**Effect of body mass index on PSA in northeast Mexican patients**


**Service de Urología, Hospital Universitario Dr. José E. González, UANL, Monterrey, NL, Mexico**

Received 26 December 2011; accepted 11 January 2012
Available online 26 September 2012

**KEYWORDS**
Body mass index; Prostate specific antigen; Prostate cancer; Overweight; Obesity

**Abstract**
Objective: To evaluate the effect of body mass index (BMI) on PSA in northeast Mexican patients included in prostate cancer (PCa) early detection screening campaigns offered by our institution.

*Materials and methods:* One hundred and ninety seven patients came voluntarily to our PCa early detection screening campaigns. Exclusion criteria: PSA >10 ng/dl, patients on 5-α reductase inhibitors or hormonal replacement. Overweight and obesity were considered when BMI was between 25-29.9 and ≥30 kg/m² respectively. Simple linear and multiple regressions were used in the statistical analysis. Mean and standard deviation were utilized to evaluate spread and normal distribution. p Values <0.05 were considered statistically significant.

**Results:** One hundred and fifty-two patients were included in this study. Forty-four percent (83) and 30.3% (46) presented with overweight and obesity, respectively. Mean BMI was 28.16 kg/m² (SD 1.77). A statistically significant negative effect of BMI on PSA was observed in the linear regression. This effect persisted when adjusted for age in the multiple regression model. A decrease of 0.085 ng/dl for every unit of BMI (p=0.001) was observed in the simple linear regression. This value was 0.07 in the multiple regression (p=0.006).

**Conclusions:** A higher negative effect of BMI on PSA was found in comparison to published literature. A higher proportion of patients with BMI >25 kg/m² than the national mean was observed. A multicentric national study is needed in order to challenge these results.

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**Efecto del índice de masa corporal en los niveles séricos del antígeno prostático específico en pacientes del Noroeste de México**

**Resumen**

Objetivo: Evaluar y corroborar el efecto del índice de masa corporal (IMC) sobre el antígeno prostático específico (PSA) en pacientes del Noroeste de México que acuden a nuestras instalaciones para la detección oportuna del cáncer de próstata (CaP).

*Material y métodos:* Se incluyeron prospectivamente 197 pacientes que acudieron voluntariamente a campañas de detección oportuna de CaP, y aquellos que acudieron espontáneamente a
Introduction

PCa is the most common malignancy in men. Prostate-specific antigen (PSA) continues to have an important role in the detection and monitoring of patients with PCa.\textsuperscript{1-5} The inversely proportional relation of the PSA and BMI has been described extensively in the literature; however, some studies do not have an appropriate statistical design, besides, this effect has not been corroborated in our population. Moreover, the prevalence of overweight and obesity in Mexico and Latin American countries has been increasing.\textsuperscript{6-8} The aim of this study is to corroborate the effect of BMI on PSA in patients in northeast Mexico who come to our facilities for early detection of PCa.

Materials and methods

Patients

We prospectively included patients who volunteered for campaigns for early detection of PCa and those who did it spontaneously in our practice. A total of 197 patients were recruited. We excluded patients with PSA > 10 ng/ml, those with intake of inhibitors of 5-α reductase or hormone treatments. The characteristics are shown in Table 1. Since it is an observational study and no invasive treatment was carried out, this work was not under consideration by the ethics committee of our institution.

Statistical analysis

The BMI was obtained by dividing the weight in kilograms by the height squared in meters. Overweight and obesity were considered when the BMI was between 25 - 29.9 and ≥ 30 kg/m\textsuperscript{2}, respectively. We used a simple linear regression and another one for the assessment of data from the observations using the MedCalc program version 11.1. The mean and standard deviation were used to assess the distribution of the sample. The observations were eliminated with atypical values (outliers) and the PSA variable was logarithmically transformed to meet all the criteria for the use of linear regression (normal distribution, homoscedasticity, etc.). The $p$ value < 0.05 was considered statistically significant.

