PS-12

Increased Prostate-Specific Antigen (PSA) Level Highly Associated with Low Skeletal Muscle Mass

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Introduction

➢ **Prostate-specific antigen (PSA) :** a key biomarker for prostate cancer. Normally confined within the prostate, small quantities of PSA can be detected in semen and blood.

➢ Elevated levels of PSA: often seen in non-cancerous prostatic conditions, such as benign prostatic hyperplasia, acute prostatitis, chronic prostatitis/chronic pelvic pain syndrome, prostate abscess, urinary tract infection in males.

➢ **Low muscle mass status** including sarcopenia presents as **subclinical inflammatory diseases**

➡ We investigated the **relationship between high PSA levels and low skeletal muscle mass (LMM)** in healthy men in a population-based study.

Method

➢ **Participants** who performed a comprehensive health-screening program (2012-2 → **"bioelectrical impedance analysis & serum PSA "**

➢ **Skeletal muscle mass index (SMI) = appendicular muscle mass (kg)/height (m)².**

- **"Normal":** greater than -1 SD of the **mean of young men (age:18–39 years, n=80,270)**
- **"Mild LMM":** within -1 to -2 SD (-2< SD ≤-1) / **"Severe LMM":** below -2 SD (SD ≤-2)
  - In this study population, cut-off values for mild and severe LMM were 6.78 kg/m² and 7.44 kg/m²

➢ **High PSA level** : defined as ≥4 ng/mL

➢ Multivariable logistic regression analyses were conducted → association of high PSA levels with mild LMM and severe LMM compared to normal muscle mass.

➢ Confounding factors: age, sex, center, smoking, alcohol, MET score, blood pressure, glucose, TG, ALT, creatinine, and CRP levels

Results

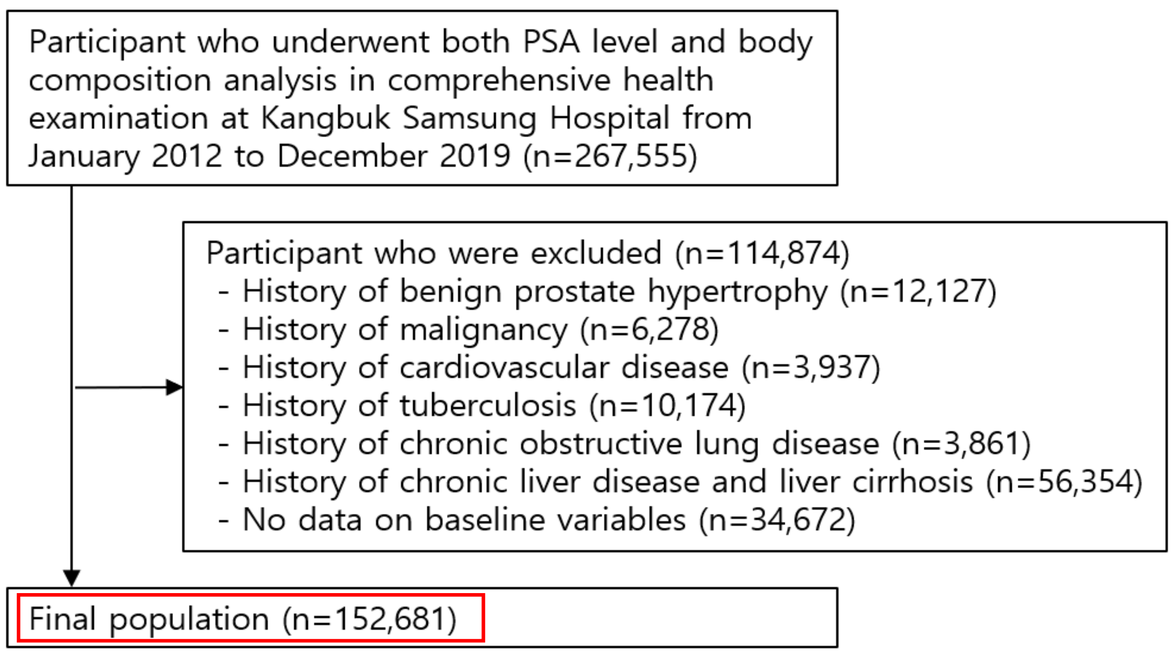


Figure 1. Selection of study population

Table 1. Baseline characteristics of study subjects classified by skeletal muscle mass index.

