

Partial Androgen Deficiency (PADAM) Among Ageing Kashmiri Men: A Cross-Sectional Study

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ABSTRACT

Background: Partial Androgen Deficiency in Ageing Men (PADAM), also known as late-onset hypogonadism, is characterised by age-related decline in testosterone levels, with implications for metabolic, cardiovascular, and quality-of-life outcomes. Despite global recognition, there is a paucity of region-specific data from India, particularly from the Kashmiri male population.

Objectives: To estimate the prevalence of PADAM and assess the hormonal profiles of apparently healthy Kashmiri men aged ≥ 35 years, with analysis of correlations with age, BMI, blood pressure, and lifestyle factors.

Methods: A cross-sectional study was conducted at Sher-i-Kashmir Institute of Medical Sciences (SKIMS), Srinagar, from February to September 2011. A total of 139 healthy Kashmiri men aged 35 years or older were recruited through community camps. Clinical assessments and anthropometric measurements were followed by biochemical evaluation, including serum total testosterone (TT), sex hormone-binding globulin (SHBG), and calculated free testosterone (FT) and bioavailable testosterone (BT).

Results: Median TT was 502 ng/dL; 8% of men had TT < 250 ng/dL. FT and BT medians were 8.1 ng/dL and 192 ng/dL, respectively, with 31% and 10% of participants below clinically relevant thresholds. TT, FT, and BT declined significantly with age ($p < 0.001$), and were negatively correlated with hypertension but positively with BMI. SHBG increased with age and was higher among smokers. PADAM prevalence, defined as FT < 5 ng/dL, was 13%. Age was the strongest independent predictor of androgen deficiency.

Conclusions: PADAM is prevalent among ageing Kashmiri men, with significant age-associated hormonal decline. These findings underscore the necessity for region-specific screening strategies and comprehensive approaches to male ageing and endocrine health in South Asian populations.

Keywords: Androgen deficiency, testosterone, hypogonadism, ageing men, Kashmir, SHBG, PADAM, free testosterone, bioavailable testosterone.

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INTRODUCTION

Numerous studies confirm that testosterone levels steadily decline with age, beginning in men's 30s and progressing gradually over time. This decline in testosterone concentration is greater for men with chronic illness and for those taking medications than in healthy older men.^{1,2}

The prevalence of Partial Androgen Deficiency in Ageing Men (PADAM), or late-onset hypogonadism, varies depending on diagnostic criteria. When both low testosterone and clinical symptoms are required, studies such as the European Male Ageing Study (EMAS) report a prevalence of approximately 2.1% among men aged 40–79³. However, if only low testosterone is considered, the

prevalence increases to 20–30% in various populations⁴. Symptom-based screening tools may show even higher estimates, but they tend to overstate the true prevalence without biochemical confirmation⁵.

The drop in testosterone arises from dysfunction at multiple points along the hypothalamic–pituitary–testicular (HPT) axis. Ageing dampens GnRH pulsatility and reduces the testicular response to LH, while increasing SHBG levels further lowers free and bioavailable testosterone¹. Lower testosterone in older men is linked to loss of muscle mass and strength, reduced physical ability, increased visceral

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fat, metabolic syndrome, insulin resistance, and higher cardiovascular risk⁶. It can also affect mood, cognition, libido, and overall quality of life⁶. The gradual decline in testosterone is termed Partial Androgen Deficiency in Ageing Men (PADAM) or late-onset hypogonadism⁷. While well-studied internationally, data on its prevalence in Indian populations—especially Kashmiri men—are scarce, with few studies like Shukla et al. reporting PADAM in other regions of India⁸.

