

The Effect of Body Mass Index and Serum Estradiol on Serum Prostatic Specific Antigen in Normal Iraqi Men

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Abstract

Background: Prostatic Specific Antigen (PSA) is one of the promising tumor markers of this decade. PSA level correlates positively with age and prostatic volume, and age-adjusted PSA values and the PSA density can be used to more precisely screen for prostatic carcinoma.

Aim of the Study: Is to identify the effect of body mass index and serum estradiol level on serum PSA in normal men in Salahaldin province.

Subjects & Methods: A cross-sectional controlled study was conducted during the body mass index from the 1st of February 2009 to the end of August 2009 in Salahaldin province. 50 males with BMI ≥ 30 [obese group or group (1)] and 50 males with BMI ≥ 18.5 and < 25 [control group or group (2)] were enrolled in this study. Subjects were collected from Tikrit Teaching Hospital. All subjects were within the same age group between 40-50 years of age. Total serum PSA, serum estradiol, body mass index, and prostatic volume measurement were done for every person in the study. A P value of less than 0.05 was considered significant. Analysis was performed by SPSS software, version 17.0 for windows (SPSS, Chicago, Illinois, USA).

Results: The mean age of group (1) was 44 ± 2.8 years; while for group (2) was 45.4 ± 2 years ($P=0.31$). Also no significant statistical difference was identified between groups concerning prostatic volume, mean 19.9 ± 3.6 ml for group (1) and mean volume was 20.7 ± 3.4 ml for group (2) ($P=0.48$). Mean BMI for group (1) 34.85 ± 3.7 kg/m² (CI 33.8-35.9) was significantly higher than that of group (2), 21.9 ± 2.78 kg/m² (CI 21.4-22.42), $P < 0.0001$. Mean PSA level for group (2) was significantly higher than that of group (1), 3 ± 0.7 ng/ml (CI 2.78-3.2), 2.28 ± 0.89 ng/ml (CI 2-2.53) respectively, $P < 0.001$. Mean estradiol level in group (1) was 91.6 ± 20.5 pg/ml (CI 85.8-97.5), whereas it was 57.5 ± 22.4 pg/ml (CI 51.1-63.9) for group (2), $P < 0.0001$. The bivariate correlation showed strong inverse relation between PSA level and BMI (Pearson $r=0.635$, $P < 0.01$). PSA level had strong inverse relation with estradiol level, (Pearson $r=0.705$, $P < 0.001$). On applying linear regression model, again inverse relations with strong linear trend between PSA level and both BMI and estradiol level. The increase in BMI and estradiol level was associated with considerable decrease in PSA level.

Conclusions: BMI and serum Estradiol had an inverse relationship with serum PSA level. Further studies with larger number of subjects are crucial to assess the specific biological pathway in relation between PSA and BMI.

Keywords: Prostatic specific antigen, Body mass index.

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Introduction

Prostatic Specific Antigen (PSA) is one of the promising tumor markers of this decade. It is one of the few organ-specific tumor markers. Prostatic cancer is one of the leading cancers in older men. When identified early (organ confined), it is potentially curable by radical prostatectomy ^[1].

Hera and colleagues in 1971 discovered PSA and entitled it γ -seminoprotein ^[2]. In 1979, Wang and co-workers purified a protein from prostatic tissue and called it prostatic specific antigen. PSA is found in normal, benign, hyperplastic, and malignant prostatic tissues ^[1].

PSA level correlates positively with age and prostatic volume, and age-adjusted PSA values and the PSA density can be used to more precisely screen for prostatic carcinoma ^[3, 4].

Obesity is a major public health problem in the western world and is linked to chronic conditions such as cancer ^[5, 6]. Although some studies report an enhanced risk of prostate carcinoma among obese and overweight men ^[7-11], others indicate little or no association ^[12-14]. More dependable findings have linked obesity with prostate carcinoma mortality, advanced stage, and higher Gleason grade ^[9-11].

Many studies reported that there is a relationship between obesity and serum PSA level ^[15-19]. Some stated that obesity is associated with lower androgen levels and higher estrogen concentration, and these changes in obese men might affect the production rate of PSA ^[20, 21]. However, most of previous studies on the association between serum PSA and obesity have been conducted in the United States. To my knowledge, no study concerning the association between PSA and obesity was conducted in Iraq, and the aim of this present study is to identify the relationship between body mass index, serum estradiol level, and serum PSA in normal men in Salahaldin province.

