

Short Communication



Associations of dietary patterns and lower urinary tract symptoms (LUTS) in Korean adults

Jung-Sun Lim ¹, Wonkyung Hwang ², Jung Kwon Kim ³, Minhyun Kim ⁴,
Oran Kwon ⁵, Sujeong Han ¹, Bumjo Oh ¹, and Jong Seung Kim ^{1S}

¹Department of Family Medicine, SMG-SNU Boramae Medical Center, Seoul 07061, Korea

²Department of Family Medicine, Seoul National University Hospital, Seoul 03080, Korea

³Department of Urology, Asan Medical Center, University of Ulsan College of Medicine, Seoul 05505, Korea

⁴Department of Family Medicine, Soonchunhyang University Hospital Cheonan, Cheonan 31151, Korea

⁵Department of Nutritional Science and Food Management, Ewha Womans University, Seoul 03760, Korea

OPEN ACCESS

Received: Aug 23, 2024

Revised: Oct 14, 2024

Accepted: Nov 1, 2024

Published online: Dec 20, 2024

^SCorresponding Author:

Jong Seung Kim

Department of Family Medicine, SMG-SNU
Boramae Medical Center, 20 Boramae-ro 5-gil,
Dongjak-gu, Seoul 07061, Korea.
Tel. +82-2-870-2682
Fax. +82-2-870-3340
Email. atena68@snu.ac.kr

©2025 The Korean Nutrition Society and the
Korean Society of Community Nutrition
This is an Open Access article distributed
under the terms of the Creative Commons
Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0/>)
which permits unrestricted non-commercial
use, distribution, and reproduction in any
medium, provided the original work is properly
cited.

ORCID iDs

Jung-Sun Lim 
<https://orcid.org/0000-0003-1590-171X>
Wonkyung Hwang 
<https://orcid.org/0009-0005-6443-6916>
Jung Kwon Kim 
<https://orcid.org/0000-0002-8069-6225>
Minhyun Kim 
<https://orcid.org/0000-0002-2017-3916>
Oran Kwon 
<https://orcid.org/0000-0002-2031-7238>
Sujeong Han 
<https://orcid.org/0000-0001-8403-5507>
Bumjo Oh 
<https://orcid.org/0000-0002-2468-0755>

<https://e-nrp.org>

ABSTRACT

BACKGROUND/OBJECTIVES: Dietary factors act on lower urinary tract symptoms (LUTS). This study examined the relationship between the overall diet quality and LUTS.

SUBJECTS/METHODS: This study analyzed the data from examinees who visited a general hospital in Korea (October 13, 2014–March 12, 2020). The number of subjects in the study was 6,506 adult men. The recommended food score was used to evaluate the overall quality of the diet, and the International Prostate Symptom Score was used to quantify LUTS. Logistic regression analysis was used to derive the odds ratio (OR) and 95% confidence interval (CI) to evaluate the relationship between the dietary quality and LUTS. The influence of age, education, marital history, income, occupation, smoking, drinking, exercise, metabolic syndrome, body mass index (BMI), and prostate-specific antigen (PSA) level was analyzed to determine the net influence of the overall diet quality on LUTS.

RESULTS: The group with high overall dietary quality showed a lower incidence of LUTS than the group with relatively lower dietary quality (OR, 0.88; 95% CI, 0.79–0.99). These results were also observed after correcting for other risk factors and associated variables: age, education, smoking, metabolic syndrome, BMI, and PSA level.

CONCLUSION: The overall diet quality and LUTS were correlated. Nevertheless, further research will be needed to find the relationship between diet quality and LUTS.

Keywords: Dietary pattern; lower urinary tract symptoms; prostatic hyperplasia; Symptom Assessment; Symptom Assessment

INTRODUCTION

Benign prostatic hyperplasia (BPH) is prevalent in aging men and results in lower urinary tract symptoms (LUTS), significantly affecting their health-related quality of life [1,2]. Emerging evidence indicates that, in addition to aging, various modifiable factors, including obesity, dietary choices, physical inactivity, hormonal imbalances, metabolic syndrome, and alcohol and tobacco use, contribute to the onset and progression of BPH, LUTS, or both [3,4]. Recent epidemiological findings underscore the substantial influence of nutritional factors on metabolism well before initiating conditions such as BPH and LUTS [5,6].

Jong Seung Kim 
<https://orcid.org/0000-0002-8416-3872>

Conflict of Interest

The authors declare no potential conflicts of interests.

Author Contributions

Investigation: Hwang W, Kim JK; Project administration: Kim M, Han S, Oh B; Supervision: Kim JS; Writing - original draft: Lim JS; Writing - review & editing: Lim JS, Hwang W, Kim JK, Kim M, Kwon O, Han S, Oh B, Kim JS.

On the other hand, studies thus far have been conducted only on the risk of BPH associated with each nutrient or food and total intake. Nevertheless, few studies have addressed the association with dietary patterns [7,8]. Several studies have evaluated the Mediterranean diet on the association between dietary patterns and LUTS. One of these studies reported that erectile dysfunction (ED) was associated with BPH and not with BPH [9]. Therefore, further research on the relationship between a healthy diet and BPH and LUTS is necessary.