	Total	Normal	Mild LMM	Severe LMM	* p value
Number of subjects (n)	152,681	127,812	21,593	3,276	
Age (years)	41.8 ± 9.6	41.5 ± 9.1	43.2 ± 11.1	46.6 ± 13.8	<0.001 †,‡,#
Screening center, Seoul (%)	51	51	51	49.7	0.329
Height (cm)	173.5 ± 5.9	174.2 ± 5.8	170.6 ± 5.4	167.6 ± 5.8	<0.001 †,‡,#
BMI (kg/m²)	24.8 ± 3.1	25.4 ± 2.9	21.9 ± 1.8	19.9 ± 2.0	<0.001 †,‡,#
Appendicular skeletal muscle mass (kg)	24.3 ± 3.0	25.1 ± 2.6	21.0 ± 1.5	18.3 ± 1.6	<0.001 †,‡,#
SMI (kg/m²)	8.6 ± 0.7	8.2 ± 0.5	7.2 ± 0.2	6.5 ± 0.3	<0.001 †,‡,#
Current smoker (%)	28.4	28.4	27.6	31.2	<0.001
Heavy drinking ᵃ (%)	26.7	27.3	23.7	24.1	<0.001
MET score (min/wk)	1798.2 ± 3186.4	1837.2 ± 3205.0	1591.7 ± 2988.1	1635.2 ± 3636.6	<0.001 †,‡
SBP (mmHg)	114.8 ± 11.6	115.5 ± 11.4	111.1 ± 11.3	109.9 ± 12.6	<0.001 †,‡,#
Diabetes mellitus (%)	3.6	3.4	4.2	7	<0.001
Insulin (uIU/mL)	7.5 ± 4.8	7.8 ± 4.9	5.9 ± 3.4	5.0 ± 3.1	<0.001 †,‡,#
Glucose (mg/dL)	99.8 ± 17.0	100.0 ± 16.6	98.5 ± 18.0	99.7 ± 23.5	<0.001 †,#
Triglycerides (mg/dL)	137.1 ± 92.6	140.9 ± 95.6	118.8 ± 72.3	110.1 ± 69.8	<0.001 †,‡,#
ALT (IU/L)	29.8 ± 22.7	30.7 ± 23.4	25.5 ± 18.4	23.8 ± 16.4	<0.001 †,‡,#
Creatinine (mg/dL)	0.96 ± 0.20	0.96 ± 0.20	0.93 ± 0.18	0.90 ± 0.18	<0.001 †,‡,#
CRP (mg/dL)	0.13 ± 0.34	0.13 ± 0.32	0.13 ± 0.40	0.16 ± 0.60	<0.001 ‡,#
PSA (ng/mL)	0.99 ± 1.16	0.97 ± 1.05	1.09 ± 1.31	1.25 ± 2.90	<0.001 †,‡,#