This paper focuses on evaluating Partial Androgen Deficiency in Ageing Men (PADAM) among Kashmiri men aged 40 years and above, aiming to assess its true prevalence and clinical spectrum in this underrepresented population. Given the lack of region-specific data, this study seeks to fill a critical gap in the literature by examining hormonal profiles and related symptoms in a culturally and genetically distinct group. Understanding the extent and characteristics of PADAM in Kashmiri men can help inform more accurate and personalised diagnostic criteria, guide early identification of at-risk individuals, and support the development of targeted management strategies. Ultimately, such insights can contribute to better health outcomes, improved quality of life, and more effective allocation of healthcare resources in the region.

MATERIAL AND METHODS

This was a cross-sectional observational study conducted jointly by the Department of Endocrinology and the Department of Immunology at Sher-i-Kashmir Institute of Medical Sciences (SKIMS), Srinagar. The study period extended from February 2011 to September 2011 and aimed to evaluate androgen levels among apparently healthy ageing men.

Study Population/Participants

The study included Kashmiri men aged 35 years and above who were in good general health. Participants were enrolled only if they met the following inclusion criteria:

1. No self-reported chronic illnesses.
2. No medical history indicative of cardiovascular, neurological, respiratory, gastrointestinal, or severe psychiatric disorders.
3. Absence of major sensory impairments (e.g., legal blindness) or cognitive limitations that could interfere with neuropsychological assessment or consent

procedures.

4. Not on any medication affecting hormonal levels and reported alcohol intake of fewer than six drinks per day.

Sample Size

A total of 139 subjects were enrolled, based on an estimated PADAM prevalence of 10% (as observed in similar studies), which provided sufficient statistical power with a sample size requirement of at least 138 participants.

Study Setting

Participants were recruited from a variety of community and institutional outreach settings, including general health check-up camps conducted at SKIMS and the College of Education in Srinagar, as well as from public health awareness programs and rural outreach initiatives conducted in various districts of the Valley.

Data Collection

After initial screening and brief history taking, a comprehensive clinical examination was carried out, including assessment of vital signs, systemic examination, and anthropometric measurements (height, weight, BMI, waist and hip circumference). All participants were administered the ADAM (Androgen Deficiency in Ageing Males) questionnaire to screen for symptoms of hypogonadism.

Following informed written consent, venous blood samples were collected for biochemical and hormonal analyses. Serum was separated the same day and stored at -70°C until batch analysis. Total testosterone and SHBG levels were measured using radioimmunoassay (RIA) kits from ImmunoTech, Germany, in the Department of Immunology. Free and bioavailable testosterone levels were calculated using the ISSAM online calculator (www.issam.ch/freetesto.htm). Serum albumin and creatinine were estimated by the Department of Biochemistry at SKIMS.

Statistical Analysis

Data analysis was carried out using Microsoft® Excel 2007 and SPSS software version 11.5 (SPSS Inc., Chicago, IL, USA). Descriptive statistics included mean, median, standard deviation (SD), and standard error of the mean (SEM). Quartile distributions of total testosterone, SHBG, free testosterone, and bioavailable testosterone were computed.

Comparisons between baseline characteristics were made using the χ^2 test or Fisher's exact test for categorical variables, and Student's t-test or Mann-Whitney U test for continuous variables, depending on data distribution. For comparisons among more than two groups, one-way ANOVA (F test) was employed. Correlation between continuous variables was evaluated using Spearman's correlation coefficient. A two-tailed P value of <0.05 was considered statistically significant.

Ethical Approval

Informed written consent was obtained from all participants prior to enrollment. All procedures involved minimal risk, with blood sampling being the only invasive aspect. Participants were informed about the purpose and procedures in the local language, and consent was obtained accordingly. The study was approved by the Departmental Research Committee of the Department of Medicine, SKIMS, which also oversees the ethical aspects of postgraduate research studies.