Observational studies and intervention trials have consistently endorsed the effectiveness of a pattern-based approach to understanding dietary exposures in the context of health [10]. From an intuitive perspective, dietary patterns may affect the disease risk by interacting with the established risk factors and their impact on the intake of micronutrients. Considering the association between dietary patterns and BPH, especially when analyzed using a diet index, this evidence holds greater practical relevance and intuitive applicability in clinical settings compared to examining individual nutrients.

Several indices for evaluating overall diet quality have been proposed, with the key ones including the healthy eating index (HEI) [11], recommended food score (RFS) [12,13], Mediterranean diet score (MDS), and alternate MDS [14].

This study examined the connection between the RFS, a tool assessing healthy dietary habits, and the International Prostate Symptom Score (IPSS), which measures LUTS, a common indicator of BPH. The goal was to understand how dietary patterns influence BPH.

SUBJECTS AND METHODS

Participants

This study analyzed 12,107 out of 23,042 adult men who visited a general hospital in Korea from October 13, 2014, to March 12, 2020, excluding 5,601 samples who did not respond to the questionnaire and were not visiting for the first time. The Institutional Review Board (IRB) approved this study (IRB No. 20-2023-56).

General characteristics and anthropometric measurement

During visits to the health examination center, the participants completed a questionnaire covering the subjects' educational background, marital history, income, occupation, IPSS, and dietary habits. The questionnaire also delved into aspects such as medical history, medication usage, and smoking and drinking history. The body mass index (BMI) was determined by measuring the height and weight using an automatic height/weight meter. The waist circumference was measured in the upright position with a light breath at the midpoint between the lowermost end of the rib and the uppermost end of the hip flexor. The fasting blood glucose, glycated hemoglobin, total cholesterol, triglycerides, and high-density lipoprotein cholesterol were measured after an overnight fast of at least 8 h.

Dietary assessment

The overall diet quality in this study was assessed using the RFS developed by Kant *et al.* [13] as a food-based metric that evaluates adherence to established dietary guidelines. The modified RFS suggested by Kim *et al.* [15] was used to align with the nuances of the Korean diet, encompassing diverse items such as mixed grains, beans, vegetables, seaweed, fruits, seafood, dairy products, and nuts.

Food items and their assigned points for the RFS were as follows: daily meal frequency (1), grains (1), legumes (4), vegetables (17), seaweeds (2), fruits (12), fish (5), dairy products (3), nuts (1), and tea (1). Forty-six foods or food groups consistent with recommended dietary guidelines were considered, and responses for the 'daily frequency of meals' were used to calculate the RFS. The participants earned one point for each recommended food or regular eating pattern (3 meals per day) if they consumed the food at least once weekly. The total score ranged from 0 to 47 points, with higher scores indicating better diet quality [16].

RFS was categorized as less than 23 points and more than 23 points to simplify analysis. This distinction was established using the median score of 23. The classification was based on differentiating the group with a score of 23 or higher as having good overall meal quality and the group with less than 23 points as having poor meal quality.

LUTS assessment

A structured questionnaire was used to collect information on LUTS using the IPSS questionnaire. The IPSS was used to determine the presence or absence of LUTS. Scores of 8 or higher indicated moderate symptoms ('yes'), while scores ranging from 0 to 7 points indicated 'mild symptoms.'

Statistical analysis

The characteristics of the 2 groups were analyzed using t-tests and chi-square tests to determine if there was a significant difference in the presence or absence of LUTS based on the general characteristics of the study subjects and the RFS.

Statistical analysis was performed using R (version 4.1.3; R Foundation for Statistical Computing, Vienna, Austria). Logistic regression analysis was then conducted to assess the impact of the RFS on the likelihood of experiencing LUTS. A variable adjustment was implemented to isolate the specific effect of RFS on the presence or absence of LUTS. Age, education, marital history, income, occupation, BMI, metabolic syndrome, smoking, drinking, and prostate-specific antigen (PSA) were adjusted to ascertain significance. The confounders were chosen using the backward stepwise selection method. A *P*-value of < 0.05 was considered significant.

RESULTS

Characteristics of the study participants

Composite sample frequency analysis was performed to ascertain the general traits of the study participants. A total of 5,527 subjects were included in the analysis (**Fig. 1**). The subjects were predominantly in their 50s and 60s, reflecting the age distribution. In particular, all variables exhibited significant differences based on the RFS except for alcohol consumption, metabolic syndrome, BMI, and PSA level, as indicated in **Table 1**.

IPSS severity characteristics among study participants

The LUTS of the participants were assessed using the IPSS. They were divided into 2 groups based on their IPSS scores: scores below 8 points and scores of 8 points or higher. **Table 2** presents the characteristics of these 2 groups. Occupation and smoking status showed significant associations with IPSS scores. Exercise and metabolic syndrome had significant associations with the IPSS scores, with lower BMI and higher PSA levels correlating with higher IPSS scores (**Fig. 2**).

