authors' contributions

This work was carried out in collaboration between all authors. Author AEO designed the study and wrote the first draft of the manuscript. Author OTH performed the statistical analysis. Author BEI wrote the protocol, and author ADE managed the literature searches. All authors read and approved the final manuscript.

Research Article

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ABSTRACT

Aims: The aim of this study was to evaluate the effect of honey on blood pressure and heart rate on healthy male and female subjects.

Methodology: 20ml honey orally administered was evaluated in hundred healthy male and female subjects. Their basal systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR) were taken as the control values. After measuring their basal SBP, DBP and HR, 20ml of honey was orally administered and the systolic blood pressure, Diastolic blood pressure and heart rate were measured at 15, 30, 60 minutes with a digital sphygmomanometer and analogue sphygmomanometer as a check.

Results: The results of this study showed that mean SBP decreased ($p=.05$) significantly in female compared to male at control, after 15, 30 and 60 minutes of oral administration of 20ml of honey. DBP decreased ($p=.05$) significantly in female compared to male at control, after 15 minutes and 60 minutes of oral administration of 20ml of honey and HR decreased ($p=.05$) significantly in female compared to male at 60 minutes of oral administration of 20ml of honey.

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Conclusion: The effect of honey on systolic blood pressure, diastolic blood pressure and heart rate shows that it has a hypotensive effect in healthy male and female subjects.

Keywords: Honey; systolic blood pressure; diastolic blood pressure and Heart rate.

1. INTRODUCTION

Honey is a substance produced by honey bees from nectar and sweet deposits from plants; these are modified and stored in honeycomb. The honeybees use this stored honey as their source of food during cold weather or when fresh food sources are scarce [1]. Honey vary in physical properties, this depend on water content, type of flora used for its production (pasturage), temperature, and the quantity of its specific sugars. The major constituents of Honey are sugar (mainly fructose 30%, glucose 31%) and water. Minor constituents are: sucrose (1%), maltose, melezitose, glucoseoxidase, phenolic, flavonoids, terpenes, and hydrogen peroxide [1].

Africa honey is produced by the Wild West Africa bee (*Apis mellifera adansonii*) [2]. It is highly beneficial; it is effective in wounds treatment, as a remedy for diarrhea [3], gastric ulcer [4], as an antioxidant [5] and anti-diabetic agent [6]. The antibacterial activity of honey is as result of various factors which include; a) osmotic effect; honey is a super-saturated solution of a mixture of fructose and glucose sugars, so no fermentation occurs in honey [1]. b) Its acidity; the pH being between 3.2 and 4.5 is low enough to be inhibitory to many pathogens [1], c) the presence of hydrogen peroxide. Hydrogen peroxide is produced enzymatically in honey by glucose oxidase enzyme secreted by bees into the nectar [7], d) the presence of antibacterial phytochemical components [1] and e) the presence of defensin-1 [7].

Blood pressure is the force exerted by blood against the arterial walls and is determined by how much blood is pumped by the heart and the resistance to blood flow [8]. Arterial blood pressure can be measured with a sphygmomanometer. The blood pressure is expressed in millimeter of mercury (mmHg) and the normal for an adult male and female are 120/80 and 110/70 respectively. Systolic blood pressure is the highest arterial pressure and is the pressure generated as blood is ejected from the heart into the arteries during ventricular contraction while the diastolic blood pressure is the lowest arterial pressure and is the pressure in the artery during ventricular relaxation [9]. The heart rate is one of the most important factors that influence the cardiac output and it is regulated by the frequency of impulse generation at sino-atrianode (SA node) while the activity of this node is in turn controlled by autonomic nervous system [10].

