Association of Adipocyte Fatty Acid–Binding Protein (FABP4) Level with Obesity in Women

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Abstract

Adipocyte Fatty Acid–Binding Protein(FABP 4) is produced by mature adipocytes, cytoplasmic lipid protein carrier, 132 amino acid and secretion increases during adipogenesis. Chemerin is adipocytokine anewly discovered novel adipokine that regulates adipocyte metabolism and adipogenesis, is The aim of this study is to investigated the relationship of chemerin and FABP4 level with obesity and identifing the usefulness of waist circumference (WC), hip circumference , waist-to-hip ratio (WHR), body mass index (BMI),, and body fat percentage(BF%) in screening obesity . Anthropometric data were collected for 180 healthy women with an age range 35-60 years, divided into four groups due to body mass index: normalweight (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2) , obese (30-39.9 kg/m^2) and morbid(≥ 40 kg/m^2).

The results revealed that FABP4 and Chemerin circulating concentration were significantly increased ($P<0.01$) in healthy morbid and obese adult women when compared with lean healthy (normal and over weight women) also significant increase of A-FABP and Chemerin with the body mass index (BMI), waist hip ratio, hip circumference, waist circumference, and with BF percentage. According to these finding suggest that the circulating chemerin and A-FABP levels can be used as Prediction marker of overall fat mass and obesity in women.

Keyword: FABP4 , BMI ,WHR,WC,Obesity.

الخلاصة

الحامض الدهني المرتبط بالبروتين الرابع (FABp4) هو ناقل الدهن السايتوبلازمي يتكون من 132 حامض أميني وينتج من الخلايا الدهنيه الناضجة ويزداد إفرازه خلال تكوين الدهون . الكمرين هو سايتوكين دهني مكتشف حديثا له دور في تنظيم ايض الدهون وتكوينها.

هدفت هذه الدراسة لمعرفة العلاقة بين مستوى الكمرين والحامض الدهني المرتبط بالبروتين الرابع (FABP4) مع السمنة في النساء ومعرفة محيط الخصر والورك ودليل كتلة الجسم ونسبة محيط الخصر إلى الورك وكذلك النسبة المئوية للدهون الجسمية في فحص السمنة .

جمعت عينات الدراسة من180 امرأة سليمة تراوحت أعمارهن بين 35 –60 سنه ,قسمت على أربعة مجاميع طبقا لدليل كتلة الجسم : وزن طبيعي (18.5–24.9)كغم /م2 ,وزن زائد (25–29.9)كغم /م2 , سمين (30–39.9)كغم /م2 والبدناء أكثر من (40)كغم /م2

بينت النتائج زياده معنويه ($P<0.01$) في تركيز الكمرين و FABP4 عند البدناء والنساء السمينات مقارنة بالنساء ذات الوزن الطبيعي , وكذلك زياده معنويه في تركيز الكمرين و FABP4 مع مؤشر كتلة الجسم ومحيط الخصر والورك والنسبة المئوية لدهون الجسم .

أشارت النتائج إمكانية استخدام الكمرين و A–FABP4 كمؤشر للتنبؤ لكتلة الدهون الإجمالية والسمنة في النساء.

الكلمات المفتاحية :,الحامض الدهني المرتبط بالبروتين الرابع , دليل كتلة الجسم, نسبة الخصر– الورك, محيط الخصر, االسمنة.

Introduction

Obesity reflects the excessive enlargement of adipose tissue, defined as a body mass index (BMI) $\geq 30\ kg/m^2$ (Haslam *et al*., 2006), is either Brown adipose tissue (BAT) or white adipose tissue (WAT), an importance on undesirability of white adipose tissue (WAT) result from The growing concern to obesity. The conservative vision of adipose tissues (AT) as a passive storage to energy is non applicable. They secrete and express a bioactive peptides variety, known as adipokines, which regulates systemic processes and adipocyte biology like nutrient metabolism, food intake, inflammation and reproduction (Wise , 2004; Trayhurn and Beattie , 2001).

