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PLASMA LEPTIN AND BLOOD PRESSURE VARIATIONS IN NORMAL WEIGHT FEMALE UNIVERSITY STUDENTS

Abdulhalim S. Serafi [1,*], Sumera Sohail [2], Nargis Anjum [3], Mohammed A. Bafail [1] and Zahir Hussain [1,*]

[1]*Department of Physiology, Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia*
[2]*Department of Physiology, University of Karachi, Karachi, Pakistan*
[3]*Department of Physiology, Karachi Medical and Dental College (KMDC), Block M, North Nazimabad, Karachi, Pakistan*
***Corresponding authors' emails:** asserafi@uqu.edu.sa, zhakbar@uqu.edu.sa

ABSTRACT

A number of studies have been conducted to understand the interrelationship of plasma/ serum leptin changes according to blood pressure (BP) and body mass index (BMI) variations. However, in view of controversial findings, we conducted the present study to understand the regulatory role of plasma leptin involving systolic blood pressure (SBP), diastolic blood pressure (DBP) and BMI in young normal weight Saudi female university students (n:26; age range: 18-23 years). The scatterplot of the points for BMI against SBP, DBP and leptin showed highly significant positive linear correlation. The leptin plasma levels against SBP and DBP also revealed highly significant positive linear correlations. However, further studies are required that may help settle some of the controversies related to association among leptin levels, BP and BMI and may uncover the interesting regulatory mechanisms whereby leptin alters BP and influences BMI, and vice versa.

Keywords: Plasma leptin, body mass index (BMI), blood pressure, systolic blood pressure, diastolic blood pressure, normal weight female students

INTRODUCTION

A number of studies have been conducted to understand the interrelationship of plasma/ serum leptin changes according to blood pressure (BP) and body mass index (BMI) variation (Redon, 2001; Hussain *et al*., 2007; Abramson *et al*., 2011; Sohail *et al*., 2013; Sohail and Hussain, 2013; Taylor *et al*., 2014; Ayeser *et al*., 2016; Ayina *et al*., 2016; Serafi *et al*., 2016; Fujita *et al*., 2019; Zulfania *et al*., 2020; Caffo *et al*., 2021). Interesting information was also obtained for the relationship for leptin levels and BMI and BP (Kazumi *et al*., 1999; Kerimkulova *et al*., 2014; Caffo *et al*., 2021) but controversy exists among various reports.

Highly controversial results were obtained, e.g. leptin levels correlated positively with BMI (Kazumi *et al*., 1999; Hirose *et al*., 2001; Al-Sultan and Al-Elq, 2006; Antunes *et al*. 2009); leptin related to BMI significantly and independently (Antunes *et al*. 2009; Nakamura *et al*., 2009); leptin associated with obesity related BP changes (Taylor *et al*., 2014); leptin associated with BP (Hirose *et al*., 1998; Kazumi *et al*., 1999; Hirose *et al*., 2001; Allison *et al*., 2013; Kerimkulova *et al*., 2014) especially with systolic blood pressure (SBP) (Hirose *et al*., 2001) or diastolic blood pressure (DBP) (Wada *et al*., 2006); leptin did not associate either with SBP or DBP (Al-Sultan and Al-Elq, 2006); Serum leptin positively correlated with gender (both female and male), BMI and BP (Abramson *et al*., 2011; Fujita *et al*., 2019; Caffo *et al*., 2021); leptin associated with BMI instead of BP (Ozawa *et al*., 2014).

In view of the published reports, it is essentially important to carry out more precise and well-organized gender-based studies to settle this controversial issue, and to understand the regulatory role of serum/ plasma leptin involving BP and BMI. Hence, we conducted the present study in young normal weight Saudi female university students.

MATERIALS AND METHODS

The present study is a part of the proposal submitted and approved (ethical approval issued from the College of Medicine, Umm Al-Qura University (UQU), Saudi Arabia) that comprised normal healthy female university students (n:26). Only those female university students were consulted who were found normal, healthy, unmarried, in the age range of 18 to 23 years, with normal healthy body weight, not having the habit of smoking, and without cardiovascular or other diseases.

The data of the subjects was recorded in a Questionnaire form including age, body weight and height, education level, body temperature, nutrition, habits, and detailed history of health and previously used medication and other required information. However, subjects were informed about the research proposal and their contribution by allowing to take biochemical/ physiological tests, medical examination, history and other information. Only those subjects were included in the study who were willing to participate in the present study.

