PLASMA ADIPOKINE VARIATIONS IN YOUNG HEALTHY UMM AL-QURA UNIVERSITY STUDENTS

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ABSTRACT

Apelin and resistin have been studied for their role in relation to body mass index (BMI) in obese, non-obese and lean subjects. However, in view of contradictory reports, we planned to carry out present study for determining plasma levels of apelin (ng/mL) and resistin (ng/mL) in young healthy non-obese university subjects (age: 18-20; BMI groups: 17-18, 18-19 and 19-20 kg/m^2. ELISA kit methods were used to estimate the cytokine plasma levels. Plasma apelin in young healthy male students of Umm Al-Qura University showed non-significant variation (F: 1.007; p: 0.374). Results for female students were also non-significantly different (F: 0.517, p: 0.600). The comparison of the apelin concentration for male vs. female for all BMI levels showed non-significant results (p>0.05). Plasma resistin (ng/mL) were also found non-significantly different for male (F: 0.044; p: 0.957) and female (F: 1,568; p: 0.221) students. The comparison of plasma resistin for male vs. female students gave non-significant difference for BMI levels of 17-18 and 18-19 but significant increase for female students compared to male students with BMI 19-20 kg/m^2 (p: 0.046). The present study, hence, provides important information for conducting further work in subjects with obesity of various levels by comparing with the data of non-obese subjects. Conclusively, the present study may orient the research workers toward investigating further the physiological variations of plasma apelin and resistin along with body weight/ BMI changes to understand normal body functions and disordered conditions.

Keywords: Apelin, resistin, adipokines, body weight, body mass index (BMI), university students

INTRODUCTION

Adipokines have been investigated in a variety of disorders and are considered as the potential biomarkers in several diseases (Blüher and Mantzoros, 2015). The present report, however, relates to only two important biomarkers, adipokines-apelin and resistin (Onalan *et al*., 2020; Ruszała *et al*., 2021).

Apelin and resistin have been studied for their role in relation to body mass index (BMI) that reveals increased levels (serum/ plasma) of apelin (Boucher *et al*., 2005; García-Díaz *et al*., 2007; Higuchi *et al*., 2007; Castan-Laurell *et al*., 2008; Frier *et al*., 2009; Yue *et al*., 2011; Sheibani *et al*., 2012; Ba *et al*., 2014; Kiskac *et al*., 2014; Bertrand *et al*., 2015; El Wakeel *et al*., 2018), and resistin (Azuma *et al*., 2003; Degawa-Yamauchi *et al*., 2003; Fujinami *et al*., 2004; Liu et a., 2006; Lausten-Thomsen *et al*., 2017) in obese compared to lean/ or non-obese subjects.

However, there are reports indicating little or no association of apelin (Castan-Laurell *et al*., 2011; Reinehr *et al*., 2011; Sentinelli *et al*., 2020; Bellissimo *et al*., 2021) or resistin (Heilbronn *et al*., 2004; McTernan *et al*., 2003; Youn *et al*., 2004; Amirhakimi *et al*., 2011) with the changes in body weight. No significant variation in BMI or correlation between resistin levels in obese and normal subjects were obtained (Amirhakimi *et al*., 2011).

In view of the mentioned reports, we considered necessary to first carry out the present study to have further information about the involvement of apelin and resistin in changing body weight and vice versa. The present study, hence, provides important information for conducting further work in subjects with obesity of various levels and comparing with the data of non-obese subjects.

MATERIALS AND METHODS

Present investigation is a part of the project submitted to the Faculty of Medicine, Umm Al-Qura University (UQU), Saudi Arabia and ethical approval was obtained. Male (n: 43) and female (n: 43) healthy non-obese students (age: 18-20 years) were consulted for collecting the required data. Consent of the students was obtained before the start of work. The subjects for the present study were unmarried, normal, healthy, and non-obese without having any serious discomfort and not having smoking habit. The students were informed about the purpose of getting their samples. Permission was obtained from the students for taking their blood samples and detailed information. The

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data was recorded in a Questionnaire for the information of the age, body weight, body height, body temperature, education level, habits, nutrition/ physical activity, and any current and previous medication etc.