Subjects and Methods

A cross-sectional controlled study was conducted during the period from the 1st of February 2009 to the end of August 2009 in Salahaldin province. 50 males with BMI ≥ 30 [or group (1)] and 50 males with BMI ≥ 18.5 and < 25 ^[22] [control group or group (2)] were enrolled in this study. Subjects were collected from Tikrit teaching hospital with the aid of specialized urologist. All subjects were within the same age group - between 40-50 years of age - to minimize the effect of age on other parameters. Exclusion criteria were presence of prostatic disease, previous prostatic surgery, patient with hormonal therapy, and total PSA level $> 4\text{ng/ml}$.

Total serum PSA, serum estradiol, body mass index, and prostatic volume measurement were done for every person in the study. Total serum PSA was analyzed by Eliza using Alpha Diagnostic International kit with [intra-assay coefficient of variation (CV) 7.8-12% and inter-assay CV 7-10% (normal value up to 4 ng/ml)]. Serum Estradiol was measured by Eliza using Alpha Diagnostic International kit with [intra-assay CV 7.54-12.2% and inter-assay CV 8.16-12.05% (normal value 15-100 pg/ml)]. Prostatic volume measurement was implemented by abdominal U/S done by the same specialized radiologist.

Since all study parameters had normal statistical distribution confirmed by normality plots and tests, Independent Samples t Test was used to show the difference between the two groups. Bivariate Pearson's correlation coefficients were calculated to test the presence and the strength of relationships among parameters. The relations between PSA (dependent variable) and other parameters were examined by linear regression model. A P value of less than 0.05 was considered significant. Analysis was performed by SPSS software, version 17.0 for windows (SPSS, Chicago, Illinois, USA).

Table (1) The mean + SD of age, prostatic volume, BMI, PSA level, and estradiol level of both groups.

Parameters	Group 1 (obese male) n=50			Group 2 (non-obese male) n=50			P value
	Mean \pm SD	95 % CI for mean		Mean \pm SD	95 % CI for mean		
		lower	upper		lower	upper	
Age (years)	44 \pm 2.8	43.2	44.8	45.4 \pm 2.0	44.8	45.95	0.31
Prostatic volume (ml)	19.9 \pm 3.6	18.9	20.87	20.7 \pm 3.4	19.7	21.7	0.48
BMI (kg/m ²)	34.85 \pm 3.7	33.8	35.9	21.9 \pm 2.78	21.4	22.42	< 0.0001
PSA (ng/ml)	2.28 \pm 0.89	2.0	2.53	3.0 \pm 0.7	2.78	3.2	< 0.001
Estradiol (pg/ml)	91.6 \pm 20.5	85.8	97.5	57.5 \pm 22.4	51.1	63.9	< 0.0001

Table (2) The bivariate correlation among PSA, Estradiol, and BMI.

Pearson Correlation				
Parameters		PSA	ESTRADIOL	BMI
PSA	Pearson Correlation	1.000	-.705(**)	-.635(**)
	P Value	.	<0.001	<0.01
ESTRADIOL	Pearson Correlation	-.705(**)	1.000	.758(**)
	P Value	<0.001	.	<0.001
BMI	Pearson Correlation	-.635(**)	.758(**)	1.000
	P Value	<0.01	<0.001	.