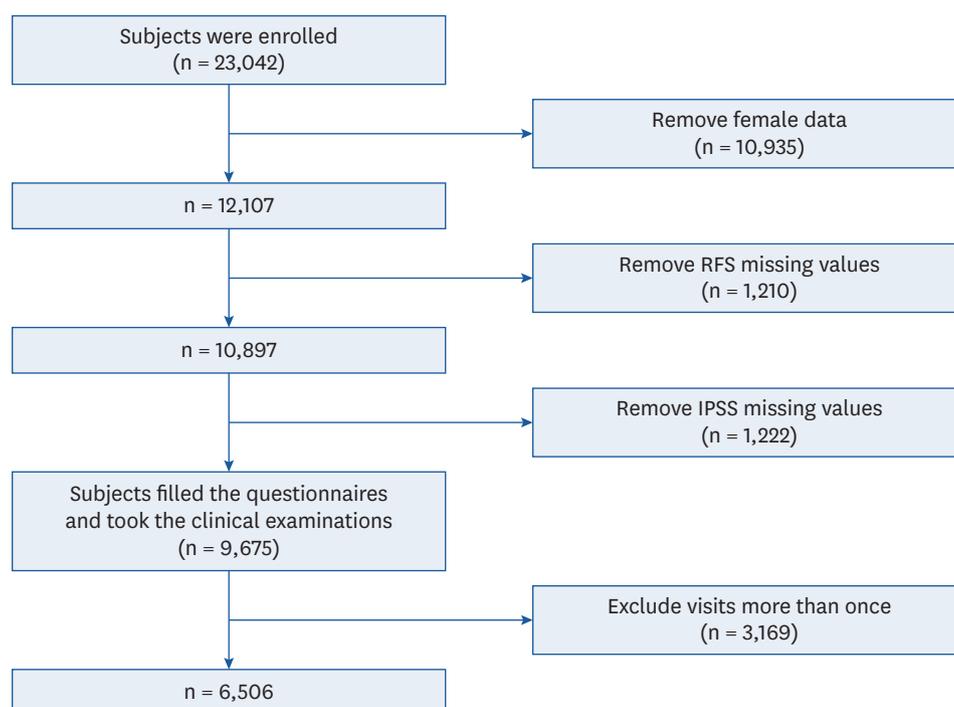


Fig. 1. Flowcharts for the study subjects.
RFS, recommended food score; IPSS, International Prostate Symptom Score.

Association between dietary quality and LUTS

A high RFS was associated with lower IPSS scores, indicating a potential protective effect. The odds ratio for high RFS in relation to moderate to severe IPSS symptoms was 0.88 ($P = 0.030$) in univariable analysis and 0.81 ($P = 0.001$) in multivariable analysis (**Table 2**).

DISCUSSION

The RFS, a measure of the overall diet quality, was negatively linked to the IPSS, which reflects LUTS among Korean men. To the best of the authors' knowledge, this is the first study showing a negative association between the RFS and IPSS in Korea. Previous studies have explored the influence of nutrients on LUTS, a common manifestation of BPH [8,17-19]. On the other hand, many of these studies examined the relationship between individual nutrients and LUTS, with limited research on the association between dietary patterns and symptoms, as reported in the present study. Although some studies suggested no significant correlation between nutrition and prostate volume [20], a substantial body of research indicates a noteworthy association between nutrition and LUTS.

Previous studies identified certain foods that may alleviate or exacerbate LUTS associated with BPH. Beneficial foods include vegetables, fruits, vegetable proteins, vitamins, and zinc while exacerbating factors include starches, high-calorie meals, and animal protein [21,22]. The present study examined the relationship between dietary patterns and LUTS while conducting subgroup analyses for individual nutrient items. Particularly noteworthy was the negative correlation observed with vegetables, fruit, legumes, seaweed, and dairy products, aligning with the findings from previous research (**Supplementary Table 1**). Although previous studies indicated a positive correlation between milk and dairy intake and the IPSS