The body mass index (BMI) in kg/m^2, and cytokine levels (apelin (ng/mL), resistin (ng/mL) were determined in male and female students. Plasma apelin was analysed using ELISA Kit methods (RayBiotech, Inc, USA. EIA Kit). Manufacturer's instructions were used for following the procedure of using the kits. Plasma resistin was measured using Enzyme-linked immunosorbent assay (ELISA) (Life Technologies, Invitrogen Corporation, Frederick, USA). The intra-assay and inter-assay coefficient of variation were found satisfactory.

The SPSS software (version 24) was used for data entry/ and statistical analysis. The statistical analysis was properly carried out employing the standard methods (Zahir *et al*., 2014). The mean ± SD, t-test, and p-value were obtained for comparing two variables, and one way ANOVA was employed for comparing the three groups for male and female subjects.

RESULTS

Association of plasma apelin (ng/mL) as well as plasma resistin (ng/mL) with body mass index was determined in young students of Umm Al-Qura University, Makkah, Saudi Arabia. The total number of students in the present study were 86 (43 each male and female students). There were three groups of male and female students based on BMI levels of 17-18 (n: 14), 18-19 (n: 15), and 19-20 (n:14) kg/m^2. Age of the subjects was 18-20 years. All these subjects were normal healthy students. Body weight and body height of the students were recorded and BMI levels were determined in kg/m^2.

Plasma apelin in young healthy male students of Umm Al-Qura University (Table 1) showed non-significant variation in BMI 17-18, BMI 18-19, and BMI 19-20 kg/m^2 (F: 1.007; p: 0.374). Results for female students were also non-significantly different (F: 0.517, p: 0.600). The comparison of the apelin concentration for male vs. female for all BMI levels showed non-significant results (p>0.05).

Table 1. Association of plasma apelin and body mass index in young healthy Umm Al-Qura University students.

Subjects	Plasma apelin* (ng/mL)			Significance #	
	BMI-1**	BMI-2**	BMI-3**	F value	p value
Male	1.23 ± 1.24 (n: 14)	1.80 ± 1.52 (n: 15)	2.06 ± 1.91 (n: 14)	1.007	0.374
Female	1.59 ± 1.39 (n: 14)	1.97 ± 1.74 (n: 15)	2.26 ± 2.05 (n: 14)	0.517	0.600

*: mean ± S.D., BMI: body mass index (kg/m^2), BMI-1, BMI-2 and BMI-3 are restively for BMI (17-18), BMI (18-19) and BMI (19-20), **: kg/m^2, n: number of subjects. #: one-way ANOVA

Plasma resistin (ng/mL) (Table 2) were also found non-significantly different for male (F: 0.044; p: 0.957) and female (F: 1,568; p: 0.221) students (Table 2). The comparison of plasma resistin for male vs. female students gave non-significant difference for BMI levels of 17-18 and 18-19 but significant increase for female students compared to male students with BMI 19-20 kg/m^2 (p: 0.046) (Table 2).

Table 2. Association of plasma resistin and body mass index in young healthy Umm Al-Qura University students.

Subjects	Plasma resistin* (ng/mL)			Significance #	
	BMI-1**	BMI-2**	BMI-3**	F value	p value
Male	5.99 ± 2.60 (n: 14)	6.14 ± 2.47 (n: 15)	6.27 ± 2.59 (n: 14)	0.044	0.957
Female	6.63 ± 2.78 (n: 14)	7.33 ± 2.99 (n: 15)	8.71 ± 3.51[a] (n: 14)	1.568	0.221

*: mean ± S.D., BMI: body mass index (kg/m^2), BMI-1, BMI-2 and BMI-3 are restively for BMI (17-18), BMI (18-19) and BMI (19-20), **: kg/m^2 , n: number of subjects, #: one-way ANOVA, a: p value= 0.046 (male vs. female), unpaired t-test (two-tailed p value)

DISCUSSION

The present study reveals the pattern of plasma apelin and resistin levels in young non-obese male and female university students. Since there is controversy about the role of apelin and resistin in obese and non-obese subjects, the current finding will be helpful for researchers to compare their patients with obesity.