Sex is one of the factors that cause variations in the blood pressure. A study has showed that blood pressure is higher in male compared to female [11]. Other factors influencing blood pressure include age, food intake, temperature, physical fitness and stress [12]. Gender has an important influence on blood pressure, with premenopausal women having a lower arterial blood pressure than age-matched men. Compared with premenopausal women, postmenopausal women have higher blood pressures, suggesting that ovarian hormones may modulate blood pressure [13]. It has been postulated that men are at greater risk of cardiovascular disease than are age-matched premenopausal women. There is significant evidence that androgens such as testosterone play an important role in gender-associated differences in blood pressure [11]. Various studies have reported medicinal

benefit of honey as an antioxidant [5] and anti-diabetic agent [6] but there is paucity of data on its effect on blood pressure and heart rate. This study therefore examines the effect of honey on systolic blood pressure, diastolic blood pressure and heart rate in healthy male and female subjects.

2. MATERIALS AND METHODS

2.1 Honey

The honey was gotten from the agric-extension of the Faculty of Agriculture of the University of Ilorin, therefore its originality and hygiene were ascertained. However, the honey was tested for adulteration using the local methods; the water test and ant test.

2.1.1 Procedure for water test

A beaker was filled with water and a small quantity of the honey was dropped into the water then the sedimentation of the honey was observed. The honey settles down completely leaving the water clear, if the water is not clear the honey is adulterated.

2.1.2 Procedure for ant test

A small quantity of the honey was dropped on the floor and we observed if ants will cluster around it. The honey attracted ants but the ants did not cluster around it. If the honey is adulterated with sugar ants will cluster around it. These show that the honey is not adulterated.

2.2 Subject Selection/Selection Criteria

140 subjects were recruited for the study, they were formally informed about the procedure and they all gave their consent. An ethical clearance was also obtained from the university of Ilorin teaching hospital.

The subjects were selected at random from University of Ilorin, mini campus. For male the range of age, weight, and height were 18-25 years, 56-70kg and height 1.62-1.82m respectively and those female were 19-23 years, 45-65kg and height 1.53-1.71m respectively.

The criteria given below were used to accept a subject as normal:

- i. Do not have any history of cardiovascular disorder such as hypertension, cardiac failure or cardiac arrest.
- ii. Is not on any special medication
- iii. Is medically fit
- iv. To be readily available and cooperate adequately during the period of the experiment; the duration and procedures of the experiment were properly explained to the subjects.
- iv. The subjects were asked to be composed during the period of the experiment.

After the prior examination, 100 subjects (50 males and 50 females) were certified fit to participate in the study.

2.3 Method / Procedures

The study was done in the Physiology laboratory of the University of Ilorin, Mini-campus. The subjects were comfortably seated. They rested for 10 minutes to allow the blood pressure and heart rate return to the basal level at rest. Then blood pressure and heart rate of the subjects were measured with automatic digital sphygmomanometer and the analogue sphygmomanometer was used as a check for blood pressure while the auscultation was used for heart rate. The arm cuff of the automatic digital sphygmomanometer SE 2000 was wrapped around the left arm and was held close to the heart. This first reading was taken as the control values. After this initial measurement, a graduated measuring cylinder was used to measure 20ml of honey; a local prescription use daily for general well being. This was orally administered to each subject using a desert spoon. Subsequently the blood pressure and heart rate of each subject was measured after 15, 30, and 60minutes of administration.

2.4 Statistical Analysis

The results are presented as mean \pm standard error of mean (SEM). Statistical differences were evaluated with SPSS version 15.0 using paired t-test and independent t-test. The statistical significance was accepted at the level of $p=.05$.

3. RESULTS AND DISCUSSION

3.1 Changes in Systolic Blood Pressure in Male and Female after Oral Administration of Honey

There was a significant ($p=.000$) decrease in the control mean systolic blood pressure in female compared to male control systolic blood pressure, also the mean systolic blood pressure decreased significantly ($p=.004$) in female compared to male after 15,30, 60minutes of oral administration of honey. There was a significant ($p=.002$) decrease after 15, 30, 60minutes of oral administration of honey compared to the control in male and there was a significant ($p=.02$) decrease after 15minutes compared to the control in female (Fig. 1).

3.2 Changes in Diastolic Blood Pressure in Male and Female after Oral Administration of Honey

There was a significant ($p=.05$) decrease in the control mean diastolic blood pressure in female compared to male control systolic blood pressure, also the mean diastolic blood pressure decreased significantly ($p=.05$) in female compared to male after 15, 60minutes of oral administration of honey while the decreased in mean diastolic blood pressure in female compared male after 30minutes of administration was not significant (Fig. 2).