Table 1. Description of the study sample

Category	Levels	Low RFS score	High RFS score	P-value
Age (yrs)	Under the 5th decade	769 (23.5)	443 (13.7)	< 0.001
	5th decade	1,039 (31.8)	949 (29.3)	
	6th decade	901 (27.6)	1,080 (33.3)	
	7th decade and over	557 (17.1)	768 (23.7)	
	Missing	0 (0.0)	0 (0.0)	
Education	Under highschool	855 (26.2)	723 (22.3)	< 0.001
	University	1,512 (46.3)	1,379 (42.6)	
	Postgraduate	842 (25.8)	1,095 (33.8)	
	Missing	57 (1.7)	43 (1.3)	
Marital history	Never	526 (16.1)	249 (7.7)	< 0.001
	Ever	2,719 (83.3)	2,969 (91.6)	
	Missing	21 (0.6)	22 (0.7)	
Income (won/mon)	< 3 mon	580 (17.8)	412 (12.7)	< 0.001
	3–6 mon	1,345 (41.2)	1,213 (37.4)	
	6–10 mon	827 (25.3)	1,025 (31.6)	
	≥ 10 mon	364 (11.1)	494 (15.2)	
	Missing	150 (4.6)	96 (3.0)	
Occupation	None	287 (8.8)	258 (8.0)	< 0.001
	Professional	1,016 (31.1)	1,196 (36.9)	
	Others	1,867 (57.2)	1,693 (52.3)	
	Missing	96 (2.9)	93 (2.9)	
Smoking	Never	975 (29.9)	1,068 (33.0)	< 0.001
	Ex	1,129 (34.6)	1,285 (39.7)	
	Current	1,144 (35.0)	868 (26.8)	
	Missing	18 (0.6)	19 (0.6)	
Drinking (frequency/week)	None	516 (15.8)	525 (16.2)	0.038
	< 2 drinks	1,599 (49.0)	1,674 (51.7)	
	≥ 2 drinks	1,136 (34.8)	1,034 (31.9)	
	Missing	15 (0.5)	7 (0.2)	
Exercise	No	321 (9.8)	182 (5.6)	< 0.001
	Yes	2,889 (88.5)	3,019 (93.2)	
	Missing	56 (1.7)	39 (1.2)	
Metabolic syndrome	No	2,182 (66.8)	2,145 (66.2)	0.636
	Yes	1,084 (33.2)	1,094 (33.8)	
	Missing	0 (0.0)	1 (0.0)	
Body mass index	Mean ± SD	24.8 ± 3.2	24.7 ± 3.0	0.174
PSA level (ng/mL)	Mean ± SD	1.6 ± 3.4	1.6 ± 1.8	0.602

Values are presented as number (%).

RFS, recommended food score; PSA, prostate-specific antigen.

[17], this study yielded contrasting results, showing a negative correlation between milk and yogurt intake and the IPSS score. In particular, the cheese intake had no significant association with the IPSS. An intriguing finding from the present study was the positive correlation between soy milk intake and IPSS. Individuals who consumed soy milk more than once a week were likelier to have higher IPSS scores (**Supplementary Table 1**). This association could be attributed to the presence of 'isoflavone' in soy milk, which may mimic the effects of estrogen, a female hormone. On the other hand, a meta-analysis showed that soy foods or isoflavone supplements do not alter bioavailable testosterone concentrations in men [23]. Therefore, although this result may indicate an effect of soy milk intake on hormones, it is essential to consider other factors, such as the high-calorie content of soy milk or other underlying causes. Further research will be needed to elucidate this relationship.

Several studies have examined the relationship between dietary patterns and LUTS, but few studies have directly investigated the impact of diet patterns on LUTS symptoms themselves. While some studies analyzed the association between Mediterranean diets and ED [9], this