Results

152 patients were included in this study. 85% of the population had overweight or obesity with contribution of 54.6% (83) and 30.3% (46), respectively. The mean BMI was 28.16 kg/m\textsuperscript{2} (SD: 1.77).

When evaluating the data with linear regression, we observed a negative trend in the reduction of the PSA as the BMI increased, which was statistically significant (Fig. 1). Furthermore, when adjusting for age in multiple regression, statistical significance was maintained (Table 2) in order to determine the estimated and the contribution of these factors, more reliably, in the PSA values where this decreases 0.085 units per BMI unit ($p$ value < 0.001) when it was evaluated in the linear regression and 0.070 when it was adjusted for age ($p$ value = 0.006).

Discussion

The relation between the PSA and the BMI has been evaluated in numerous studies, mainly North American.\textsuperscript{1,3-5} However, it is particularly relevant in our population, where
Table 2  Single and multiple linear regression.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimated</th>
<th>Standard error</th>
<th>CI 95%</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single linear regression</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.0417</td>
<td>0.0119</td>
<td>0.0182; 0.0652</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>BMI</td>
<td>−0.0856</td>
<td>0.0250</td>
<td>−0.1350; −0.0362</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Multiple regression</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>−0.1197</td>
<td>0.0250</td>
<td></td>
<td>0.006</td>
</tr>
<tr>
<td>Age</td>
<td>0.0345</td>
<td>0.0119</td>
<td></td>
<td>0.004</td>
</tr>
</tbody>
</table>

\[ F = 10.35; R^2 = 0.12; p \text{ value} < 0.001. \]

there is a high prevalence of overweight and obese people,\(^9\) to assess and confirm this effect. Lopez-Fontana et al.
assessed the effect of the PSA and diet on PCa; however,
the sample was very small and the conclusions were based on
an inappropriate statistical analysis.\(^10\) Pater et al.\(^7\) assessed
767 patients for finding the inversely proportional effect of
the PSA in the BMI, and adjusted it for age and race. However,
their study had statistical limitations, since only 0.8% of
the observations were explained by linear regression vs.
12% in our study according to the \(R^2\). In this study, we found
a decrease of 0.07 ng/dl of PSA for each unit of BMI, which is
almost twice what found by Pater et al. This might be due
to the fact that the above-mentioned study showed many
outliers, which were eliminated in the present study, avoiding
the statistical bias, logarithmically transforming the PSA
values for a normal distribution. An interesting fact is that
age gave the same value in both studies.

One of the most important biases in our study is that
it was conducted in patients who came to campaigns for
early detection of PCa and not in the general population;
i.e., some patients came after showing symptoms of
prostate growth. However, this type of population is the
closest to the one found in our daily practice. Another
missing datum in this study was assessment of PSA hemodilution
in obese patients, which has been mentioned in the
literature.\(^{1-3}\) Evaluation of prostate volume could not be
included, because not all the patients had this datum.

Beyond the findings presented in this article and that
described in the literature, the clinical significance of this
inversely proportional relation of the PSA and the BMI has
not yet been determined. Loeb et al. assessed this issue and
reported that the inverse effect of the BMI on the PSA is too
small to justify a change or adjustment in the biopsy
indication based on the BMI.\(^{11}\) The effect on our population
has not yet been established.

There is a high rate of obese men in Mexico. The estimation
and projection of obese people > 35 years in Mexico in
2010 was between 8 and 14 million people.\(^8\) The National
Survey of Health and Nutrition 2006\(^6\) mentions that 42.5%
of the male population was overweight, and about 24%
had obesity, which together account for about 67%, which
slightly contrasts with what is presented in this study, where
the rate of overweight and obesity is 85%.

Conclusions

This is the first study to assess the effect of the BMI on
the PSA in Mexican population. There is an inverse effect
of the BMI on the PSA slightly higher than that reported by
other authors. There is a higher proportion of overweight
and obese patients seeking prostate assessment in relation
to the national average. A national multicenter study to
verify these findings is required. The clinical implication of this
effect in our population is still unknown.

Conflict of interest

The authors declare that they have no conflict of interest.

References

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