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Chemerin levels and body fat percentage in Pakistani males

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Abstract: Chemerin is recently discovered protein that regulates adipocyte cell size, differentiation and modulates the metabolic changes in adipocytes and is secreted form mature adipose tissue. The study aimed to examine the relationship of chemerin with body fat percentage, and to compare these levels in lean and obese healthy Pakistani volunteers, grouped according to the Body Mass Index criteria for South Asian Population. Circulating chemerin levels were significantly higher in obese subjects with body mass index (BMI) greater than 26 kg/m^2 compared with those with a BMI below 25 kg/m^2 (P 0.001). Serum chemerin levels were found to be independently associated and significantly correlated with body fat percentage (r=0.280 P=0.015), hip circumference (r=0.246; P=0.021) and waist hip ratio (r=0.187; P=0.031). Circulating chemerin is associated with degree of fat mass, and can be used as a screening marker with reference to estimation of overall fat mass of an individual.

Keywords: Chemerin, BMI, adipokine, adipocytes, obesity.
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INTRODUCTION

Commonly used proxy or anthropometric measures such as body mass index (BMI), waist circumference (WC), waist-to-hip ratio (WHR), hip circumference have been proposed to define obesity however, there is controversy as they may not correspond to the same degree of fatness in different individuals, overestimating the percentage of body fat in people with muscular builds while underestimating the body fat in people lacking muscle mass[1].

The growing concern with obesity has led to an importance on the undesirability of white adipose tissue (WAT). The conventional view of adipose tissue as a passive reservoir for energy storage is no longer applicable, they express and secrete a variety of bioactive peptides, known as adipokines, which regulates adipocyte biology and systemic processes like food intake, nutrient metabolism, insulin sensitivity bone growth, inflammation and reproduction[2,3].

Chemerin also known as Retinoic acid receptor responder protein 2 (RARRES 2) is a chemo attractant protein. It exists in the circulation in two forms: as a full length, inactive protein containing 163 amino acids and a short16 kDa, active form containing, 146 amino acids , produced as a result of removal of 5-10 amino acids at the C-terminal end of chemerin by serine proteases. Because of its role in adipocyte differentiation and glucose uptake it is classified as an adipokine [4-6].

MATERIALS AND METHODS

Total 90 healthy male subjects, between ages 15-65 years, who visited the Jinnah Post Graduate Medical Centre, Karachi, Pakistan, were enrolled in this study and were asked to complete a written informed consent.

The study subjects had no previous history of cardiovascular disease, diabetes, moderate to severe hypertension (resting blood pressure (BP)>170/100mmHg), dyslipidemia, body weight fluctuation of 5 kg in the recent 6 months, acute infectious disease or chronic inflammatory disease, endocrine disease, or cancer. Smokers, alcoholics and females were excluded from our study. The participants were divided into three groups according to BMI criteria for South Asian population as Group A were subjects with normal weight (BMI 18-22.9), Group B were overweight (BMI 23-25.9), Group C were obese (BMI ≥26) subjects[7].

Anthropometric and biochemical measurements

The WHO Stepwise Approach to Surveillance (STEPS) protocol was used to measure the waist and hip circumference as previously described[8]. Waist to hip ratio was calculated by dividing the waist circumference by hip circumference. BMI was calculated by dividing weight by height squared (kg/m^2)[9]. The body fat percentage was measured using Diagnostic Scale BG55 (Beurer Germany) through bioelectrical impedance matching/analysis.
Blood samples were collected in the morning after an overnight fast. Serum chemerin levels were measured with an enzyme immunoassay kit (Creative Diagnostics, USA) a sensitivity of less than 3 pg/ml, using ELISA plate reader equalizer ER 2005, (Eqiupar, Italy).

Statistical analysis

A descriptive statistical analysis of continuous variables was performed using SPSS (version 11; SPSS Inc., Chicago, IL, USA). Statistical

comparisons were computed using a student t-test and a one-way analysis of variance (ANOVA) for continuous/quantitative variables, after adjusting for age, and BMI, Pearson coefficient of correlation (r) was used to determine the correlation between serum chemerin levels and body fat parameters. In all statistical analysis performed P<0.05 were considered significant.

RESULTS

Mean ages of all three groups were comparable on average, and so no significant difference was observed among groups. Weight in group B and C were statistically significant (P=0.001) as compared to group A depicting a strong positive correlation of (r=0.705;P<0.01) with serum chemerin concentration. Serum chemerin concentration was significantly increased in obese group C as compared to groups A and B controls P=0.001(Table 1).

Table 1: Anthropometric Characteristics of the study subjects.