Anthropometric indices, such as BMI, hip circumference, waist circumference, body fat percentage BF% and WHR are usually used a instruments for measuring obesity because their low cost and simplicity , in addition to their strong association with percentage body fat PBF (Caprio,2006; Paniagua *et al*., 2008). Anthropometric indices WC and WHR are used as methods to limit the lipid developing in the abdominal area of the body, while BMI and PBF are anthropometric indices usually used to limit the lipid in all the body (Kuczmarski *et al*., 2002) Chemerin, is a chemoattractant protein secreted as prochemerin, is an inactive shape and is converted to the active form by coagulation serine proteases and inflammation during cleavage of the C-terminal (Zabel *et al*., 2005; Song *et al*., 2010).

Chemerin is involved in an autocrine / paracrine signaling to the stimulation of adipocyte differentiation and lipolysis (Bozaoglu *et al*., 2007). Fatima *et al*.,(2013) showed that serum chemerin cocentrations were significantly increased in adult obese with body mass index of more than25 kg/m^2 compared with the body mass index of lower than 25 kg/m^2, Serum chemerin has been revealed to be positively related to waist circumference and hip circumference (Li *et al*., 2014).

A-FABP is produced by dendritic cells, macrophages and mature adipocytes. Its expression and secretion rise through adipogenesis (Rolph *et al*., 2006; Furuhashi *et al*., 2008) Serum FABP4 concentration were significantly increased in obese subjects (Xu *et al*., 2006)**.** FABP4 was released into the blood stream from adipocytes. Recently they have described the regulatory functions of A-FABP in glucose and lipid metabolism (Furuhashi *et al*., 2008; Karakas *et al*., 2009) . In the study of Hyun *et al*., (2009)which included mildly obese or overweight patients, FABP4 was closely related to MS and obesity

Materials and Methods

The current study was done on 180 healthy women who were between (35-60) years of age .Anthropometric data were collected from women have no previous history of diabetes, cardiovascular disease, hypertension, dyslipidemia and non Smokers. According to The BMI the contributors were separated into four groups due to BMI classification was as follows: normal (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2) , obese (30-39.9 kg/m^2) and morbid($\geq 40\ kg/m^2$) (Garrow and Webster, 1985). Therefore, 44 normal, 44 overweight , 46 obese and 46morbid women participated in this study .Waist to hip ratio was calculated By dividing the waist circumference to hip circumference (Garrow and Webster, 1985). The hip and waist circumference as described in the WHO (2008) was measured. The body fat percentage BF% was determined by the formula :

BF% = (1.20×BMI) + (0.23×Age) – (10.8×gender) – 5.4

Where sex was 0 for females and 1 for males. The equation was devised by Slaughter *et al*., (1988) and Deurenberg *et al*., (1991). Samples of blood were collected in the morning, levels of serum chemerin were measured with ELISA Kit was supplied by Ray Biotech, Inc. U.S.A. FABP-4 Serum levels were measured with ELISA Kit supplied by Elabscience Biotechnology Co., Ltd

Statistical Analysis

The statistical analysis was done by SPSS package (SPSS, Version 17). The means of the groups and Standard Error were compared . Pearson multivariate ANOVA and correlation was used for the comparison between groups for the measured parameters. These was statistically analyzed at levels $P<0.05$ and $P<0.01$.

Result

Circulating chemerin and A- FABP levels increased significantly ($P<0.01$) in obese and morbid group when compared normal and overweight groups and insignificant increase was observed between normal weight and overweight groups. Also BMI, hip circumference ,waist circumference and BF % were significantly increased ($P<0.01$) in obese groups and morbid group as compared to normalweight and over weight group. Insignificantly increase was present among normal weight groups and overweight group, waist-to-hip ratio (WHR) . (Table 1)

The results revealed a significantly positive correlation between level of serum chemerin with other measured parameters that showed in Figure (1) A: the result revealed a significantly positive correlation ($P<0.01$) between chemerin and BMI of obesity, ($r =0.820$). B: A significant positive correlation ($P<0.01$) between chemerin and waist circumference (WC) , ($r =0.609$) C: A significantly positive correlation ($P<0.01$) between chemerin and hip circumference , ($r =0.607$) . D : A significantly positive correlation ($P=0.162$) between chemerin and WHR($r =0.152$) . E : A significantly positive correlation ($P<0.01$) between chemerin and FB% for obese, ($r=0.834$) .