The main parameters to be investigated in the present work were: body mass index (BMI) in kg/m2, blood pressure (BP) in mmHg (systolic blood pressure (SBP), diastolic blood pressure (DBP), and plasma leptin levels (ng/mL). Blood samples were taken, aliquots stored at the required temperature, and leptin levels determined using Leptin Human ELISA Kit. The statistical analysis was properly carried out (Zahir *et al*., 2014). Mean ± SEM, t-test, and p-value were analyzed for comparing two variables whereas the strength of correlation was determined by coefficient of determination (R^2). SPSS software version 24 was used for data entry/ statistical analysis. Regression/ regression line was used to find the cause-and-effect relation between two variables by applying the relevant equation. The scatterplot of points indicated the strength of correlation, and analysis of the coefficient of determination (R^2) was employed to determine the correlation between two variables.

RESULTS

Mean ± SEM values for BMI (kg/m^2), SBP (mmHg), DBP (mmHg) and plasma leptin levels (ng/mL) in normal healthy female university subjects were obtained respectively as 22.16 ± 0.43, 118.62 ± 1.32, 73.65 ± 1.28 and 3.33 ± 0.28, respectively.

Association of body mass index and systolic blood pressure in normal female subjects

The scatterplot of the points for BMI against SBP (Fig.1) showed a significant positive linear correlation (R^2: 0.3659, p: 0.001).

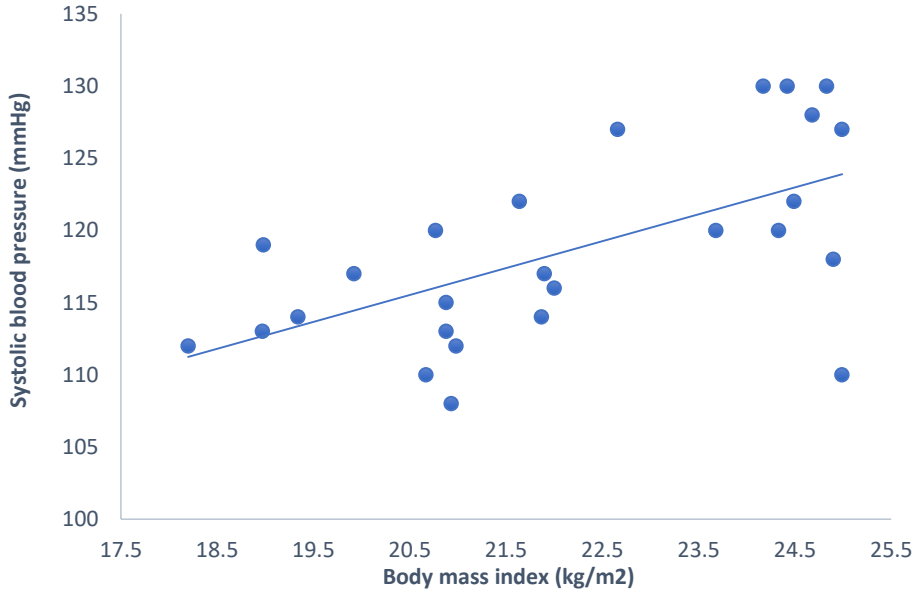

Fig.1. Association of body mass index and systolic blood pressure in normal female subjects (Regression equation: y= 1.8641x +77.313, R^2=0.3659, p:0.001)

Association of body mass index and diastolic blood pressure in normal female subjects

The scatterplot of the points for BMI against DBP (Fig.2) showed a significant positive linear correlation (R^2: 0.4566, p: 0.0002).