Phenotypes	Normal Weight	Overweight	Obese
	n=30	n=30	n=30
Age (Years)	31.9 ± 15.0	33.3 ± 9.4	38.6 ± 10.4
95% CI	26.88,38.06	29.79,36.88	34.75, 42.51
Weight (Kg)	57.9 ± 7.10	71.2 ± 7.11*	88.4 ±16.2 *□
95% CI	55.28,60.60	68.46,73.76	82.35, 94.47
BMI	20.0 ± 1.92	24.4 ± 0.7*	31.9 ± 4.6* □
95% CI	19.32,20.76	24.10, 24.65	30.23, 33.65
Waist Circum (cm)	77.4 ± 11.9	88.2 ± 7.6*	100.4 ±12.9 * □
95% CI	73.63,81.86	85.41, 91.11	95.59,105.22
Hip Circum (cm)	88.0 ±10.5	100.8 ±6.9 *	109.3 ± 11.5* □
95% CI	84.69,91.94	98.19,103.3	104.9,113.5
WHR	0.88 ± 0.11	0.88 ± 0.07	0.91 ± 0.07
95% CI	0.83, 0.92	0.85, 0.91	0.88, 0.94
Body Fat (%)	19.2 ± 7.22	27.3 ±4.0 *	34.9 ± 4.5* □
95% CI	16.89,21.89	25.75, 28.82	33.22, 36.56
Chemerin (pg/ml)	12.0 ± 3.3	17.2 ± 6.1	76.4 ± 13.4 * □
95% CI	10.69,13.14	14.93,19.54	56.49,96.39

Where: WHR (waist hip ratio), BMI (body mass index)
* statistically significant as compared to control subjects, where p<0.01, □ statistically significant as compared to overweight subjects, where p<0.01

Body mass index (BMI) was statistically significant in group B and C as compared to group A (r=0.769; P= 0.001). Body fat % was also significant in group B as compared to group A (P=0.001) and in group C as compared to both group B and A (r=0.550; P=0.001). Waist circumference (r=0.567; P=0.001) and Hip circumference (r=0.470; P=0.001) showed a positive correlation with serum chemerin concentration, After adjustment for age and BMI, body fat percentage (r=0.280 P=0.015), hip circumference (r=0.246; P=0.021) and waist hip ratio (r=0.187; P=0.031) were found to be independently associated with chemerin level (Table 2).

Table 2: Correlation of serum chemerin levels with body fat parameters.

Phenotype	Unadjusted (r)	Adjusted for Age and BMI (r)	P-value
Age (Year)	0.123	-	-
BMI	0.769**	-	-
Waist Circum (cm)	0.567**	0.022	0.841
Hip Circum (cm)	0.470**	0.246*	0.021
WHR	0.257*	0.187*	**0.031**
Body Fat (%)	0.550**	0.288*	**0.015**

Where: WHR (waist hip ratio), BMI (Body mass index)
* significant correlation whereby p<0.05
** significant correlation whereby p<0.01

DISCUSSION

The primary finding in this study identified a significantly increased serum amount of total chemerin in obese compared to lean subjects, which is related to the amount of fat (expressed in percentage) in the study subjects. Chemerin noticeably demonstrated a strong positive correlation with increasing weight, BMI, waist and hip circumference and body fat percentage but a weak association with waist hip ratio, in a healthy disease free population, integrating a new data set for body fat percentage and its positive relation with serum chemerin levels.

An increased expression of both chemerin and CMKLR1 in mice fed on high-fat diet, also depicts a significant correlation of circulating chemerin levels with BMI similar to our results[10,11]. Similarly other studies conducted on children, and obese adults depicts an increased chemerin level of about 30% in obese as compared to lean controls, correlating positively with subcutaneous and omental adipose tissue, BMI, WHR, and skinfold thickness[12-14]. These findings are in accordance with the findings of our study. After adjusting for age and BMI, hip circumference, waist hip ratio and body fat percentage remained independently associated with chemerin. This finding is tempting to speculate that chemerin levels may be used as a screening tool to measure adiposity in individuals, since it has an independent relation with body fat mass, as BMI gives a rough estimate and is dependent on the state of hydration, clothing, time of day and muscularity of an individual[15].

In this study, no significant correlations were observed between chemerin levels and age in our study population, which is in accordance with a study where non-significant association with age and serum chemerin levels were seen in a group of pregnant females.[16] While Landgraf *et al*.,[14] reported no correlation between gender and chemerin levels

but a negative relation with age and circulating levels especially in boys. This difference may be due to the variations in culture and environmental settings.

Obesity in childhood and adolescence is increasing in developing countries around the world. In Pakistan the disease pattern currently in transition from acute and infectious diseases to an increasing burden of chronic disease, obesity being one of their major factors. Pakistan is ranked 165 (out of 194 countries) in terms of its overweight population[17]. Since, chemerin has been recently described to be secreted from mature adipocytes and the circulating levels of chemerin in human plasma increased with obesity, also depicted by the finding of our study, which may suggest that chemerin expression may reflect the state of differentiation of adipocytes, adipocytes cell size or total body fat mass[4,18]. Collectively, chemerin may provide interesting link between obesity, its classification and identification of obesity related co-morbidities in humans. The mechanisms regulating chemerin expression is still to be explored, even though a relationship of elevated serum levels in obesity has been suggested. Further studies are required to validate.

CONCLUSION

In the present study significant increase in serum chemerin concentration in obese and overweight subjects is observed. Elevated serum chemerin concentration was positively correlated with body fat percentage, waist and hip circumference proportional to the degree of obesity. These findings therefore suggest that the circulating chemerin levels can be used as a screening marker of overall fat mass of an individual.

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