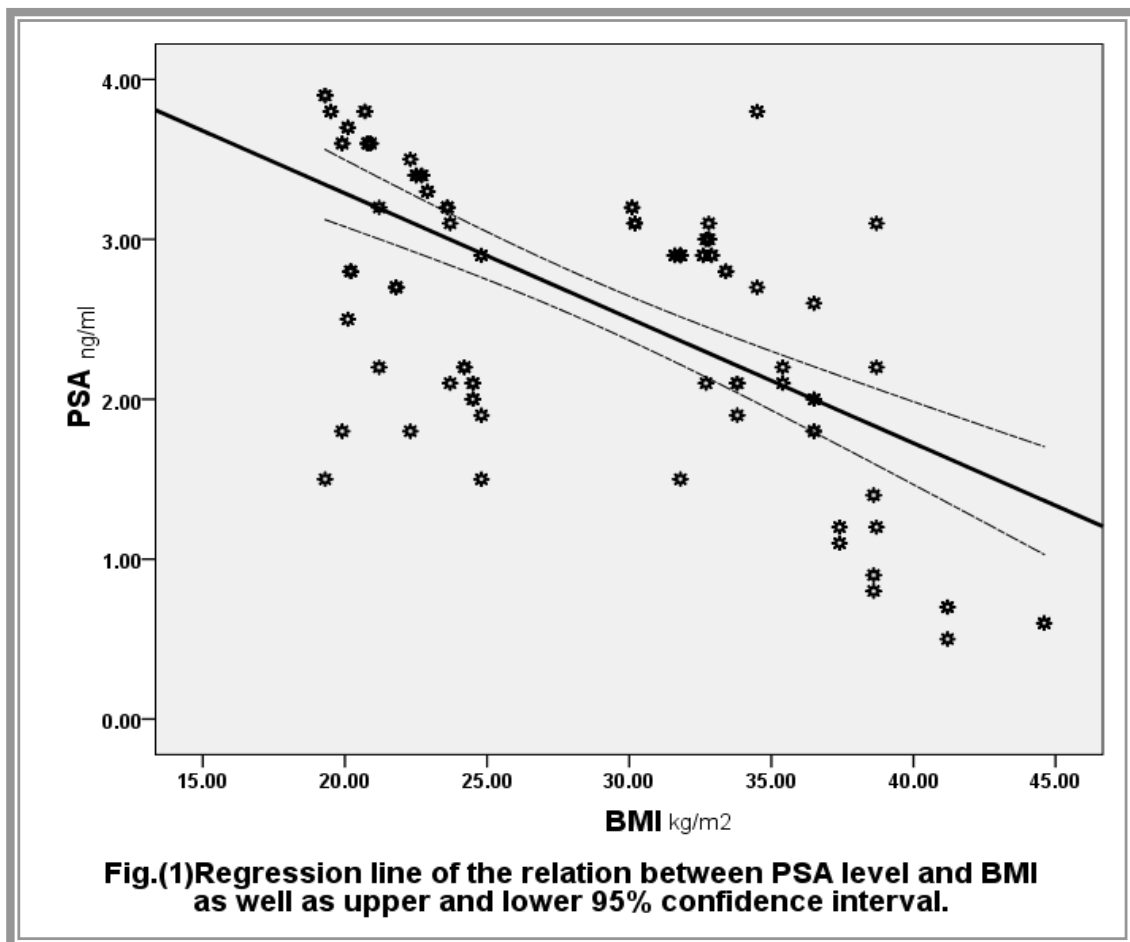
Mean estradiol level in group (1) was 91.6 \pm 20.5 pg/ml (CI 85.8-97.5), whereas it was 57.5 \pm 22.4 pg/ml (CI 51.1-63.9) for group (2), P< 0.0001.