Diet and lower urinary tract symptom

Table 2. Association between the variables and IPSS

IPSS	Mild symptoms	Moderate to severe symptoms	OR (univariable)	P-value	OR (multivariable)	P-value
Recommended food score				<i>P</i> = 0.030		<i>P</i> = 0.001
Low	2,369 (72.5)	897 (27.5)	-		-	
High	2,427 (74.9)	813 (25.1)	0.88 (0.79–0.99)		0.81 (0.71–0.92)	
Age (yrs)						
Under 5th decade	1,042 (86.0)	170 (14.0)	-		-	
5th decade	1,611 (81.0)	377 (19.0)	1.43 (1.18–1.75)	<i>P</i> < 0.001	1.44 (1.15–1.81)	<i>P</i> = 0.002
6th decade	1,384 (69.9)	597 (30.1)	2.64 (2.19–3.20)	<i>P</i> < 0.001	2.46 (1.95–3.11)	<i>P</i> < 0.001
7th decade and over	759 (57.3)	566 (42.7)	4.57 (3.77–5.57)	<i>P</i> < 0.001	3.73 (2.89–4.82)	<i>P</i> < 0.001
Education						
High or under university	1,002 (63.5)	576 (36.5)	-		-	
Postgraduate	2,207 (76.3)	684 (23.7)	0.54 (0.47–0.62)	<i>P</i> < 0.001	0.79 (0.67–0.93)	<i>P</i> = 0.005
Marital history				<i>P</i> < 0.001		<i>P</i> = 0.397
Never	629 (81.2)	146 (18.8)	-		-	
Ever	4,142 (72.8)	1,546 (27.2)	1.61 (1.33–1.95)		0.90 (0.71–1.15)	
Income (won/mon)						
< 3 mon	650 (65.5)	342 (34.5)	-		-	
3–6 mon	1,924 (75.2)	634 (24.8)	0.63 (0.53–0.73)	<i>P</i> < 0.001	0.94 (0.78–1.14)	<i>P</i> = 0.532
6–10 mon	1,414 (76.3)	438 (23.7)	0.59 (0.50–0.70)	<i>P</i> < 0.001	0.91 (0.74–1.13)	<i>P</i> = 0.396
≥ 10 mon	657 (76.6)	201 (23.4)	0.58 (0.47–0.71)	<i>P</i> < 0.001	0.91 (0.71–1.17)	<i>P</i> = 0.474
Occupation						
None	332 (60.9)	213 (39.1)	-		-	
Professional	1,720 (77.8)	492 (22.2)	0.45 (0.37–0.54)	<i>P</i> < 0.001	0.79 (0.62–1.01)	<i>P</i> = 0.056
Others	2,629 (73.8)	931 (26.2)	0.55 (0.46–0.67)	<i>P</i> < 0.001	0.84 (0.67–1.05)	<i>P</i> = 0.119
Smoking						
Never	1,598 (78.2)	445 (21.8)	-		-	
Ex	1,689 (70.0)	725 (30.0)	1.54 (1.35–1.77)	<i>P</i> < 0.001	1.19 (1.02–1.39)	<i>P</i> = 0.029
Current	1,488 (74.0)	524 (26.0)	1.26 (1.09–1.46)	<i>P</i> = 0.001	1.26 (1.07–1.49)	<i>P</i> = 0.006
Drinking						
None	740 (71.1)	301 (28.9)	-		-	
< 2 drinks	2,468 (75.4)	805 (24.6)	0.80 (0.69–0.94)	<i>P</i> = 0.005	1.02 (0.85–1.21)	<i>P</i> = 0.867
≥ 2 drinks	1,572 (72.4)	598 (27.6)	0.94 (0.79–1.10)	<i>P</i> = 0.423	1.09 (0.90–1.32)	<i>P</i> = 0.376
Exercise				<i>P</i> = 0.001		<i>P</i> = 0.195
No	338 (67.2)	165 (32.8)	-		-	
Yes	4,387 (74.3)	1,521 (25.7)	0.71 (0.59–0.86)		0.86 (0.70–1.08)	
Metabolic syndrome				<i>P</i> < 0.001		<i>P</i> = 0.034
No	3,255 (75.2)	1,072 (24.8)	-		-	
Yes	1,540 (70.7)	638 (29.3)	1.26 (1.12–1.41)		1.17 (1.01–1.34)	
Body mass index				<i>P</i> < 0.001		<i>P</i> < 0.001
Mean ± SD	24.8 ± 3.1	24.3 ± 3.0	0.95 (0.93–0.97)		0.95 (0.93–0.98)	
PSA level				<i>P</i> < 0.001		<i>P</i> = 0.017
Mean ± SD	1.5 ± 1.5	1.9 ± 4.7	1.10 (1.06–1.13)		1.04 (1.01–1.08)	
Yes	2,889 (88.5)	3,019 (93.2)				
Missing	56 (1.7)	39 (1.2)				
Metabolic syndrome			0.636			
No	2,182 (66.8)	2,145 (66.2)				
Yes	1,084 (33.2)	1,094 (33.8)				
Missing	0 (0.0)	1 (0.0)				

Values are presented as number (%).

IPSS, International Prostate Symptom Score; OR, odds ratio; PSA, prostate-specific antigen.

does not explicitly address LUTS symptoms or the expression of BPH. Currently, several therapeutic diet patterns are available for immediate application in clinical practice, such as the Mediterranean diet, the Dietary Approaches to Stop Hypertension diet, which is beneficial for cardiovascular disease, and the low FODMAP diet, effective for irritable bowel syndrome. Considering the abundance of studies examining BPH and nutrients, it is prudent to examine diet patterns that can alleviate BPH symptoms. This could pave the way for the development of dietary interventions directly applicable to clinical practice in the future.

