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Original Article

Association between andropause symptoms and work functioning impairment: a cross-sectional study in two Japanese companies

Makoto OKAWARA[1]*, Seiichiro TATEISHI[2], Shigeo HORIE[3], Toshiyuki YASUI[4] and Yoshihisa FUJINO[1]

[1]Department of Environmental Epidemiology, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Japan
[2]Disaster Occupational Health Center, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Japan
[3]Department of Urology, Graduate School of Medicine, Juntendo University, Japan
[4]Department of Reproductive and Menopausal Medicine, Institute of Biomedical Sciences, Tokushima University Graduate School, Japan

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Abstract: The study aimed to assess the relationship between andropause, or male menopause, and work functioning in aging Japanese male workers. A cross-sectional study was conducted on 561 male employees from two Japanese companies. We measured andropause symptoms using the Aging Male's Symptoms (AMS) scale, and work functioning impairment using the Work Functioning Impairment Scale (WFun). The data were analyzed using Poisson regression with robust variance to estimate the relationship between andropause severity and work functioning impairment. The findings indicated a significant association between severe symptoms of andropause and increased work functioning impairment among male workers. Higher AMS scores, reflecting more severe symptoms, correlated with greater work functioning impairment, particularly with regard to physical and psychological health issues, such as muscle weakness and depressive symptoms. This study highlights the need for workplace health programs that include middle-aged and older male workers to address and manage symptoms of andropause. Further, it emphasizes the importance of recognizing andropause as a significant health issue that can adversely affect work performance and productivity. Future studies should incorporate the measurement of testosterone to ensure the more accurate assessment of andropause and its impact on work functioning.

Key words: Male menopause, Late-onset hypogonadism (LOH) syndrome, Presenteeism, Observational study, Japan

Introduction

Andropause, also known as male menopause, is characterized by a range of physical and psychological symptoms in middle-aged and older men[1, 2]. Symptoms associated

*To whom correspondence should be addressed.
E-mail: makotouoeh@med.uoeh-u.ac.jp

with andropause include decreased energy levels, sleep disturbances, emotional instability, poor concentration, decreased muscle strength, and decreased libido. Symptoms that are primarily due to age-related androgen reduction are referred to as late-onset hypogonadism (LOH)[3]. The prevalence of symptomatic LOH was reported to be 2.1% to 5.7% in men aged under 70 yr[4]. However, the etiology of andropause is complex; in particular, the symptoms are often nonspecific and may not always be caused by low androgen levels[5, 6].

Andropause among male workers has received increasing attention, particularly in Japan, where the decrease in the number and ratio of young adults and aging of the population have led to an increase in middle-aged and older male workers. Indeed, while 48% of male workers in Japan were aged 50 yr or older in 2013, this had risen to 55% by 2023[7]. Aging affects the health and work participation of working aging men. The quality of life of aging men is affected by andropause[8]. In certain sectors, physical and muscular prowess among male employees continues to be a critical factor in production processes. Maintaining the mental health of aging workers is also essential for making use of their wealth of knowledge and experience. The severity of andropause is associated with an increased need for sick leave[9, 10].

To date, however, andropause had been understood as a natural phenomenon associated with aging, and proactive measures to ameliorate its adverse impact have typically not been taken. Additionally, because of the stigma attached to it, many aging men do not address andropause aggressively, such as by seeking diagnosis or treatment. In a previous survey, the percentage of Japanese men who had visited a hospital for andropause was less than 0.2%, even for the largest group, those aged 55–59[11]. Lack of public awareness, including in the workplace, has led to missed opportunities to improve the health and productivity of older men of working age.