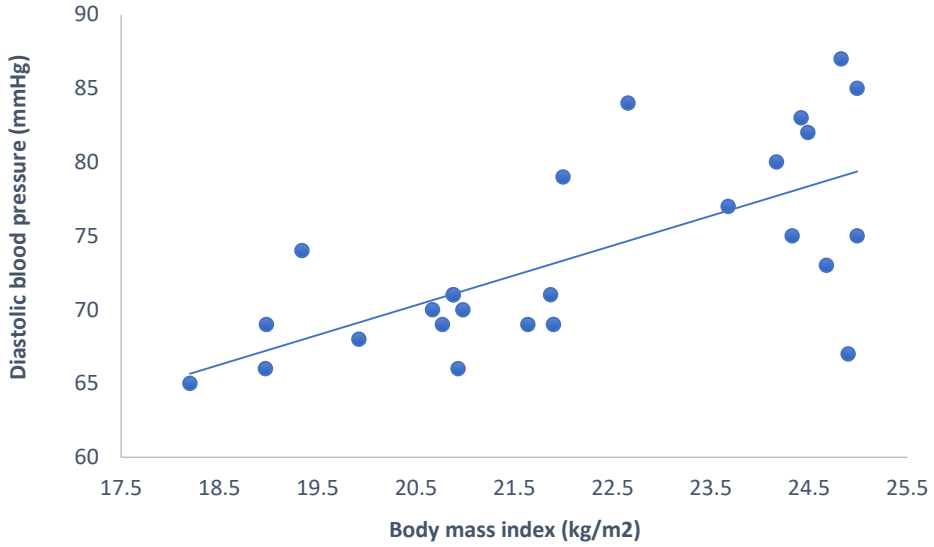

Fig 2. Association of body mass index and diastolic blood pressure in normal female subjects (Regression equation: y= 2.0184x +28.933, R^2=0.4566, p:0.0002)

Association of body mass index and plasma leptin in normal female subjects

Scatterplot of the points for BMI against plasma leptin levels (Fig.3) showed a significant positive linear correlation (R^2: 0.6517, p< 0.0001).

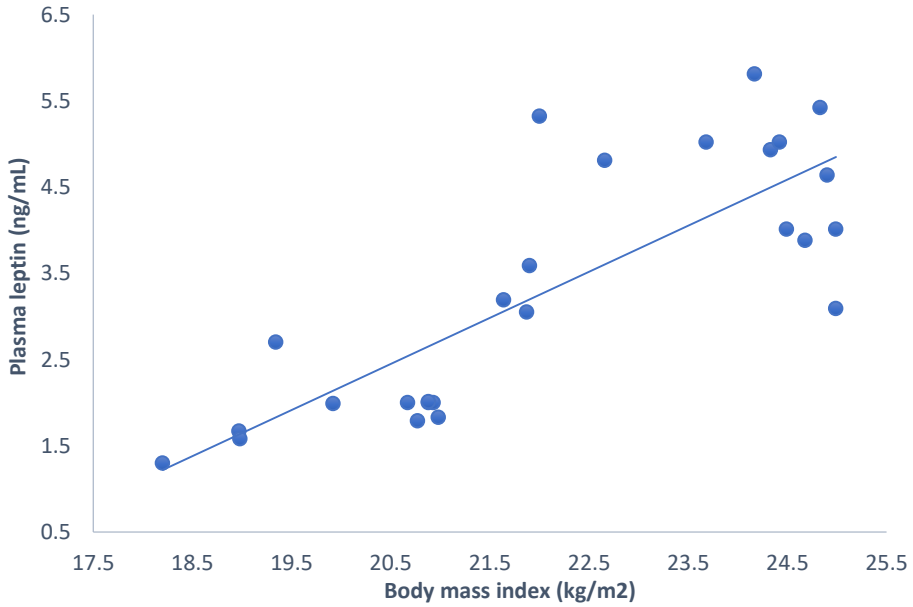

Fig. 3. Association of body mass index and plasma leptin in normal female subjects (Regression equation: y= 0.5342x -8.502, R^2=0.6517, p< 0.0001)

Association of systolic blood pressure and plasma leptin in normal female subjects

The points for SBP against plasma leptin levels (Fig.4) in the scatterplot showed a significant positive linear correlation (R^2: 0.4979, p< 0.0001).