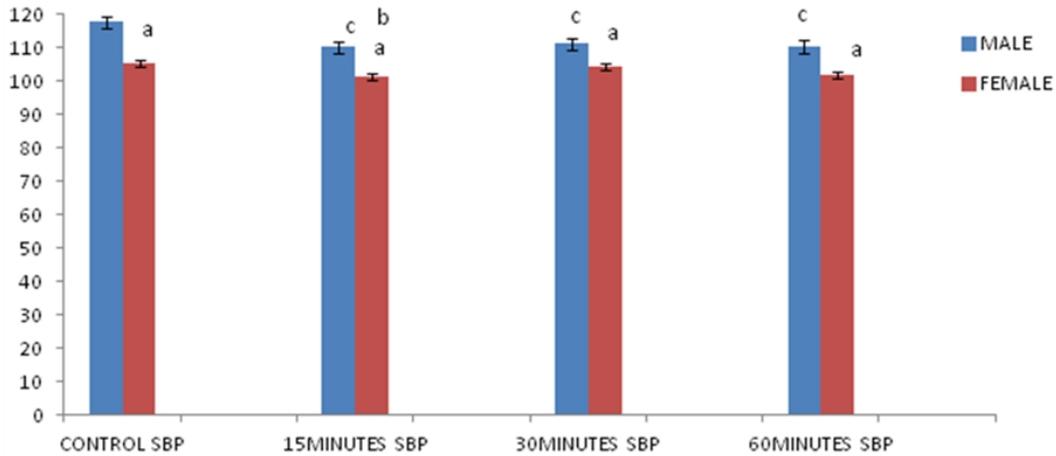


Fig. 1. changes in systolic blood pressure in male and female after oral administration of honey

a- Significant decrease of female from the male systolic blood pressure values, b- a significant decrease from control in female, c- a significant decrease from control in male. (p=0.05, n= 100)

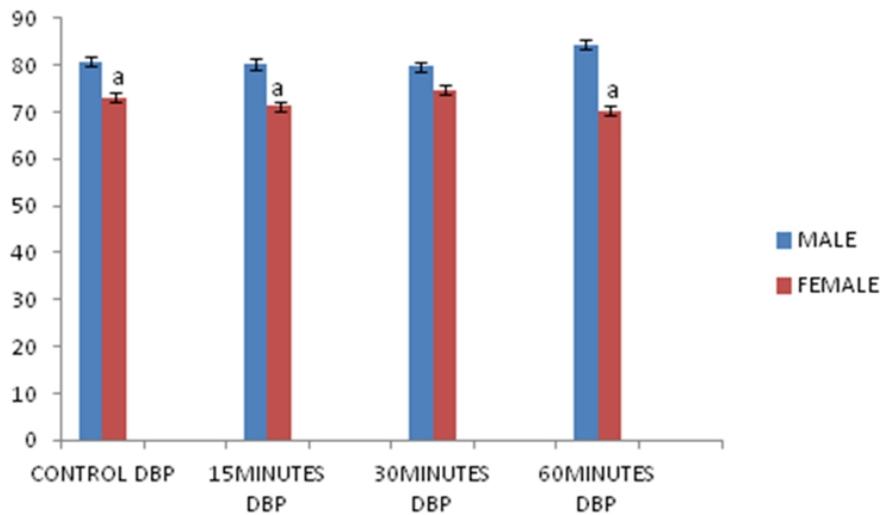


Fig. 2. changes in diastolic blood pressure in male and female after oral administration of honey

a- Significant decreased from the male diastolic blood pressure values. (p=.05, n= 100)

3.3 Changes in Heart Rate in Male and Female after Oral Administration of Honey

The decrease in the control mean heart rate in male compared to female control heart rate was not significant, the decrease in mean heart rate in female compared to male after 15, 30minutes of oral administration of honey was not significant while after 60minutes of administration the heart rate decreased significantly ($p>0.05$) in female compared to male (Fig. 3).