RESULTS

This cross-sectional study, conducted at Sher-i-Kashmir Institute of Medical Sciences, aimed to determine the prevalence and hormonal profile of Partial Androgen Deficiency in Ageing Men (PADAM) among apparently healthy Kashmiri males aged 35 years and above. A total of 139 participants underwent detailed clinical evaluation followed by biochemical and hormonal testing, including serum albumin, creatinine, total testosterone (TT), sex hormone-binding globulin (SHBG), and derived free and bioavailable testosterone levels. Baseline Demographic, Anthropometric, and Clinical Characteristics of the Study Population are shown in Table 1.

Response to questionnaire

Responses to the questionnaire were not specific (Table 2); on average, about 40% people responded affirmatively to all ten questions, whereas the questionnaire positivity (defined as an affirmative answer to Question No. 1, Question No. 7 or any three questions) was in 65.9%.

Hormonal Profiles and Age-wise Distribution

The range of total testosterone (TT) levels in the study population was 111–1111 ng/dL, with a median of 502 ng/dL. Notably, 8% of subjects had TT levels below 250 ng/dL. A statistically significant age-related decline in TT

was observed, with mean levels decreasing across age brackets (Table 3). TT levels showed a positive correlation with BMI and smoking, and a negative correlation with hypertension ($p<0.05$). Free testosterone (FT) levels ranged from 2.7–33.3 ng/dL, with a median of 8.1 ng/dL. About 31% of participants had FT levels <6.5 ng/dL. FT also declined significantly with age (Table 3). FT showed a positive correlation with BMI and a negative correlation with hypertension ($p<0.05$). Bioavailable testosterone (BT) ranged from 62–677 ng/dL, with a median of 192 ng/dL. Approximately 10% of participants had BT <100 ng/dL. Age-wise decline in BT was also significant (Table 3). BT also correlated positively with BMI and negatively with hypertension ($p<0.05$). The SHBG levels ranged from 8–97 nmol/L, with a median of 38 nmol/L. Mean SHBG levels increased with age (Table 3). SHBG showed a negative correlation with BMI and a positive correlation with smoking ($p<0.05$). Correlation of Total testosterone, Bioavailable testosterone, serum SHBG and Free testosterone with age in normal vs. overweight subjects is shown in Fig. 1.

Prevalence of PADAM

Logistic regression identified age as the strongest independent predictor of declining androgen levels. Nearly two-thirds of men aged ≥ 65 years were found to be androgen deficient. The inverse association between androgen levels and age remained statistically significant after controlling for confounders such as BMI, smoking, and hypertension. Based on a free testosterone cut-off of <5 ng/dL, the prevalence of PADAM in this cohort of healthy Kashmiri men was determined to be 13%. When the variables that showed significant correlation on univariate analysis with androgen deficiency ($FT<5$ ng/dl) were entered into Logistic regression analysis, only age correlated with androgen deficiency; higher the age, more chances of androgen deficiency (Table 4).

DISCUSSION

This study evaluated androgen levels and the prevalence of Partial Androgen Deficiency in Ageing Men (PADAM) among apparently healthy Kashmiri men aged ≥ 35 years. Our key findings include an age-related decline in total, free, and bioavailable testosterone, a rise in SHBG levels, and a PADAM prevalence of approximately 13% based on low free testosterone. These results offer insight into