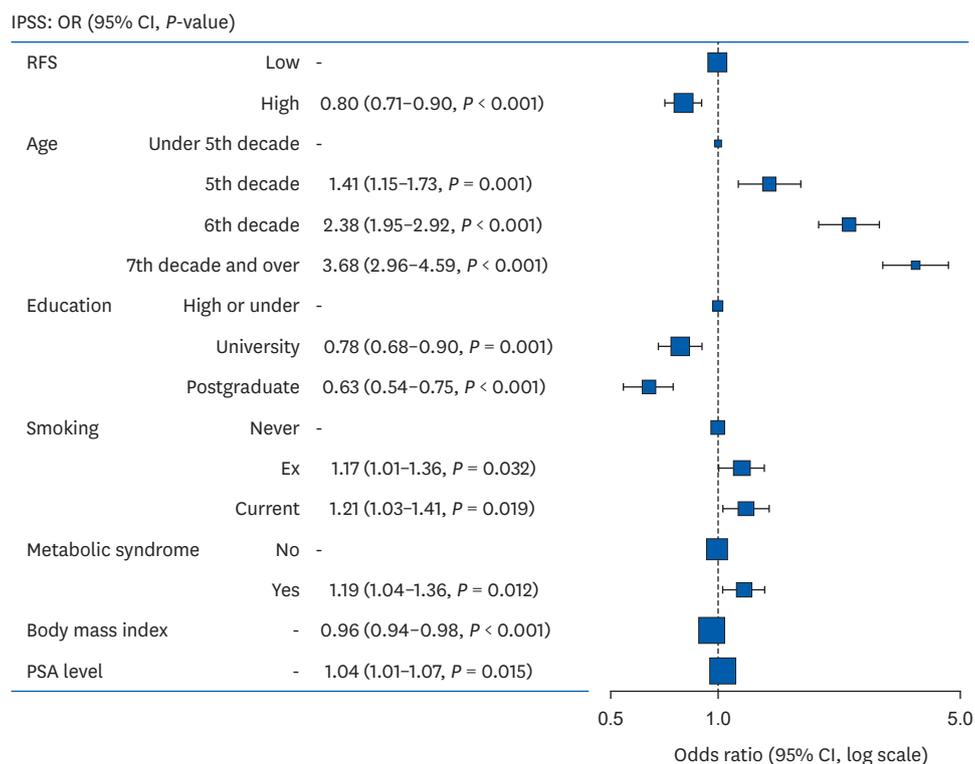


Fig. 2. Forest plot of subgroup analysis.

IPSS, International Prostate Symptom Score; OR, odds ratio; CI, confidence interval; PSA, prostate-specific antigen.

The RFS is a designed measurement tool for assessing dietary health developed by Kant *et al.* [12,13]. Despite the existence of indicators like Dietary Diversity Score for Commissioned Foods, HEI, and the Mediterranean diet, more tailored metrics were necessary for examining Korean dietary patterns. Recognizing the suitability of the RFS proposed by Kim, it was chosen as the evaluation tool for this study [15]. Previous research indicated that LUTS decreases more noticeably in Eastern or Mediterranean diets than in Western diets [24]. Moreover, oxidative stress may play a role in the mechanism underlying LUTS occurrence [4], and the RFS can be viewed as a dietary measure capable of reducing oxidative stress [15]. Furthermore, the Mediterranean diet includes items such as alcohol and red meat consumption, which may exacerbate LUTS symptoms. Thus, the RFS is suitable as a measurement tool for this study.

In this study, the IPSS questionnaire was chosen as the measurement tool to assess LUTS. This decision was based on the understanding that LUTS holds greater clinical significance than the prostate volume in diagnosing and managing BPH, particularly in its early stages, because it closely relates to voiding symptoms [25]. In addition, research has indicated that Korean men exhibit similar LUTS symptoms despite having smaller prostate volumes than Western men, further supporting the suitability of the IPSS questionnaire for capturing relevant outcome variables [26].

The results also revealed associations between LUTS and various factors, as indicated by the IPSS score (**Table 2**). Consistent with previous research, positive correlations were observed with subjects' age, smoking habits, PSA levels, and metabolic syndrome [27,28]. Higher education levels were associated with fewer LUTS symptoms [29]. On the other

hand, no significant associations were observed with the BMI and alcohol consumption, contrary to expectations. The relationship between the BMI and LUTS remains ambiguous in previous studies, with some suggesting a positive correlation because of elevated estrogen levels. In contrast, others argued that BMI and BPH/LUTS are unrelated [6,30]. The present findings did not show any association between alcohol consumption and LUTS. This lack of association could be attributed to limitations in the self-reporting accuracy of the drinking questionnaire (**Table 2**).

This study represents the first large-scale analysis of the relationship between the RFS survey and the IPSS in Korea. This research provides valuable insights applicable to clinical practice using real-world data collected from health examination centers. The focus of this study on a healthy population enhances its generalizability, making it relevant for broader segments of the population undergoing dietary interventions. Consequently, the findings can be easily translated into clinical practice, facilitating the development of tailored dietary interventions for individuals seeking to improve their health outcomes. Overall, real-world data and the emphasis of this study on a healthy population strengthen its applicability and potential impact in clinical settings.

This study had several limitations. First, the RFS and IPSS rely on self-reported data, which introduces the potential for recall bias. Second, while previous studies have analyzed various individual nutrients, this study assessed dietary patterns using a single questionnaire, which may result in less precise measurements. Hence, additional analyses are needed to explore the relationship between each dietary component and IPSS scores. Third, the study did not include an analysis of individuals currently receiving medication for BPH. Nevertheless, the findings may still be relevant for medicated and non-medicated individuals because dietary interventions are often used as adjunct or preventive therapies. Fourth, the prostate volume was not measured in this study. On the other hand, this study examined the relationship between dietary patterns and LUTS severity because LUTS is considered more clinically significant in diagnosing and managing BPH). Therefore, while the prostate volume remains relevant in specific contexts, this study prioritized understanding the impact of dietary habits on LUTS. In addition, the study did not include results regarding red meat consumption despite previous research suggesting a positive correlation between animal protein intake and LUTS. Future studies could explore this aspect to provide a more comprehensive understanding of dietary influences on LUTS. Last, this study used a modified version of the RFS tailored to the Korean diet, focusing on antioxidant-rich foods like whole grains, legumes, fruits, vegetables, and fish, excluding meat protein. Although meat protein, particularly from red and processed meats, may affect LUTS through increased oxidative stress, the RFS used in the present study reflects dietary components that are more common in Korea. Previous research suggests that antioxidant-rich diets are associated with reduced LUTS, supporting the relevance of this modified RFS.