Andropause can significantly impair work performance by affecting the health and work functioning of male workers. Work functioning impairment refers to a state in which the worker's health condition is not sufficient to carry out the tasks assigned to them[12]. Work functioning impairment often leads to presenteeism, namely productivity loss due to poor health condition[13]. To date, it has been shown that various diseases or conditions such as depression, chronic pain, insomnia, and more are related to work functioning impairment[14–16]. Furthermore, work functioning impairment are related to occupational safety, such as near misses and traffic accidents[17, 18]. A range of examples of work functioning impairment related to andropause can be cited: decreased muscle strength due to andropause can make physical work more difficult; sleep problems can exacerbate the challenges which typically accompany shift work; and mental health problems can diminish the working ability of workers by reducing their concentration and motivation. Despite these important health and workplace effects in aging men, however, few studies have examined andropause in the workplace or its relationship with work functioning.

We hypothesized that middle-aged and older workers with andropause symptoms experience work functioning impairment. Although the association of various health conditions and work functioning impairment has been investigated, the relationship between andropause and work functioning impairment remains largely unexplored.

Here, we investigated the connection between andropause and work functioning impairment.

Methods

The study was conducted under a cross-sectional design in October 2023 among employees of two Japanese corporations. The first site involved Company A, a general chemical firm in Japan, where approximately 160 male employees from all age groups in one of the office departments were invited to participate via the company intranet from October 18 to October 31, 2023. The second site, Company B, was a consumer goods chemical manufacturer in Japan with 6,778 male employees aged 40 yr and above across 11 sites. In October 2023, the study was advertised through the company intranet and email to those aged 40 yr and older. Participants voluntarily completed a web-based self-administered questionnaire. The study was approved by the Ethics Committee of the University of Occupational and Environmental Health, Japan (approval numbers ER23-007 and ER23-008).

Assessment of symptoms about andropause

Andropause symptoms were assessed using the Aging Male's Symptoms (AMS) scale, which has three subscales for physical, psychiatric, and sexual symptoms. The AMS scale has been validated as internally consistent, structurally sound, and responsive to testosterone replacement therapy[19–23].

Questionnaires asking about symptoms of andropause, such as the AMS and the Androgen Deficiency in the Aging Male (ADAM) questionnaire[24], have been shown to have low specificity for LOH with an actual decrease in

testosterone[25, 26], and the European Association of Urology consequently discourages their use in screening for LOH[4]. Our assessment of symptoms about andropause relies on only AMS questionnaire, that could be insufficient identification andropause or LOH specifically. In contrast, a study by the European Male Aging Study group found that the presence of sexual symptoms such as erectile dysfunction, decreased sexual thinking, and decreased morning erection was significantly associated with serum total or free testosterone levels[27]. Akehi *et al.* reported that a total score of 10 or higher on specific AMS items was significantly associated with measures of total, free, calculated free, and calculated bioavailable testosterone. These four specific items, known as the "selective score", included a decrease in muscular strength (No. 10), a decrease in the ability to perform sexually or its frequency (No. 15), a decrease in the number of morning erections (No. 16), and a decrease in sexual desire/libido (No. 17)[28].

The classifications of the total and subscale scores were determined based on these results. Total score for andropause symptoms was categorized as follows: none (17–26), mild (27–36), moderate (37–49), and severe (50–75). Due to insufficient sample size, the "none" and "mild" categories for three subscales were combined. Physical symptoms were classified as none or mild (7–12), moderate (13–18), and severe (19–32). Psychiatric symptoms were classified as none or mild (5–8), moderate (9–12), and severe (13–21). For sexual function symptoms, the severe category had a range of points (11–24), while the other categories were none or mild (5–7) and moderate (8–10). The selective score was classified as <10 and ≥10 points.

Assessment of Work functioning impairment and other covariates

Work functioning impairment was evaluated using the Work Functioning Impairment Scale (WFun)[12]. Developed based on the Rasch model, this self-reported measure of work functioning impairment has been validated by the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) and has demonstrated convergent validity and responsiveness with the severity of conditions such as pain, rheumatism, and depression, among others[14, 15, 29]. The WFun scale comprises seven questions ("I haven't been able to behave socially"," I haven't been able to maintain the quality of my work", "I have had trouble thinking clearly", "I have taken more rests during my work", "I have felt that my work isn't going well", "I haven't been able to make rational decisions", and "I haven't been proactive about my work") with a maximum score of 35. A cut-off score of 21 or higher, indicating moderate or severe impairment of work functioning, was established based on studies that correlated occupational health nurse interviews with the impact of health issues on work performance[30].