Our results for plasma apelin not differing statistically at various normal level BMI values in both male and female subjects seem similar to some of the investigations in previous reports (Castan-Laurell *et al*., 2011; Reinehr *et al*., 2011; Sentinelli *et al*., 2020; Bellissimo *et al*., 2021). It was interpreted that the changes in apelin levels had no association with the body weight and BMI, and rather because of age and puberty changes (Sentinelli *et al*., 2020). Another report confirms our present results for apelin levels (Bellissimo *et al*., 2021). It was also suggested that the lack of association of change in body weight and apelin concentrations might be for certain populations (Castan-Laurell *et al*., 2011), that clarifies our present findings. Furthermore, a comprehensive study involving one year life modification intervention did not show a connection of changes in apelin with the body weight changes (Reinehr *et al*., 2011). Hence, our study seems quite potential for carrying out further well controlled studies.

There are several reports that show contradictory results for apelin variations with change in body weight, and it was suggested that lipid metabolism/ lipolysis related to change in body weight is carried out by apelin via adenosine monophosphate (AMP) activated protein kinases (Yue *et al*., 2011), or some of the important functions of apelin relate to glucose homeostasis, modulation of energy metabolism, lipogenesis and lipolysis (Bertrand *et al*., 2015). Some of the other reports against our present findings are: positive correlation of serum apelin with BMI (El Wakeel *et al*., 2018), severe obesity having adiposity with high plasma levels of apelin (Frier *et al*., 2009; Higuchi *et al*., 2007), significant role of apelin in obesity-related comorbidities/complications (Boucher *et al*., 2005; García-Díaz *et al*., 2007), apelin as a potential factor related to pathophysiology of obesity/ related disorders (Sheibani *et al*., 2012), and plasma levels of apelin higher in obese subjects compared to lean controls (Castan-Laurell *et al*., 2008). However, all these repots present relative results (obese vs. lean or non-obese subjects). Our approach was quite different as we did not study obese subjects at all, rather compared the apelin levels in male and female subjects with normal level BMI. Hence, the variations in apelin in the present study seem valid and corresponding to the reports carried out with similar approach and purpose.

The results in the present study for plasma resistin at various normal level BMI values in both male and female subjects showed significantly increased levels at BMI 19-20 range for female subjects compared to male subjects that are quite similar to some of the previous studies (Azuma *et al*., 2003; Degawa-Yamauchi *et al*., 2003; Fujinami *et al*., 2004; Liu et a., 2006; Lausten-Thomsen *et al*., 2017) in obese compared to lean/ or non-obese subjects. Serum levels of resistin associated to body mass index (BMI) (Azuma *et al*., 2003; Degawa-Yamauchi *et al*., 2003; Fujinami *et al*., 2004) resemble to our present results. However, it is still controversial whether male or female subjects present higher levels of resistin with the increase in body weight/ obesity. Another report is similar to our findings, though documents that resistin correlated to BMI in both boys and girls (Lausten-Thomsen *et al*., 2017), the serum levels of resistin were higher in girls compared to those in boys. There is another study that found resistin significantly higher in girls than in boys (Liu *et al*., 2006).

On the other hand, no significant difference in BMI or correlation was found between resistin levels in obese and normal subjects (Amirhakimi *et al*., 2011). There are several other reports that also contradict our findings (Heilbronn *et al*., 2004; McTernan *et al*., 2003; Youn *et al*., 2004) that is mainly due to the reason that they studied obese subjects and compared them with normal controls or non-obese subjects. Whereas, our emphasis in the present study was to only predict the change in resistin in normal healthy non-obese male and female students.

Conclusively, the output of present study may orient the research workers toward investigating further the physiological variations of plasma apelin and resistin along with body weight changes to understand normal body functions and disordered conditions.

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