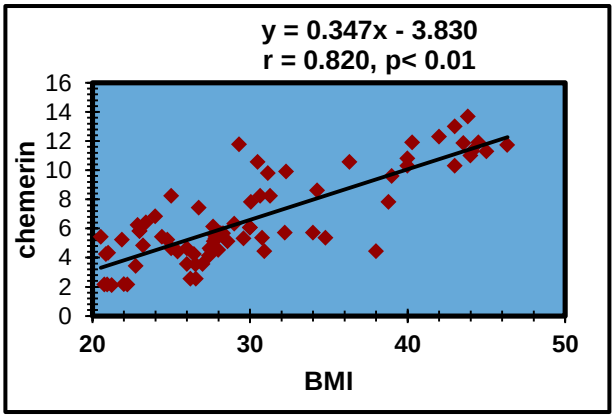
Also in figure (2) revealed significant positive correlation between level of serum FBP4 with other measured parameters:-A: A positive significant correlation ($P<0.01$) between FABP4 and BMI of obesity, ($r =0.824$).B: A significantly positive correlation ($P<0.01$) between FABP4 and waist circumference (WC) , ($r =0.683$) C: A significant positive correlation ($P<0.01$)between FABP4 and hip circumference , ($r =0.667$) . D : The existence of a positive significant correlation ($P=0.152$) between FABP4 and WHR, ($r =0.060$) . E : A significantly positive correlation ($P<0.01$)between FABP4 and FB% for obese subject, ($r=0.749$) .

Table(1): FABP4 and Chemerin levels and other anthropometric parameters measurments indifferent groups .

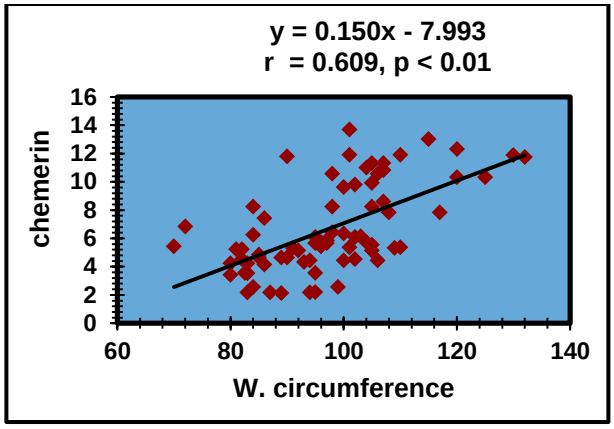
Parameters / BMI value	Chemerin (ng/ml)	FABP4 (ng/ml)	BMI ($Kg/m^{2)}$	Waist circum (cm)	Hip circum (cm)	WHR	Body fat %
Normal weight(18-24.9)	4.382 ± 0.560	4.563 ±0.270	23.388 ±0.512	85.474 ±3.105	100.11 ±2.463	0.853 ±0.0296	25.95 ±0.705
Overweight (25-29.9)	4.638 ±0.368	5.208 ±0.337	25.988 ±0.303	90.600 ±2.741	106.700 ±2.300	0.849 ±0.291	28.011 ±0.530
Obese weight(30-39.9)	7.581 ±0.539 *	9.775 ±0.520 *	32.515 ±0.676 *	102.77 ±1.467 *	113.833 ±2.032 *	0.903 ±0.012	35.151 ±0.232 *
Morbid weight (over 40)	11.534 ±0.512 **	16.918 ±3.115 **	43.468 ±0.836 **	119.166 ±5.147 **	125.333 ±3.565 **	0.950 ±0.027	41.523 ±0.615 **
L.S.D	1.720	2.959	3.057	7.966	7.582	0.201	4.203

(*) ($p<0.05$) compared between normal , overweight to obese .

(**) ($p<0.01$) when compared to morbid weight subjects. Where: BMI (body mass index), BF % (body fat percentage),WHR (waist hip ratio).