Excluding meat protein limits the ability to assess its effects on LUTS. Future studies should consider incorporating meat intake to provide a more comprehensive view of dietary influences on LUTS across different populations.

Although additional research is needed to elucidate the effects of nutrients on the expression of LUTS, this study has provided valuable insights by confirming their significant impact. By investigating dietary habits as an indicator, this research offers a practical approach that may facilitate a more straightforward application in clinical practice. Moreover, the self-

report nature of the study, based on patient input, enhances the relevance of the findings to real-world clinical outcomes. As a result, the study findings contribute to developing more detailed intervention strategies in clinical settings for patients experiencing LUTS. By understanding the relationship between dietary patterns and LUTS, healthcare providers can tailor dietary recommendations to manage and alleviate symptoms better, ultimately improving the quality of life for patients affected by this condition.

The RFS negatively correlated with the IPSS, indicating that higher RFS values were associated with lower IPSS scores. In addition, most items comprising the RFS exhibited negative correlations with IPSS, suggesting that greater adherence to recommended dietary patterns was generally associated with a less severe form of LUTS. Soy milk intake showed a positive correlation with IPSS, suggesting that increased consumption of soy milk may be associated with higher LUTS scores.

This study indicates that a healthy diet, particularly one recommended by the RFS, correlates with a reduced incidence of LUTS. While adopting a healthy diet alone may not cure these symptoms, following an RFS diet could be a beneficial approach to alleviating them.

ACKNOWLEDGMENTS

The authors are grateful to all study participants for their contributions.

SUPPLEMENTARY MATERIAL

Supplementary Table 1

RFS association with the IPSS symptoms by item

REFERENCES

1. Isaacs JT. Etiology of benign prostatic hyperplasia. *Eur Urol* 1994;25 Suppl 1:6-9. [PUBMED](#) | [CROSSREF](#)
2. Platz EA, Joshu CE, Mondul AM, Peskoe SB, Willett WC, Giovannucci E. Incidence and progression of lower urinary tract symptoms in a large prospective cohort of United States men. *J Urol* 2012;188:496-501. [PUBMED](#) | [CROSSREF](#)
3. Russo GI, Broggi G, Cocci A, Capogrosso P, Falcone M, Sokolakis I, Gül M, Caltabiano R, Di Mauro M. Relationship between dietary patterns with benign prostatic hyperplasia and erectile dysfunction: a collaborative review. *Nutrients* 2021;13:4148. [PUBMED](#) | [CROSSREF](#)
4. Das K, Buchholz N. Benign prostate hyperplasia and nutrition. *Clin Nutr ESPEN* 2019;33:5-11. [PUBMED](#) | [CROSSREF](#)
5. Calogero AE, Burgio G, Condorelli RA, Cannarella R, La Vignera S. Epidemiology and risk factors of lower urinary tract symptoms/benign prostatic hyperplasia and erectile dysfunction. *Aging Male* 2019;22:12-9. [PUBMED](#) | [CROSSREF](#)
6. Gupta A, Gupta S, Pavuk M, Roehrborn CG. Anthropometric and metabolic factors and risk of benign prostatic hyperplasia: a prospective cohort study of Air Force veterans. *Urology* 2006;68:1198-205. [PUBMED](#) | [CROSSREF](#)
7. Suzuki S, Platz EA, Kawachi I, Willett WC, Giovannucci E. Intakes of energy and macronutrients and the risk of benign prostatic hyperplasia. *Am J Clin Nutr* 2002;75:689-97. [PUBMED](#) | [CROSSREF](#)
8. Lagiou P, Wu J, Trichopoulou A, Hsieh CC, Adami HO, Trichopoulos D. Diet and benign prostatic hyperplasia: a study in Greece. *Urology* 1999;54:284-90. [PUBMED](#) | [CROSSREF](#)