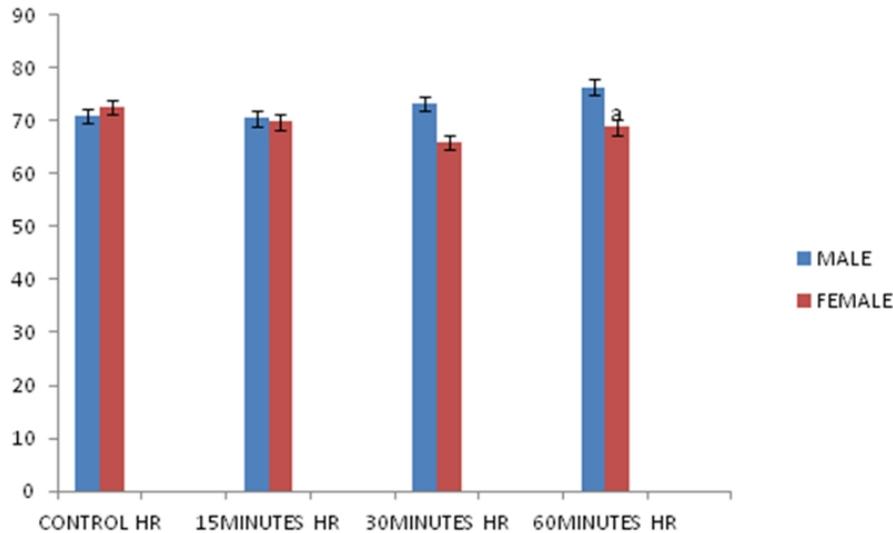


Fig. 3. Changes in heart rate in male and female after oral administration of honey
a- Significant decreased from the male heart rate values. ($p < 0.05$, $n = 100$)

3.4 Discussion

The study assessed the effect of honey on systolic blood pressure, diastolic blood pressure and heart rate in healthy male and female subjects. The result showed a significant decrease in mean SBP after 15, 30, 60minutes compared to the control in male, a significant decrease in mean SBP after 15minutes compared to the control in female, and a significant decrease in mean SBP, DBP and HR in female subjects compared to male subjects after oral administration of 20ml of honey. There was a significant decrease in the basal systolic blood pressure in female compared to male this is similar to what has been previously reported [11,13]. The mechanisms responsible for the gender differences in blood pressure control are not clear but it might be due to the influence of sex hormones [14-18].

In our study we observed a significant decrease in systolic blood pressure both in male and female subjects after administration of honey, the decrease observed in male subject was maintained throughout the duration of the experiment, while the decrease in female was just 15minutes after administration. The decrease in female systolic blood pressure compared to that of male was maintained throughout the duration of the experiment. There are limited data on the effectiveness or efficacy of honey on blood pressure, however, Erejuwa et al. [19] reported that short-term (3 weeks) administration of honey in streptozotocin- induced diabetic spontaneously hypertensive rats resulted in reduction in systolic blood pressure. A study of antihypertensive effect of honey supplementation in spontaneously hypertensive rats reported that honey supplementation reduces systolic blood pressure [20].

It has been suggested that honey has an insulin sensitization effect [21]. The lowering effect of honey on systolic blood pressure might be due to its ability to trigger insulin secretion. Insulin enhances the absorption of magnesium ions which in turn cause vascular dilation. Paolisso and Barbagallo [22] reported that insulin directly stimulates magnesium levels and they also suggested that insulin might contribute to its regulation. The ability of insulin to

elevate cellular magnesium levels was first reported by Lostroh [23,24]. The vasodilatory effect of magnesium ions has been documented [25]. The increase in heart rate observed in male compared to female after 60 minutes of administration might be as result of physiological response to the lowering blood pressure.

4. CONCLUSION

We observed in this study that honey has hypotensive effect in healthy male and female subjects. However, the mechanism of action of honey was not studied; this aspect is suggested for further studies. The effect of honey reported in this study is therefore recommended for further studies in hypertensive patients.

CONSENT

Not applicable.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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