

# Prostate specific antigen reference ranges in Saudi men

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## ABSTRACT

**Objectives:** The aim of this study is to find out the age-specific and population-specific values of prostate specific antigen (PSA) among Saudi men. Normal values for different age groups between 40 and 89 years will be obtained.

**Methods:** The study was conducted in King Fahd Hospital of the University, Al-Khobar, Kingdom of Saudi Arabia. The total free and percent free PSA were measured for Saudi men who were free of prostate cancer by digital rectal examination (DRE) and with PSA value of <4ng/ml. Transrectal ultrasonography and needle biopsy were performed in those with suspicious DRE or PSA >4ng/ml. A total of 567 cancer free Saudi men were included in this study. All men were divided into 5 groups; each 10 years interval starting from the age of 40 years.

**Results:** The mean values of total PSA were 0.87 for men 40-49 years, 1.36 for men 50-59 years, 1.81 for men 60-69 years, 2.32 for men 70-79 years and 2.36 for men 80-89 years. The percent free PSA was >30% in all age groups. When those with PSA <4ng/ml were considered, the percent free PSA was the same and only 16.6% of them had a ratio of 18%. The upper limit of normal PSA was near to that of Chinese and Korean.

**Conclusion:** Normal mean PSA values for Saudi men are lower than the reported values. The percent free PSA for men having PSA <4ng/ml is applicable. Racial variations of PSA values were observed.

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Serum prostate specific antigen (PSA) has now become a valuable tool for detecting unsuspected cases of prostate cancer.<sup>1</sup> The cutoff value of 4ng/ml is used to differentiate benign from malignant prostatic disease.<sup>2</sup> However, this cutoff value is not practical to generalize for all ages, and age-specific values should be considered.<sup>3</sup> It is generally accepted that PSA levels increase in correspondence with age increase.<sup>3-5</sup> Furthermore, many investigators stated that racial variations should be considered, and studies have been started to find out population specific ranges of PSA.<sup>3,6-11</sup> The present study was carried out to define age and population specific reference ranges of PSA among Saudi men. To our knowledge, this is the first study in the Kingdom of Saudi Arabia (KSA).

**Methods.** The study included Saudi males presenting to outpatient department or admitted to King Fahd Hospital of the University, Al-Khobar, KSA, for different reasons. Digital rectal examination (DRE), total PSA and free PSA were performed (using microparticle enzyme immunoassay method) to all patients. Percent free PSA was calculated. Transrectal ultrasonography and needle biopsy of the prostate were carried out if there was an abnormality by DRE or serum levels of PSA >4ng/ml. Patients with prostate cancer were excluded from the study. Prostate cancer free men were divided into 5 age groups, each of 10 years interval starting from the age of 40 years. The means of PSA values for all groups were compared using the analysis

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of variance test. Correlation coefficient test was used to test the correlation between the age and PSA levels. The 95th percentile was used to define the upper limit of normal values of PSA. The derived values of PSA were compared with those reported in previous studies.

**Results.** Five hundred and sixty-seven Saudi males were studied and divided into 5 age groups, each of them has a 10 years interval starting from the age of 40 years and ending by the age of 89 years (**Table 1**). The mean values of total, free and percent free PSA were measured for all age groups (**Figure 1**). There was a positive correlation between age increase and increase in total PSA ( $r=0.263$ ,  $P<0.01$ ), free PSA ( $r=0.351$ ,  $P<0.01$ ) and percent free PSA ( $r=0.236$ ,  $P<0.01$ ) (**Figures 2, 3 & 4**). The mean value of total PSA was 0.87 for the age 40-49 years, 1.36 for the age 50-59 years, 1.81 for the age 60-69 years, 2.32 for the age 70-79 years, and 2.36 for the age 80-89 years (**Table 1**). The mean value of free PSA was 0.22 for the age 40-49 years, 0.37 for the age 50-59 years, 0.61 for the age 60-69 years, 0.92 for the age 70-79 years, and 1.05 for the age 80-89 years (**Table 2**). The percent free PSA was between 30% and 45% for all groups (**Table 2**). The difference between the mean values of total PSA, free PSA and percent free PSA for all age groups was statistically significant ( $F=10.662$ ,  $P<0.05$ ,  $F=16.422$ ,  $P<0.05$ , and  $F=7.142$ ,  $P<0.05$  respectively) (**Tables 1 & 2**). The mean values of total PSA were compared with those of published studies and they were lower than reported values except for one study<sup>12</sup> (**Table 3**). The 95th percentile was obtained for all men to define the upper limit of normal of total PSA. Comparison between our results and that in previous studies revealed levels almost near to that of the Chinese and Korean studies (**Table 4**).