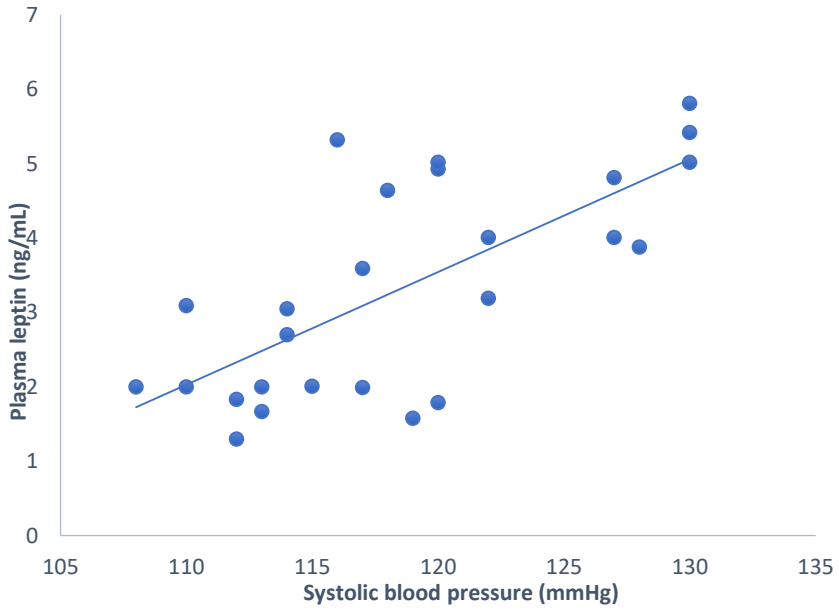

Fig.4. Association of systolic blood pressure and plasma leptin in normal female subjects (Regression equation: y= 0.1515x -14.637, R^2=0.4979, p< 0.0001)

Association of diastolic blood pressure and plasma leptin in normal female subjects

The points for DBP against plasma leptin levels (Fig.5) in the scatterplot showed a significant positive linear correlation (R^2: 0.5760, p< 0.0001).

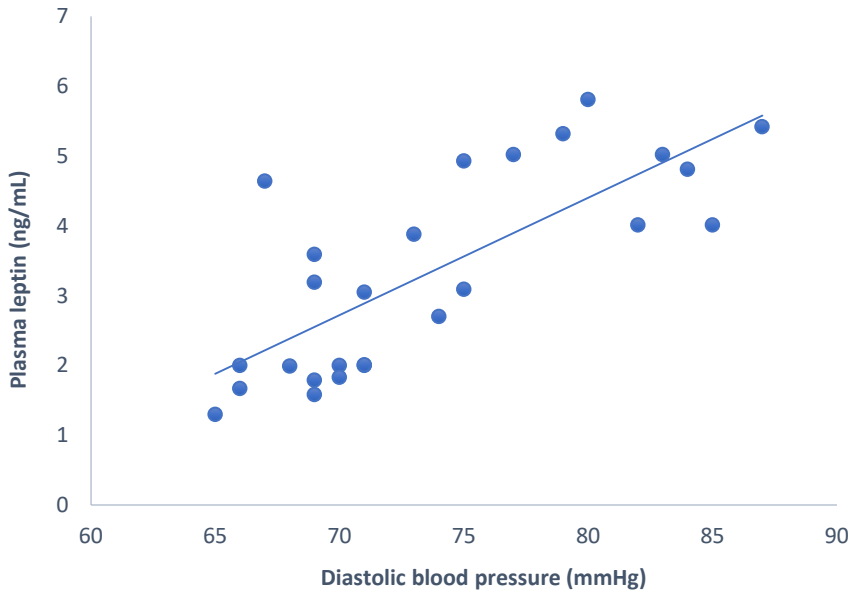

Fig.5. Association of diastolic blood pressure and plasma leptin in normal female subjects (Regression equation: y= 0.1681x -9.05, R^2=0.5760, p< 0.0001)

DISCUSSION

Present study in young healthy female university students presents interesting information for the types of association among BMI, BP and plasma levels of leptin, and hence, may provide insights to understand the role of BMI based leptin in the regulation of blood pressure.

Significant positive linear relationship of BMI with BP in the present study is quite similar to previous reports (Redon, 2001; Allison *et al*., 2013; Kerimkulova *et al*., 2014). Similarly, BMI correlated significant and independently with leptin levels (Antunes *et al*., 2009; Nakamura *et al*., 2009) confirming the association of BMI and plasma leptin levels investigated in the present work.

Significant linear relationship between SBP and leptin levels investigated in the present report resembles with other studies (Hirose *et al*., 1998; Kazumi *et al*., 1999; Hirose *et al*., 2001; Allison *et al*., 2013; Kerimkulova *et al*., 2014). However, no significant correlation between SBP or DBP with leptin levels in subjects with a different age group (Al-Sultan and Al-Elq, 2006) differs from our current work, though another study (Wada *et al*., 2006) had similar results as we obtained between DBP and leptin levels. Positive and significant correlation of leptin levels with DBP but not with SBP in subjects with normal BP range (Wada *et al*., 2006) requires further studies to clarify this issue. We suggest that further studies with the help of investigations obtained in the present report may settle some of the controversies related to association among leptin levels, BP and BMI and may uncover the interesting regulatory mechanisms whereby leptin alters BP and influences BMI, and vice versa.

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