We collected additional covariates, including age (categorized as 40–49, 50–59, 60, and over), job type (mainly desk work, jobs mainly involving interpersonal communication, and mainly physical work), smoking status (current or not), alcohol intake (almost never, less than 1day per week, 2–3 d per week, 4–5 d per week, 6–7 d per week). Categorical data on company type were also obtained. Working days per week and working hours per day were recorded as continuous variables.

Statistics

The questionnaire was web-based and missing values were not permitted, except with regard to the AMS score; this was due to the inclusion of questions on sexual function, for which responses were made optional. However, the number of respondents with missing values was small, and we consequently excluded participants with missing AMS scores.

We used the AMS total score, subscales, and selective score as exposure factors and moderate or greater work functioning impairment (WFun score >21) as the outcome. We conducted Poisson regression with robust variance to determine the prevalence ratio (PR) for work functioning impairment. Preliminary analyses showed no significant heterogeneity for company type in the association between AMS and work functioning impairment. We used age group, job type, smoking status, alcohol intake, company type, working days per week, and working hours per day as covariates in the multivariable analyses, in addition to univariable analyses. Sensitivity analysis was conducted using general linear regression, with the outcome as a continuous value of the WFun total score and the exposure as a dummy variable for each category of the AMS or a continuous value of the score for each category. All analyses were performed using Stata (Stata Statistical Software release 17. 0; StataCorp LLC, College Station, TX, USA), with a p-value of less than 0.05 considered to indicate statistical significance.

Results

Figure 1 shows the participant flowchart. The 607 respondents consisted of 85 individuals (53%) from Company A and 522 (8%) from Company B. After exclusion

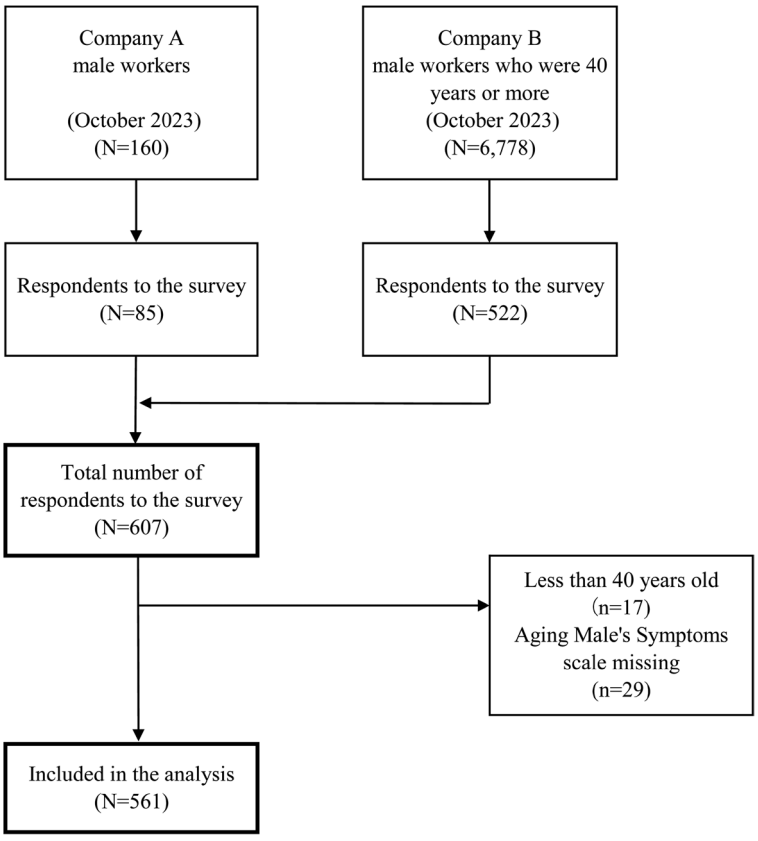

Fig. 1. Flow chart of participants in the study.

of those aged under 40 yr (n=17) and those with missing AMS scores (n=29), 561 were included in the analysis.