(A)



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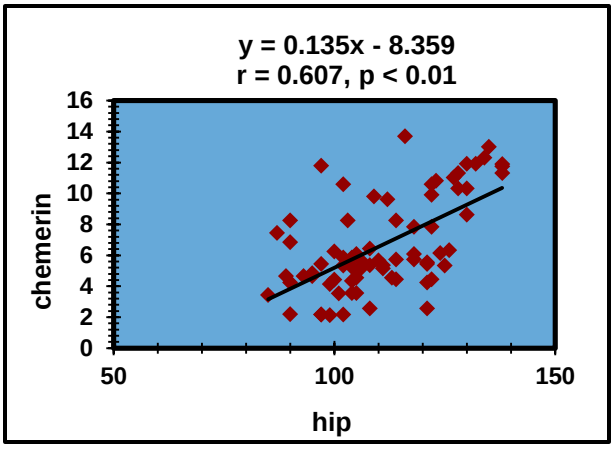

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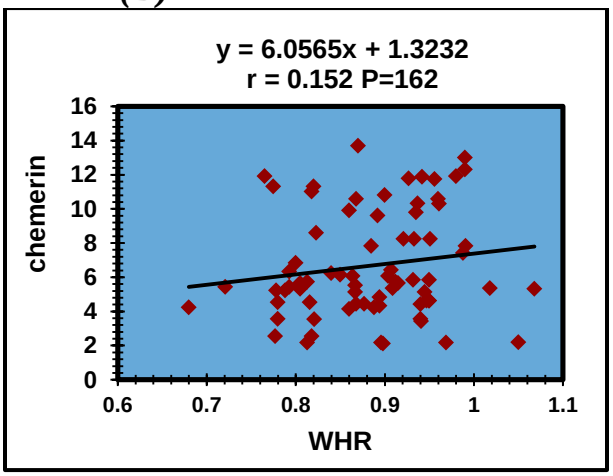

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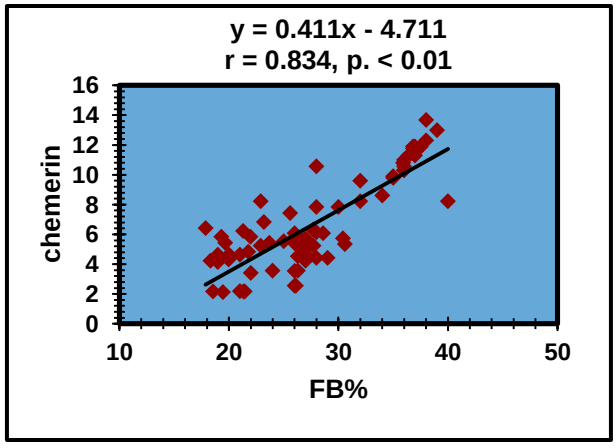
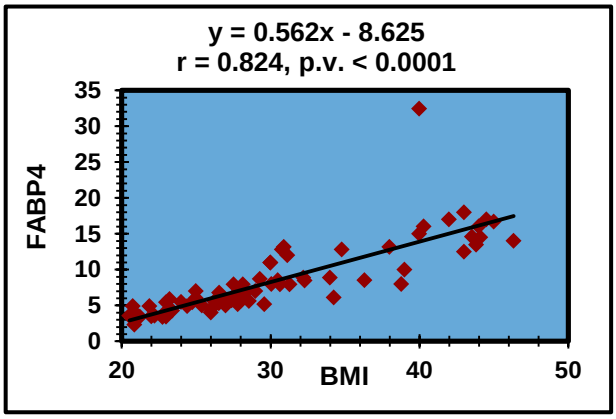


(E)

Figure (1): Correlation between the levels of circulating chemerin and other measured criteria:- **A:** Correlation among BMI and concentration of serum chemerin. **B:** Correlation between W. circumference and serum chemerin level. **C:** Correlation between hip and level of serum chemerin. **D:** Correlation between WHR and level of serum chemerin. E: Correlation between FB% and serum chemerin level.