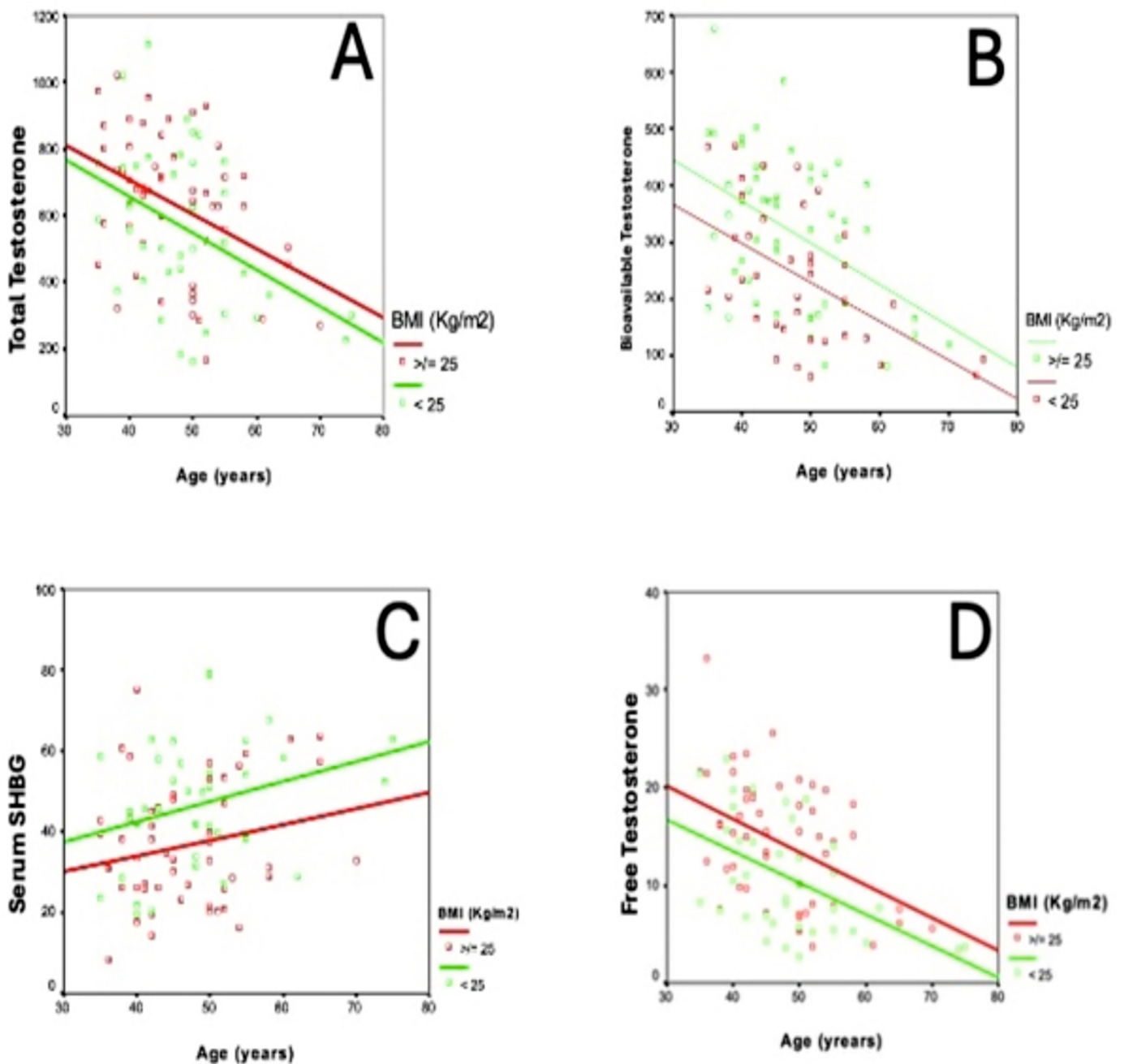


Fig. 1. Correlation of Total testosterone, Bioavailable testosterone, serum SHBG and Free testosterone with age in normal vs. overweight subjects

Table 1. Baseline Demographic, Anthropometric, and Clinical Characteristics of the Study Population