Table 1 shows the characteristics of the participants. Most respondents were aged 50–59 and desk workers. Median workweek was five days and median workday was eight hours, which is the standard workday for full-time workers in Japan.

Figure 2 shows the distribution of WFun scores by AMS total score. Higher AMS severity was associated with higher WFun scores, with few individuals in the "none" severity group having moderate or severe work functioning impairment.

Table 2 shows the association between AMS total score, subscales and selective scores and work functioning impairment. For all scores except the sexual subscale, prevalence ratios were significantly higher compared to the "none" or "mild" severity group. The sexual subscale was statistically significant in the severe group (PR: 4.45, 95% CI: 2.06–9.61). All scales showed a significant trend at the $p<0.001$ level.

Discussion

This cross-sectional study of male workers aged 40 and older in two Japanese companies identified an association between andropause severity (AMS) and work functioning impairment (WFun). The sensitivity analysis using general linear regression showed similar result (Appendix Table). To our knowledge, this is the first study to measure andropause symptoms and work functioning impairment in companies.

Results showed that physical symptoms related to andropause were associated with work functioning impairment. Andropause symptoms can be classified into three categories: physical, psychological, and sexual. The physical symptoms, which include fatigue, muscle weakness, joint pain, and sleep disturbances, lead to a reduction in energy and endurance and thereby negatively affect productivity, particularly in physically demanding tasks. For instance, fatigue and muscle weakness have a direct effect on performance in work environments that require heavy lifting or prolonged standing. Additionally, sleep disturbances result in poor concentration and fatigue, leading to a decline in efficiency and an increase in work

Table 1. Participants characteristics

	Total N=561	Aging Male's Symptoms Scale			
		17–26 n=223	27–36 n=230	37–49 n=80	50–75 n=28
Age class (yr)					
40–49	122 (21.7%)	59 (26.5%)	43 (18.7%)	16 (20.0%)	4 (14.3%)
50–59	321 (57.2%)	122 (54.7%)	133 (57.8%)	49 (61.3%)	17 (60.7%)
over 60 years	118 (21.0%)	42 (18.8%)	54 (23.5%)	15 (18.8%)	7 (25.0%)
Smoking, current	117 (20.9%)	51 (22.9%)	46 (20.0%)	15 (18.8%)	5 (17.9%)
Alcohol intake					
almost never	146 (26.0%)	54 (24.2%)	67 (29.1%)	16 (20.0%)	9 (32.1%)
less than 1 day per week	84 (15.0%)	33 (14.8%)	34 (14.8%)	12 (15.0%)	5 (17.9%)
2–3 days per week	94 (16.8%)	38 (17.0%)	38 (16.5%)	15 (18.8%)	3 (10.7%)
4–5 days per week	52 (9.3%)	21 (9.4%)	22 (9.6%)	8 (10.0%)	1 (3.6%)
6–7 days per week	185 (33.0%)	77 (34.5%)	69 (30.0%)	29 (36.2%)	10 (35.7%)
Job type					
Mainly desk work	400 (71.3%)	150 (67.3%)	168 (73.0%)	64 (80.0%)	18 (64.3%)
Jobs mainly involving interpersonal communication	107 (19.1%)	53 (23.8%)	40 (17.4%)	9 (11.2%)	5 (17.9%)
Mainly physical work	54 (9.6%)	20 (9.0%)	22 (9.6%)	7 (8.8%)	5 (17.9%)
Company					
A	64 (11.4%)	22 (9.9%)	29 (12.6%)	9 (11.2%)	4 (14.3%)
B	497 (88.6%)	201 (90.1%)	201 (87.4%)	71 (88.8%)	24 (85.7%)
Workday per week, median (IQR)	5 (5–5)	5 (5–5)	5 (5–5)	5 (5–5)	5 (5–5)
Workhour per day, median (IQR)	8 (8–9)	8 (8–9)	8 (8–8)	8 (8–9)	8 (8–8)