**Discussion.** In the present study, normal PSA values for 567 Saudi men between the age of 40 years and 89 years have been established. Many studies found a correlation between age increase and PSA increase.<sup>5,7-10,12-20</sup> Some authors found only correlation between age increase and total PSA increase with no correlation regarding free PSA and percent free PSA.<sup>13</sup> In the present study, there was a significant correlation between age increase and the increase in total PSA, free PSA and percent free PSA. When the mean values of total PSA in the present study were compared with those in previous studies, they were lower than the suggested values,<sup>18-20</sup> except for one study, which recorded similar values.<sup>12</sup> In the present study, the mean of percent free PSA was  $>30\%$  in all age groups. Some authors proposed that the percent free PSA is valid only at a total PSA range from 4-10ng/ml.<sup>4,21</sup> The value of percent free PSA for screening for prostate cancer has not yet been assessed optimally especially in the PSA range  $<4\text{ng/ml}$  and a threshold should be established.<sup>22</sup> Reviewing the literature of published data for the upper limit of normal PSA values showed obvious variations among the

Table 1 - The means of total PSA values for different age groups (N=567).

Group	Age intervals	n of men	Mean (SD)	95% CI
1	40-49	93	0.87 (0.735)	0.71-1.03
2	50-59	157	1.36 (1.502)	1.11-1.62
3	60-69	200	1.81 (1.783)	1.53-2.09
4	70-79	86	2.32 (2.139)	1.78-2.86
5	80-89	31	2.36 (1.924)	1.55-3.17

$F = 10.662$ ,  $p < 0.05$ , CI - confidence intervals, PSA - prostate specific analysis

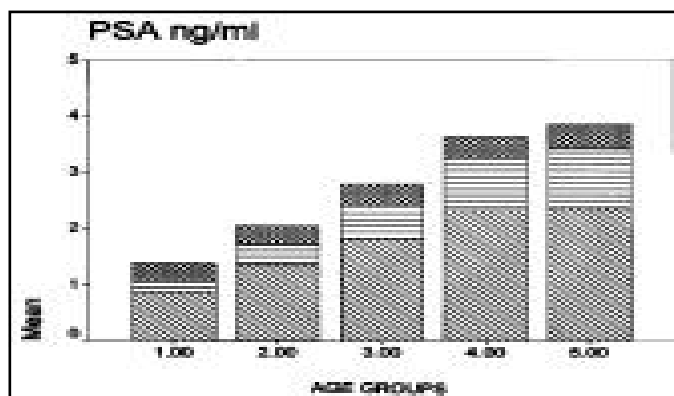


Figure 1 - The means of total PSA, free PSA and percent free PSA. PSA - prostate specific analysis.

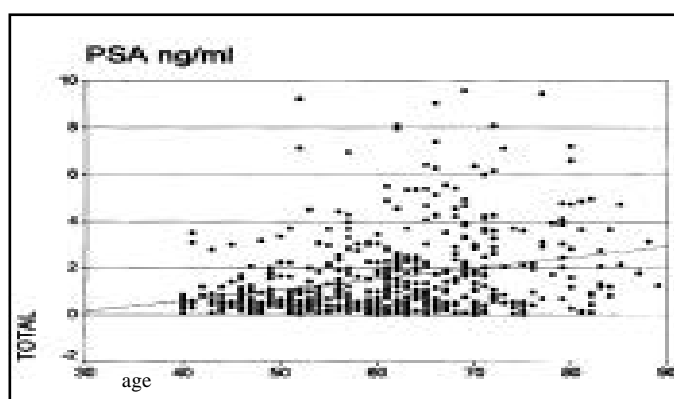


Figure 2 - Scatter gram for the total PSA values for all men. PSA - prostate specific analysis.

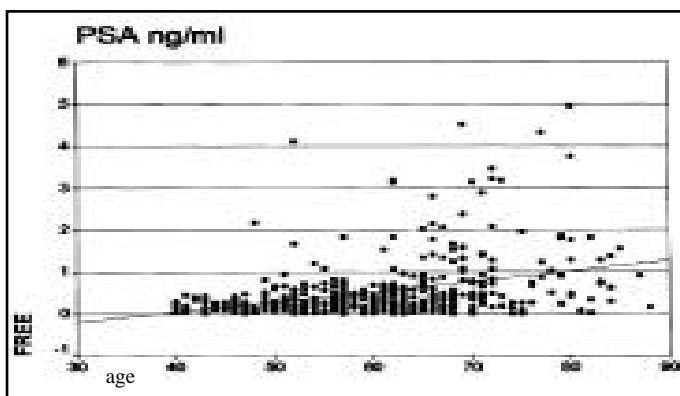


Figure 3 - Scatter gram for the free PSA values for all men. PSA -prostate specific analysis.