Where: BMI(Body mass Index),WHR(waist-hip-ratio), and FB%(fat body percentage).



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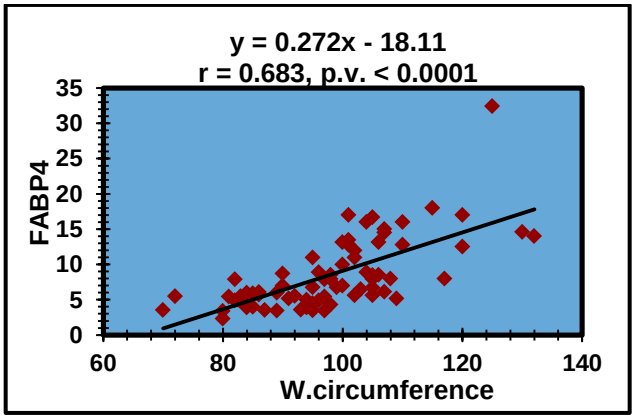

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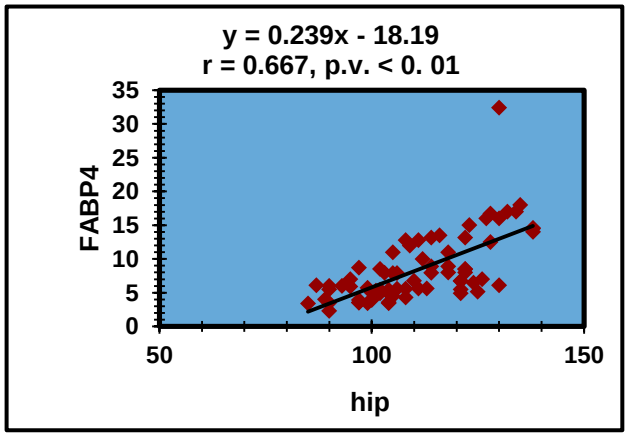

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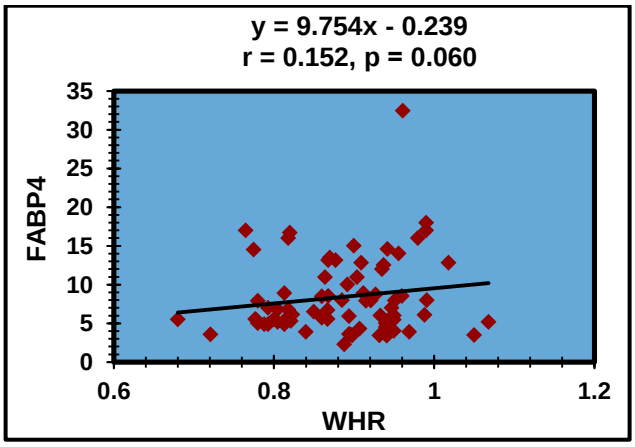

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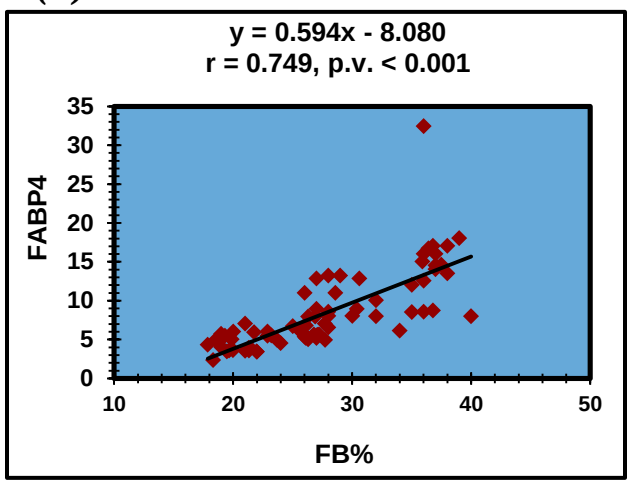

(E)

Figure (2): Correlation between the levels of serum FABP4 with other measured criteria :-**A:** Correlation among BMI and level of serum FABP4. **B:** Correlation between W. circumference and serum FABP4 level. **C:** Correlation between hip and serum FABP4 level. **D:** Correlation between WHR and serum FABP4 level. E: Correlation between FB% and serum FABP4 level.