IQR: interquartile range.

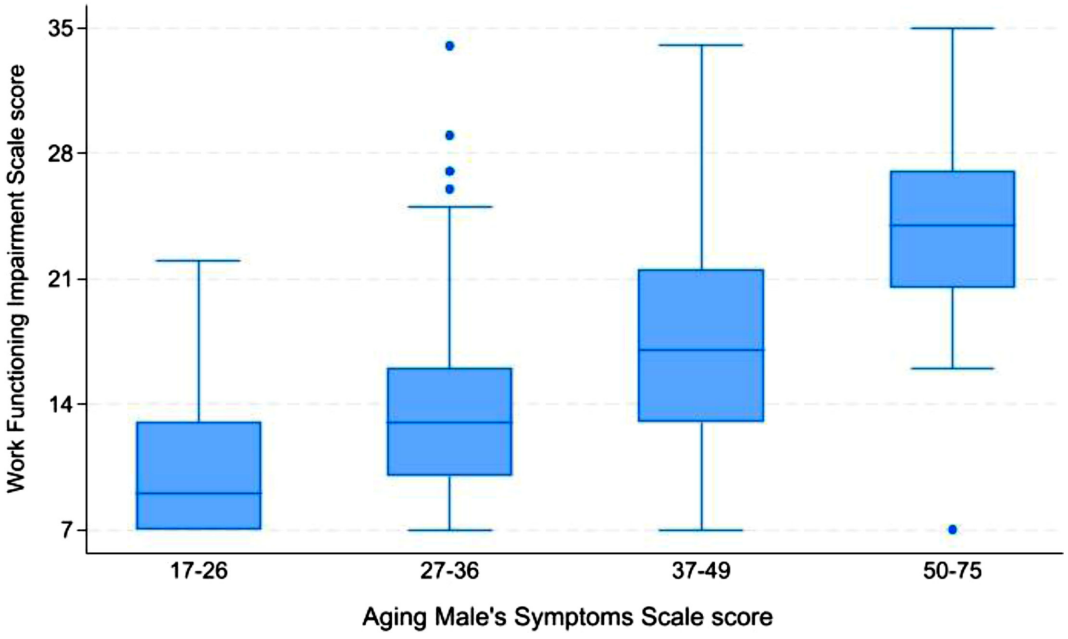

Fig. 2. Distribution of Work Functioning Impairment Scale scores by Aging Male's Symptoms Scale total score.

errors, ultimately reducing productivity. By introducing a flexible working hours system for fatigue and providing mechanical support and ergonomic measures to ensure that the workload is not too much for all workers, including those with reduced muscle strength, it can be possible to alleviate impact of physical symptoms to work.