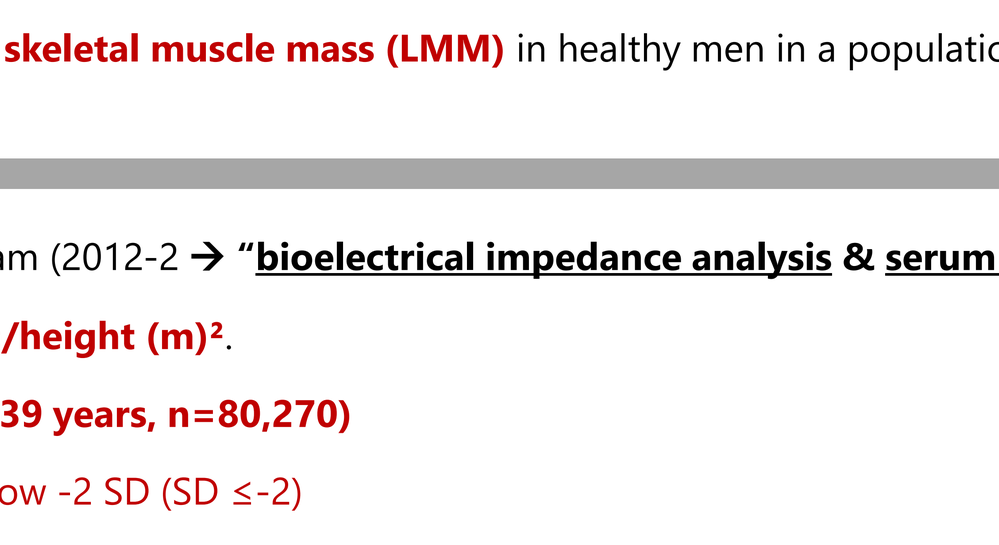


Figure 2. Comparison of proportion of high PSA level between normal, mild LMM, and severe LMM group. PSA levels in the groups were compared using chi-square test. p for trend < 0.001. (n = 152,681).

Table 2. Multivariate regression analyses showing association of increased CA 19-9 with LMM

	Mild LMM, OR (95% CI)	Severe LMM, OR (95% CI)
Model 1		
Normal (<4 ng/mL)	1 (reference)	1 (reference)
High PSA level (≥4 ng/mL)	**1.407 (1.245-1.591)**	**1.626 (1.282-2.063)**
Model 2		
Normal (<4 ng/mL)	1 (reference)	1 (reference)
High PSA level (≥4 ng/mL)	**1.388 (1.227-1.570)**	**1.580 (1.245-2.007)**
Model 3		
Normal (<4 ng/mL)	1 (reference)	1 (reference)
High PSA level (≥4 ng/mL)	**1.448 (1.276-1.642)**	**1.728 (1.357-2.202)**

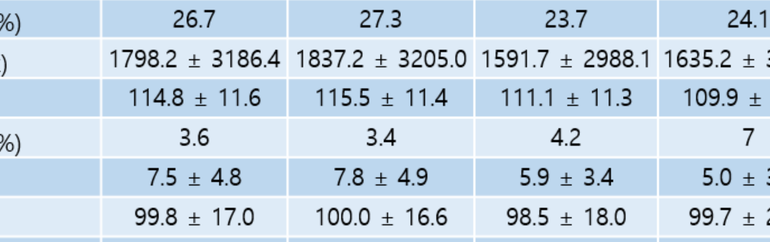
ORs were calculated as the risks of having mild, low or severely low skeletal muscle mass according to the presence of high PSA level. Model 1: adjusted for age, screening center. Model 2: adjusted for age, screening center, smoking status, heavy drinker and MET score. Model 3: adjusted for age, screening center, smoking status, heavy drinker, MET score, SBP, glucose, triglyceride, ALT, creatinine and CRP.

Discussion

<PSA as an inflammatory factor contributing sarcopenia>

- Cai et al. *Int J Mol Sci. 2019.*

: Inflammatory processes → PSA ↑ → upregulation of inflammatory cytokines (ex, TNF-α, IL-6)



PSA level : a possible inflammation-associated biomarker for sarcopenia

<PSA : highly associated with metabolic syndrome>

- Byun HK et al. *K J URol 2012.*

: metabolic syndrome components (central obesity, high SBP/DBP, high TG, low HDL-C, and high FPG) highly associated with PSA level

: Adipose tissue (adipocytokines)

→ induce insulin resistance & hyperinsulinemia

→ related to prostate enlargement and PSA elevation ↑

Prostate-specific antigen ↑ : a possible metabolic risk factor including sarcopenia

Conclusion

➢**Elevated PSA level was independently associated with a higher prevalence of LMM** in healthy men without prostate cancer or BPH.

➢Therefore, **increased PSA** could be used as **a novel biomarker for detecting sarcopenia status.**