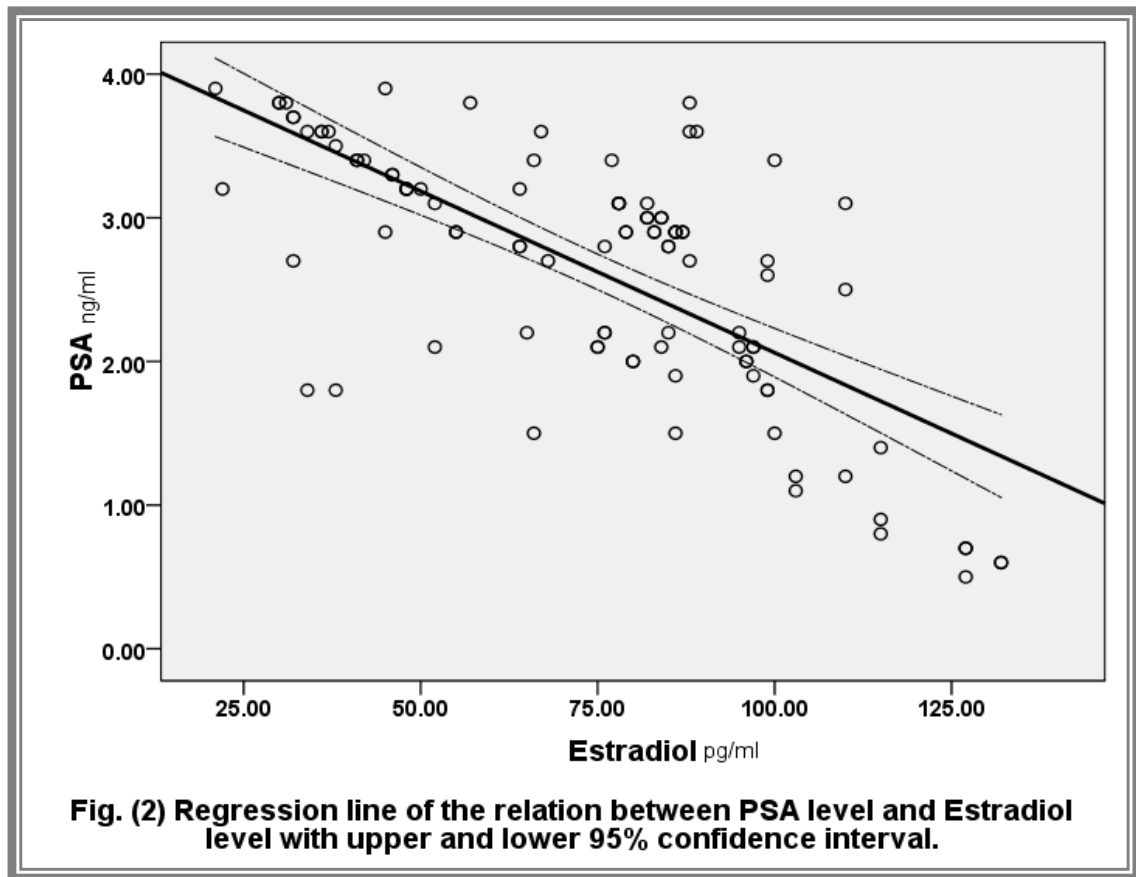
Results

The mean \pm SD of age, prostatic size, BMI, PSA level, and estradiol level of both groups are shown in table (1). The mean age of group (1) was 44 ± 2.8 years (confidence interval (CI) 43.2-44.8); while for group (2) was 45.4 ± 2 years (CI 44.8-45.95). No statistical difference was observed between groups regarding age ($P=0.31$). Also no significant statistical difference was identified between groups concerning prostatic volume, mean 19.9 ± 3.6 ml (CI 18.9-20.87) for group (1) and mean volume was 20.7 ± 3.4 ml (19.7-21.7) for group (2) ($P=0.48$). Mean BMI for group (1) 34.85 ± 3.7 kg/m² (CI 33.8-35.9) was significantly higher than that of group (2), 21.9 ± 2.78 kg/m² (CI 21.4-22.42), $P < 0.0001$. Mean PSA level for group (2) was significantly higher than that of group (1), 3 ± 0.7 ng/ml (CI 2.78-3.2), 2.28 ± 0.89 ng/ml (CI 2-2.53) respectively, $P < 0.001$.

The bivariate correlation showed strong inverse relation between PSA level and BMI (Pearson $r=0.635$, $P < 0.01$). PSA level had strong inverse relation with estradiol level, (Pearson $r=0.705$, $P < 0.001$). Quite the opposite, a strong positive relation was identified between BMI and estradiol level (Pearson $r=0.758$, $P < 0.001$) Table (2). No significant relations were found among age, prostatic volume and other parameters.

On applying linear regression model (PSA was the dependent variable), again inverse relations with strong linear trend between PSA level and both BMI and estradiol level (P for linear trend < 0.01 and < 0.001 respectively). The increase in BMI and estradiol level was associated with considerable decrease in PSA level. Figures 1 and 2.





Discussion

It is well known that PSA level is affected by prostatic volume and the age of patient. But the results of the prostate cancer prevention trial have highlighted determination bias in prostate carcinoma detection. Because PSA is the primary reason for prostatic biopsy and subsequent prostatic carcinoma diagnosis, it is essential to set up the effects of additional factors on serum PSA level [23]. Obesity and serum estradiol level are factors that studied in this study.

In this present study, it was clearly evident that obese men have lower PSA level than normal men ($P < 0.001$). Also BMI and estradiol level showed strong negative linear association with PSA (P for linear trend < 0.01 and < 0.001 respectively).

These differences can be attributed to the fact that a greater BMI is associated with more plasma volume and with lower serum PSA level in patient with prostatic carcinoma [19].

Furthermore, Werny et al. [16] found that increased total body water was associated with moderately lower PSA levels in a population-based study. Hence the inverse relationship between PSA level and BMI can be explained by obesity related plasma hemodilution. The outcome of this study concerning the inverse relationship between PSA level and BMI was similar to what reported by other researches [15-19].

Another possible and important explanation for the inverse relation between PSA and BMI is that obesity is associated with increased serum estradiol level as this was confirmed in this study. Serum estradiol was markedly higher in obese than non-obese men in this study ($P < 0.0001$).

In addition obesity is associated with decreased serum androgen level, and these endocrine alterations in obese men may affect the production rate of PSA from prostate gland [20, 21].

The limitation of this study was that a small number of subjects was enrolled. However it can be declared that the opportunity of obesity to influence PSA level - in addition to age of patient and prostatic volume - has to be considered. Further studies with larger number of subjects and wider age groups can yield better results concerning the specific biological pathway in the relation between PSA level and BMI.

Conclusions & Recommendations:

BMI and serum Estradiol level had an inverse relationship with serum PSA level. Further studies with a larger number of subjects are crucial to assess the specific biological pathway in the relation between PSA and BMI.

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