Table 2. Association between AMS score and work functioning impairment

Variable	Number of each category	Work functioning impairment	Univariable				Multivariable*			
	n	%	Prevalence ratio	95% Confidence Interval		*p*-value	Prevalence ratio	95% Confidence Interval		*p*-value
Aging Male's Symptoms Scale (AMS)										
17–26	223	1	reference			< 0.001†	reference			< 0.001†
27–36	230	10	7.43	2.26	24.43	0.001	7.38	2.23	24.34	0.001
37–49	80	28	20.44	6.28	66.52	< 0.001	18.90	5.77	61.85	< 0.001
50–75	28	75	55.75	17.74	175.21	< 0.001	59.64	19.00	187.25	< 0.001
AMS Subscales										
Physical										
7–12	297	4	reference			< 0.001†	reference			< 0.001†
13–18	213	14	3.80	1.95	7.42	< 0.001	3.45	1.76	6.75	< 0.001
19–32	51	55	14.82	7.88	27.88	< 0.001	14.30	7.55	27.10	< 0.001
Psychological										
5–8	417	5	reference			< 0.001†	reference			< 0.001†
9–12	112	21	3.89	2.25	6.72	< 0.001	3.71	2.14	6.44	< 0.001
13–21	32	75	12.22	9.03	22.38	< 0.001	14.92	9.19	24.23	< 0.001
Sexual										
5–7	151	5	reference			< 0.001†	reference			< 0.001†
8–10	192	9	1.91	0.81	4.49	0.138	1.95	0.83	4.57	0.124
11–24	218	21	4.45	2.06	9.61	< 0.001	4.67	2.18	10.01	< 0.001
AMS Selective score ‡										
4–9	366	7	reference			< 0.001	reference			< 0.001
10–20	195	22	2.92	1.86	4.59	< 0.001	2.96	1.90	4.62	< 0.001

WFun: The Work Functioning Impairment Scale.

*adjusted for age, smoking status, alcohol intake, job type, company, workday per week, workhour per day.

†*p* for trend.

‡decrease in muscular strength (No. 10), decrease in the ability to perform sexually or its frequency (No. 15), decrease in the number of morning erections (No. 16), and decrease in sexual desire/libido (No. 17).

Our study also demonstrated a connection between psychological symptoms of andropause, such as depression, anxiety and poor concentration, and work functioning impairment. Previous studies indicated that low testosterone levels are associated with depressive symptoms[31]. Psychological symptoms including depression are major causes of work functioning impairment[13, 14, 32]. Depression and anxiety may lead to decreased motivation, reluctance to tackle new tasks, and a loss of interest in assigned tasks. Irritability and emotional instability may also affect workplace relationships and indirectly affect team performance and duties.

Further, our study proposes that sexual dysfunction, including reduced sex drive and erectile dysfunction, may also have an indirect impact on work productivity. This could be potentially explained by psychological impacts including a lack of enthusiasm and self-efficacy. Although there are lack of study investigating the mechanisms between sexual dysfunction and work motivation directly, sexual dysfunction has a significant impact on men's quality of life as it can result in decreased self-esteem and increased stress in partner relationships[33]. As a result, sexual dysfunction may lead to a reduction in work motivation and engagement. Lack of work enthusiasm and low self-efficacy have been shown to be associated with presenteeism and decreased productivity[34–36]. Patients with erectile dysfunction experience depressive symptoms, and both are interrelated and form a downward spiral[37].

This study reveals previously unnoted social repercussions of andropause. Sixty percent of the participants exhibited mild to severe symptoms of andropause. Unfortunately, however, both workers and healthcare providers frequently fail to adequately identify the presence or effects of the andropause, with a consequent potential for delay in addressing symptoms and obtaining care. This can in turn lead to diminished productivity in the workplace.

It is therefore crucial to acknowledge the influence of andropause and implement measures, such as andropause screening programs in the workplace. Further, employees should be offered exercise programs for all employees including older male workers, to enhance their healthy lifestyles[38, 39]. Arranging working schedules can be considered especially shift workers or those with sleep disorders with andropause to make it easier for them to manage their symptoms themselves[40, 41]. Some studies reported work related factors such as job type and job demands can affects testosterone levels or andropause symptoms[42–45]. Use of Employee Assistance Programs (EAPs) and occupational health professionals will be effective in enhancing the consultation system for work-related problems and in diagnosis and treatment.