Characteristic	N*	Mean $\pm$ SD	Range
Age (years)	139	48.15 $\pm$ 7.47	35 – 75
Age distribution			
• 35-40 years	23 (16.5)		
• 41-45 years	34 (24.5)		
• 46-50 years	39 (28.1)		
• 51-55 years	29 (20.9)		
• 56-60 years	07 (5.0)		
• 61-65 years	04 (2.9)		
• >65 years	03 (2.2)		
Smoker	55 (39.6)		
Hypertension	65 (46.8)		
Family history of hypertension	21 (14.8)		
Family history of Diabetes	09 (6.8)		
History of Hypothyroidism (treated)	09 (6.5)		
Anthropometric parameters			
• Weight (Kg)	139	64.73 $\pm$ 8.79	45–85
• Height (cm)	139	160.16 $\pm$ 5.69	142–173
• BMI (Kg/M2)	139	25.21 $\pm$ 2.99	18–30
• Waist Circumference (cm)	139	85.80 $\pm$ 8.31	63–106
• Hip Circumference (cm)	139	89.63 $\pm$ 5.47	78–111
• Waist/Hip Ratio	139	0.96 $\pm$ 0.08	0.76–1.13

*Figures in parenthesis indicate percentage.

Table 2. Response to Questionnaire

	Question	+Ve Response (%)
Q 1	Do you have decrease in libido ?	34.1
Q 2.	DO you have lack of energy ?	52.3
Q 3	Do you have decrease in strength and/endurance?	40.9
Q 4	Have you lost height?	15.9
Q 5	Have you noticed a decreased enjoyment of life?	47.7
Q 6	Are you sad and/or grumpy?	27.3
Q 7	Are your erections less strong?	36.4
Q 8	Have you have noticed a recent deterioration in your ability to play sports?	47.7
Q 9	Are you falling asleep after dinner?	36.6
Q 10	Has there been a recent deterioration in your work performance	54.5
	All questions	39.9

Table 3. Relationship of Mean Testosterone, SHBG, Free testosterone and Bioavailable testosterone levels with age

Age group (years)	N	Testosterone (ng/dl)	SHBG (nmol/L)	Free T (ng/dl)	Bioavailable T (ng/dl)
35-44	44	645.5 $\pm$ 33.1	35.9 $\pm$ 2.23	14.7 $\pm$ 0.96	323.9 $\pm$ 19.7
45-54	69	476.6 $\pm$ 26.6	41.2 $\pm$ 2.05	9.3 $\pm$ 0.64	211.4 $\pm$ 14.3
55-64	21	457.3 $\pm$ 42.3	43.3 $\pm$ 3.65	8.5 $\pm$ 0.89	193 $\pm$ 20.0
= 65	5	350.6 $\pm$ 53.9	53.7 $\pm$ 5.66	5.3 $\pm$ 0.75	115.3 $\pm$ 17.2
	P	0.000	0.060	0.000	0.000

Table 4. Results of Logistic regression*

	B	S.E.	Wald	df	Sig.	Exp(B)
Age	.139	.053	6.809	1	.009	1.150
Hypertension	-.394	1.020	.149	1	.699	.674
Smoking	-.650	.915	.505	1	.477	.522
BMI	-.183	.136	1.831	1	.176	.832
Constant	-4.707	4.175	1.271	1	.260	.009

* Variable(s) entered on step 1: AGE, HYPERTENSION, SMOKER, BMI.

regional hormonal ageing patterns, with implications for early detection and management strategies.

Age-Related Testosterone Decline. Consistent with global observations, we found a progressive decline in total testosterone (TT) with age. Mean TT dropped from 646 ng/dL (ages 35–44) to 351 ng/dL (≥ 65 years), while 8% of participants had TT <250 ng/dL. Previous research, including longitudinal studies, documents a 1–3% annual testosterone decrease after age 30, with up to 20–50% of men over 60 experiencing levels below young-adult norms^{9,10}. Our findings parallel those in diverse cohorts, including European and American men¹¹. The European Male Ageing Study similarly delineated both “classical” (TT <11 nmol/L) and “compensated” hypogonadism trajectories increasing with age³.

Decline in Free and Bioavailable Testosterone. In our cohort, the free testosterone (FT) median was 8.1 ng/dL, with 31% below 6.5 ng/dL. Bioavailable testosterone (BT) median was 192 ng/dL, with 10% below 100 ng/dL. Both FT and BT declined sharply with age, mirroring trends observed in the Baltimore Longitudinal Study of Ageing, where bioavailable testosterone decline was more pronounced than total testosterone¹². The greater sensitivity of free fractions compared to TT emphasises the value of measuring FT/BT in diagnosing PADAM, especially in older men.