9. Giugliano F, Maiorino MI, Bellastella G, Autorino R, De Sio M, Giugliano D, Esposito K. Adherence to Mediterranean diet and erectile dysfunction in men with type 2 diabetes. *J Sex Med* 2010;7:1911-7. [PUBMED](#) | [CROSSREF](#)
10. Kant AK. Dietary patterns and health outcomes. *J Am Diet Assoc* 2004;104:615-35. [PUBMED](#) | [CROSSREF](#)
11. Kennedy ET, Ohls J, Carlson S, Fleming K. The Healthy Eating Index: design and applications. *J Am Diet Assoc* 1995;95:1103-8. [PUBMED](#) | [CROSSREF](#)
12. Kant AK, Graubard BI. A comparison of three dietary pattern indexes for predicting biomarkers of diet and disease. *J Am Coll Nutr* 2005;24:294-303. [PUBMED](#) | [CROSSREF](#)
13. Kant AK, Schatzkin A, Graubard BI, Schairer C. A prospective study of diet quality and mortality in women. *JAMA* 2000;283:2109-15. [PUBMED](#) | [CROSSREF](#)
14. Fung TT, McCullough ML, Newby PK, Manson JE, Meigs JB, Rifai N, Willett WC, Hu FB. Diet-quality scores and plasma concentrations of markers of inflammation and endothelial dysfunction. *Am J Clin Nutr* 2005;82:163-73. [PUBMED](#) | [CROSSREF](#)
15. Kim JY, Yang YJ, Yang YK, Oh SY, Hong YC, Lee EK, Kwon O. Diet quality scores and oxidative stress in Korean adults. *Eur J Clin Nutr* 2011;65:1271-8. [PUBMED](#) | [CROSSREF](#)
16. Jeong GW, Kim YJ, Park S, Kim H, Kwon O. Associations of recommended food score and physical performance in Korean elderly. *BMC Public Health* 2019;19:128. [PUBMED](#) | [CROSSREF](#)
17. Chen Y, Yu W, Zhou L, Wu S, Yang Y, Wang J, Tian Y, He D, Xu Y, Huang J, et al. Relationship among diet habit and lower urinary tract symptoms and sexual function in outpatient-based males with LUTS/BPH: a multiregional and cross-sectional study in China. *BMJ Open* 2016;6:e010863. [PUBMED](#) | [CROSSREF](#)
18. Denis L, Morton MS, Griffiths K. Diet and its preventive role in prostatic disease. *Eur Urol* 1999;35:377-87. [PUBMED](#) | [CROSSREF](#)
19. Sebastiano C, Vincenzo F, Tommaso C, Giuseppe S, Marco R, Ivana C, Giorgio R, Massimo M, Giuseppe M. Dietary patterns and prostatic diseases. *Front Biosci (Elite Ed)* 2012;4:195-204. [PUBMED](#) | [CROSSREF](#)
20. Shirazi M, Ariaifar A, Zeyghami S, Hosseini MM, Khezri AA. Association of diet with prostate specific antigen and prostate volume. *Nephrourol Mon* 2014;6:e19411. [PUBMED](#) | [CROSSREF](#)
21. Espinosa G. Nutrition and benign prostatic hyperplasia. *Curr Opin Urol* 2013;23:38-41. [PUBMED](#) | [CROSSREF](#)
22. Bravi F, Bosetti C, Dal Maso L, Talamini R, Montella M, Negri E, Ramazzotti V, Franceschi S, La Vecchia C. Food groups and risk of benign prostatic hyperplasia. *Urology* 2006;67:73-9. [PUBMED](#) | [CROSSREF](#)
23. Hamilton-Reeves JM, Vazquez G, Duval SJ, Phipps WR, Kurzer MS, Messina MJ. Clinical studies show no effects of soy protein or isoflavones on reproductive hormones in men: results of a meta-analysis. *Fertil Steril* 2010;94:997-1007. [PUBMED](#) | [CROSSREF](#)
24. Stewart KL, Lephart ED. Overview of BPH: symptom relief with dietary polyphenols, vitamins and phytochemicals by nutraceutical supplements with implications to the prostate microbiome. *Int J Mol Sci* 2023;24:5486. [PUBMED](#) | [CROSSREF](#)
25. Chokkalingam AP, Yeboah ED, Demarzo A, Netto G, Yu K, Biritwum RB, Tettey Y, Adjei A, Jadallah S, Li Y, et al. Prevalence of BPH and lower urinary tract symptoms in West Africans. *Prostate Cancer Prostatic Dis* 2012;15:170-6. [PUBMED](#) | [CROSSREF](#)
26. Lee SH, Chung BH, Kim CS, Lee HM, Kim CI, Yoo TK, Lee KS, Park KS, Byun SS, Yoon BI, et al. Survey on benign prostatic hyperplasia distribution and treatment patterns for men with lower urinary tract symptoms visiting urologists at general hospitals in Korea: a prospective, noncontrolled, observational cohort study. *Urology* 2012;79:1379-84. [PUBMED](#) | [CROSSREF](#)
27. Roehrborn CG, McConnell JD, Lieber M, Kaplan S, Geller J, Malek GH, Castellanos R, Coffield S, Saltzman B, Resnick M, et al. Serum prostate-specific antigen concentration is a powerful predictor of acute urinary retention and need for surgery in men with clinical benign prostatic hyperplasia. *Urology* 1999;53:473-80. [PUBMED](#) | [CROSSREF](#)
28. Gilling PJ. The metabolic syndrome and the prostate. *BJU Int* 2018;121:675. [PUBMED](#) | [CROSSREF](#)
29. Xiong Y, Zhang Y, Li X, Qin F, Yuan J. The prevalence and associated factors of lower urinary tract symptoms suggestive of benign prostatic hyperplasia in aging males. *Aging Male* 2020;23:1432-9. [PUBMED](#) | [CROSSREF](#)
30. Joseph MA, Harlow SD, Wei JT, Sarma AV, Dunn RL, Taylor JM, James SA, Cooney KA, Doerr KM, Montie JE, et al. Risk factors for lower urinary tract symptoms in a population-based sample of African-American men. *Am J Epidemiol* 2003;157:906-14. [PUBMED](#) | [CROSSREF](#)