This study has several limitations. First, completion of the questionnaire was voluntary and the response rate was low. The participants might accordingly have been more interested in or have experience of andropause symptoms or work functioning impairment. Second, the study was conducted in two large Japanese companies, and the sample was not representative of the Japanese workforce. However, the similar results obtained across the two companies support the homogeneity of the findings. Third, AMS screening has low specificity and does not exclude patients with mood disorders like depression, which might be confused with andropause[46]. We referred to previous studies to confirm the association of questionnaire items with actual testosterone concentrations. Future studies should include objective indices like testosterone measurement. Fourth, our analysis did not include some unmeasured potential confounders, such as history of chronic disease or work-related stress, which have an uncertain effect on the result. Last, the study design is cross-sectional and this study cannot determine causal relationship.

Conclusions

In this study using a cross-sectional design, we show that Japanese workers with severe andropause symptoms exhibited a higher prevalence of work functioning impairment. Validation of these findings requires additional research in diverse populations and the incorporation of testosterone measurement.

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Conflicts of Interest

Dr. Fujino has the copyright to WFun with royalties paid from Sompo Health Support Inc., outside from this work. The other authors declare no conflicts of interest associated with this manuscript.

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Appendix

Appendix Table. Association between AMS score and WFun score

Variable	WFun score	Univariable				Multivariable*			
	Mean (Standard Error)	Coefficient	95% Confidence Interval		*p*-value	Coefficient	95% Confidence Interval		*p*-value
Aging Male's Symptoms Scale (AMS)	13.1 (0.24)	0.36	0.32	0.40	< 0.001‡	0.37	0.33	0.41	< 0.001‡
17–26	10.1 (0.23)	reference				reference			
27–36	13.5 (0.33)	3.35	2.47	4.23	< 0.001	3.42	2.56	4.28	< 0.001
37–49	16.9 (0.71)	6.78	5.56	8.00	< 0.001	6.85	5.65	8.04	< 0.001
50–75	23.4 (1.05)	13.23	11.35	15.10	< 0.001	13.53	11.70	15.36	< 0.001
AMS Subscales									
Physical		0.78	0.69	0.87	< 0.001‡	0.77	0.68	0.86	< 0.001
7–12	10.8 (0.25)	reference				reference			
13–18	14.6 (0.36)	3.85	2.97	4.72	< 0.001	3.68	2.81	4.55	< 0.001
19–32	20.7 (0.98)	9.90	8.42	11.37	< 0.001	9.85	8.39	11.30	< 0.001
Psychological		1.20	1.07	1.32	< 0.001‡	1.18	1.06	1.31	< 0.001‡
5–8	11.5 (0.23)	reference				reference			
9–12	16.4 (0.51)	4.90	3.88	5.91	< 0.001	4.73	3.71	5.74	< 0.001
13–21	23.2 (1.03)	11.73	9.99	13.48	< 0.001	11.80	10.06	13.53	< 0.001
Sexual		0.46	0.34	0.58	< 0.001‡	0.52	0.40	0.64	< 0.001‡
5–7	11.2 (0.39)	reference				reference			
8–10	13.0 (0.37)	1.81	0.61	3.01	0.003	2.02	0.82	3.21	0.001
11–24	14.7 (0.44)	3.50	2.34	4.67	< 0.001	3.91	2.74	5.09	< 0.001
AMS Selective score †		0.52	0.38	0.65	< 0.001‡	0.57	0.44	0.71	< 0.001‡
4–9	12.3 (0.26)	reference				reference			
10–20	14.7 (0.48)	2.44	1.45	3.43	< 0.001	2.67	1.68	3.65	< 0.001

WFun: The Work Functioning Impairment Scale.

*adjusted for age, smoking status, alcohol intake, job type, company, workday per week, workhour per day.

†decrease in muscular strength (No. 10), decrease in the ability to perform sexually or its frequency (No. 15), decrease in the number of morning erections (No. 16), and decrease in sexual desire/libido (No. 17).

‡*p* for trend, and the change in the WFun total score for 1 point increase in the each AMS score.