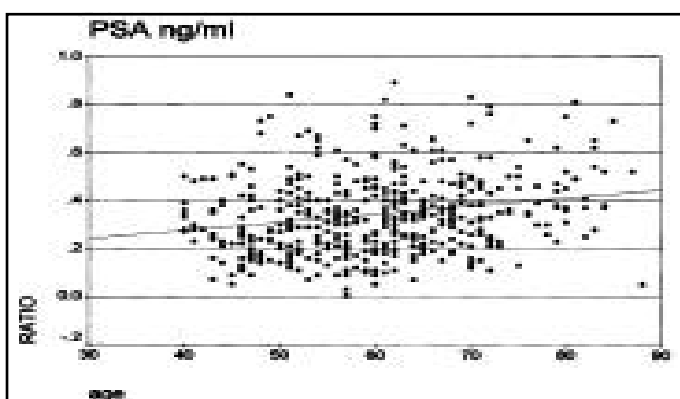


Figure 4 - Scatter gram for the percent free PSA for all men. PSA -prostate specific analysis.

Table 2 - The means of free and percent free PSA of different age groups.

Group	n of men	Mean free PSA (SD)	95% CI	Mean % Free PSA (SD)	95% CI
1	81	0.22 (0.258)	0.17-0.28	0.30 (0.145)	0.26-0.33
2	136	0.37 (0.453)	0.29-0.44	0.31 (0.153)	0.29-0.34
3	156	0.61 (0.679)	0.50-0.72	0.36 (0.154)	0.34-0.39
4	63	0.92 (1.008)	0.67-1.18	0.38 (0.169)	0.34-0.42
5	24	1.05 (1.156)	0.57-1.54	0.45 (0.179)	0.37-0.52

F = 16,422, p<0.05 (for men free PSA), F = 7,142, p<0.05 (for men percent-free PSA) only 460 patients had free PSA value.  
CI - confidence intervals, PSA - prostate specific analysis

Table 3 - Comparison of mean total PSA with previous studies.

Studies	Age groups				
	40-49	50-59	60-69	70-79	80-89
Atalay et al <sup>18</sup>	1.7	2	2.9	3.5	
Lankford et al <sup>19</sup>	2.5	3.5	4.5	6.5	
Dalkin et al <sup>12</sup>	-	1.32	1.91	2.36	
Oesterling et al <sup>20</sup>	-	-	4.5	6.5	
Present study	0.87	1.36	1.81	2.32	2.36

PSA - prostate specific analysis

Table 4 - The upper limit of normal PSA in different population-based studies.

Studies	Age groups				
	40-49	50-59	60-69	70-79	80-89
American <sup>12</sup>		1.3	1.91	2.36	
American-Black <sup>11</sup>	2.8	5.4	9.59	15.45	21.05
American-White <sup>11</sup>	2.01	4.19	7	9.4	18.25
American <sup>13</sup>	2	3	4	5.5	
American <sup>14</sup>	2.5	3.5	4.5	6.5	
American <sup>15</sup>	1.5	2.6	4.4	7.5	
African-American <sup>7</sup>		2.36			5.59
Japanese <sup>10</sup>		2.1	3.2	4.4	6.5
Japanese <sup>16</sup>	2.6	5	7.5	10.1	12.4
Chinese <sup>17</sup>	2.71	5.01	6.05	7.92	
Chinese <sup>8</sup>	1.88	2.37	4.82	5.86	
Chinese <sup>9</sup>	2.59	3.31	5.03	5.73	
Korean <sup>3</sup>	2.4	3.9	6.3		
Present study	2.85	3.99	5.41	6.29	6.84

PSA - prostate specific analysis

American population.<sup>7,11-15</sup> This can be explained by the fact that the American population is a multiracial community. The same observation was noted on reviewing the Japanese and Chinese figures.<sup>8-10,16,17</sup> As a population based study, our upper limit of normal PSA (95th percentile) was near to those of Chinese and Korean studies.<sup>3,8,9,17</sup> Our study is in accordance with other studies proposing racial variations of PSA values.<sup>3,6-11</sup>

In conclusion, age-specific PSA values in Saudi men were lower than reported values. Percent free PSA can be applied in patients with PSA <4ng/ml. Racial variations for PSA values are suggested.

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