Where: BMI(Body mass Index) ,WHR (waist-hip-ratio), and FB%(fat body percentage)

Discussion

In the present study, a relationship between chemerin and FABP4 in obese women was found significant increase of chemerin and FABP-4 levels in serum of obese women as well as in morbid weight women compared to normal and overweight women was observed , which is maybe due to the role of chemerin and FABP-4 in the evolution of obesity, and positive correlation with increasing hip circumference ,waist circumference , BMI and body fat percentage but a weak association with waist hip ratio.

This results are in agreement with Alfadda *et al*., (2012) and Kohan *et al*., (2014) who found that the expression of circulating chemerin was elevated in obesity and the level of serum chemerin was associated with BMI and obesity. These findings may suggest that chemerin could play an important role in the obesity pathophysiology,especially in women.

Recent findings strongly suggest that (WAT) serves as a target for autocrine /paracrine chemerin signaling and secretion.The chemerin regulate adipogenesis in adipocytes of mice and humans.Expression of chemerin in (WAT) is much greater than in (BAT) (Goralski *et al*., 2007) . Knockdown of chemerin largely revokes differentiation of an adipocyte, Thus chemerin is important in early different processes and may regulate or contribute to critical initial events in adipogenesis. Recent results also refer to that chemerin could have a significant biological role in the formation of white adipose tissue (WAT) through normal evolution and in pathological states such as obesity (Bozaoglu *et al*., 2007 ; Goralski *et al*., 2007**)**

On the other hand other studies conducted on obese adults describe an increment of chemerin level of about 30% in obese, and in morbid women as compared to lean control. The level of serum chemerin was associated positively with omental ,subcutaneous adipose tissue, WHR and BMI (Deurenberg, 1991). These findings are in accordance with the findings of (Shehata *et al*., 2015*)*. Study waist circumference, BMI, hip circumference , waist, BF% and hip ratio remained independently connected with chemerin. This finding is alluring to guess that level of chemerin may be used as a screening tool to measure obesity. This result is in agreement with the previous study of Osman *et al*., (2012) and Yoo *et al*.,(2012). The circulating chemerin concentration was incraesed significantly in obese as compared with non-obese . In addition, statistical significant differences of chemerin level were observed in WC and BMI. The results of the current study shown that mean circulating chemerin concentration was significantly increased in obese subject as compared with non-obese .

The current study revealed the elevation of A-FABP in serum of obese weight as well as in morbid weight women subjects. It significantly increased compared to normal weight and overweight females .This study agree with Terra, (2011)who found a relationship between FABP4 and obesity. In morbidly obese women, level of plasma FABP4 were significantly greater than in non obese women, these level were positively associated with

body mass index. High levels of circulating FABP4 were related with the A-*FABP* mRNA expression in

visceral adipose tissue and with its serum level in morbidly women. Also these results are in agreement with Xu *et al*., (2005) , Rosenbaum *et al*., (2011) and Hammod *et al*., (2016) who found positively relationship between circulating FABP4 concentrations and indicators of obesity (body mass index, waist-to-hip ratio, fat percentage and waist circumference) . Adipose tissue which consists of macrophages and adipocytes, is perhaps the main contributor of FABP4 secreted into the serum. Reinehr *et al*., (2007)showed that there was a positive association between FABP4 levels and adiposity degrees as estimated by the body fat percentage.

Our study shows for the first time that FABP4 is a serum adiposity biomarker in humans,a resulte which support the central role of FABP4 in obesity. Also according to our result the Chemerin may provide an interesting association with obesity.

Conclusion

In the present study there is a significant increases in serum FABP4 and Chemerin concentrations in obese and morbid women group. Elevated serum FABP4 and Chemerin concentration were positively correlated with body fat percentage, waist and hip circumference proportional to the degree of obesity. These findings, therefore ,suggested that the circulating FABP4 and Chemerin levels can be used as a screening marker of overall fat mass in women.

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