Increase in SHBG Levels. SHBG rose linearly with age, from a median of 35.9 nmol/L in younger men to 53.7 nmol/L in those ≥ 65 years. This trend aligns with established literature attributing increased SHBG to ageing, decreased insulin levels, and reduced adiposity^{9,13}. Elevated SHBG in smokers, as observed in our study, also reflects consistent findings where smoking correlated with higher SHBG and TT, but unchanged BT¹⁰. The absence of BT elevation suggests SHBG mediates the change in TT in smokers without affecting bioavailable fractions.

Associations with BMI, Hypertension, and Smoking. Our analysis identified positive correlations between TT/FT/BT and BMI, alongside negative correlations with hypertension. Obesity has dual effects: increasing peripheral aromatisation of testosterone and lowering SHBG, resulting in lower TT but relatively preserved free fractions¹³. The negative link between hypertension and testosterone aligns with studies associating lower T levels with cardiometabolic diseases. In contrast, smoking exhibited a complex relationship, positively associated with TT and SHBG but not BT, reflecting increased SHBG production with minimal clinical impact on bioavailable hormone.

Age as Independent Predictor and PADAM Prevalence. Logistic regression confirmed age as the strongest independent predictor of decreasing androgen levels, with ~66% of men ≥ 65 years classified as androgen-deficient. This echoes prior research showing hypogonadism prevalence rising from ~5% in the 40s to over 20% in those over 70⁹. Using the FT cut-off of 5 ng/dL, PADAM prevalence was 13%—higher than symptom-based PADAM rates (2–5%) but within ranges reported for biochemical hypogonadism (20–30%). Our estimate reflects rising testosterone insufficiency risk with age, even in apparently healthy individuals.

Clinical and Public Health Implications. The observed trends bear significant clinical relevance. Age-related testosterone decline is associated with diminished muscle mass, bone density, libido, and metabolic dysfunction, including insulin resistance and cardiovascular risk. The prevalence of testosterone deficiency in this population suggests further assessment of functional symptoms and targeted screening—especially in men over 50—may be warranted.

The associations between low T, hypertension, and obesity point to a need for integrated management strategies

addressing metabolic health in men, potentially involving lifestyle interventions and consideration of testosterone replacement therapy where indicated. However, given potential risks, screening and treatment decisions should be individualized and based on comprehensive assessments⁹.

Strengths and Limitations. This is the first study to assess PADAM in healthy Kashmiri men, using a comprehensive hormonal profile (total, free, and bioavailable testosterone, and SHBG) and robust statistical analysis accounting for key confounders like age, BMI, smoking, and hypertension. A primary limitation of this study is its cross-sectional design, which precludes the establishment of causality and may introduce selection bias due to the sampling methods employed. Furthermore, while radioimmunoassay (RIA) was utilised for hormonal measurements, its reliance, though standard, presented a limitation in precision compared to more advanced techniques such as mass spectrometry¹⁴. Lastly, symptom assessments via the ADAM questionnaire were not reported, limiting clinical correlation interpretations.

Future Directions: Longitudinal follow-up would clarify temporal changes in androgen levels and their health impacts. Exploring symptom associations, as suggested by collaborations with international studies¹⁴. This may enable more precise PADAM definitions. Additionally, evaluating interventions such as lifestyle modification, testosterone therapy, or weight reduction would inform therapeutic guidelines tailored to local needs.

CONCLUSION

Our findings demonstrate an age-associated decline in TT, FT, BT, and increased SHBG among Kashmiri men, aligning with global hormone-ageing patterns. The PADAM prevalence of 13% underscores the significance of this condition in this underrepresented population. Age remains the primary driver of androgen decline, with additional influence from comorbid hypertension and obesity. Recognition of PADAM in this group emphasises the need for tailored diagnostic strategies and comprehensive management focused on both hormonal and metabolic health, with broader implications for male health in South Asian settings.

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REFERENCES

1. Matsumoto AM. Fundamental Aspects of Hypogonadism in the Aging Male. *Rev Urol.* 2003;5(Suppl 1):S3–10.
2. Ponce OJ, Spencer-Bonilla G, Alvarez-Villalobos N, Serrano V, Singh-Ospina N, Rodriguez-Gutierrez R, et al. The efficacy and adverse events of testosterone replacement therapy in hypogonadal men: A systematic review and meta-analysis of randomized, placebo-controlled trials. *J Clin Endocrinol Metab.* 2018 Mar 17;
3. Tajar A, Huhtaniemi IT, O'Neill TW, Finn JD, Pye SR, Lee DM, et al. Characteristics of androgen deficiency in late-onset hypogonadism: results from the European Male Aging Study (EMAS). *J Clin Endocrinol Metab.* 2012 May;97(5):1508–16.
4. Amore M, Innamorati M, Costi S, Sher L, Girardi P, Pompili M. Partial Androgen Deficiency, Depression, and Testosterone Supplementation in Aging Men. *Int J Endocrinol.* 2012;2012:280724.
5. Stanworth RD, Jones TH. Testosterone for the aging male; current evidence and recommended practice. *Clin Interv Aging.* 2008;3(1):25–44.
6. Amore M. Partial androgen deficiency and neuropsychiatric symptoms in aging men. *J Endocrinol Invest.* 2005;28(11 Suppl Proceedings):49–54.
7. Yadav GK, Pahwa M, Singh M, Tyagi V, Chadha S. Prevalence of Age-Associated Testosterone Deficiency Syndrome in Indian Population. *Adv Urol.* 2019 Mar 20;2019:2468926.
8. Shukla A, Sharda B, Sharma S, Bhardwaj S, Kailash U, Kalani R, et al. Association Between Serum Testosterone and Serum PSA Among Men With and Without Partial Androgen Deficiency. *Indian J Clin Biochem IJCB.* 2020 Jan;35(1):127–31.
9. Surampudi PN, Wang C, Swerdloff R. Hypogonadism in the Aging Male Diagnosis, Potential Benefits, and Risks of Testosterone Replacement Therapy. *Int J Endocrinol.* 2012;2012:625434.
10. English KM, Pugh PJ, Parry H, Scutt NE, Channer KS, Jones TH. Effect of cigarette smoking on levels of

- bioavailable testosterone in healthy men. *Clin Sci Lond Engl* 1979. 2001 Jun;100(6):661–5.
11. Whittaker J, Wu K. Low-fat diets and testosterone in men: Systematic review and meta-analysis of intervention studies. *J Steroid Biochem Mol Biol*. 2021 Jun;210:105878.
 12. Fabbri E, An Y, Gonzalez-Freire M, Zoli M, Maggio M, Studenski SA, et al. Bioavailable Testosterone Linearly Declines Over A Wide Age Spectrum in Men and Women From The Baltimore Longitudinal Study of Aging. *J Gerontol A Biol Sci Med Sci*. 2016 Sep;71(9):1202–9.
 13. Cooper LA, Page ST, Amory JK, Anawalt BD, Matsumoto AM. The association of obesity with sex hormone-binding globulin is stronger than the association with ageing – implications for the interpretation of total testosterone measurements. *Clin Endocrinol (Oxf)*. 2015 Dec;83(6):828–33.
 14. Spetz ACE, Palmefors L, Skobe RSP, Strömstedt MT, Fredriksson MG, Theodorsson E, et al. Testosterone correlated to symptoms of partial androgen deficiency in aging men (PADAM) in an elderly Swedish population. *Menopause*. 2007 Dec;14(6):999.