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Prevalence and Associated Factors of Sarcopenia in Preretirement Aged With Chronic Nonspecific Low Back Pain

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Background: Sarcopenia stands as a prominent health concern, exhibiting a notable correlation with chronic lower back pain among the elderly population, with an observed upward trajectory of both conditions within the preretirement age group.

Objective: To examine the prevalence of sarcopenia among individuals in the preretirement age group experiencing chronic nonspecific low back pain, and identify any associated factors.

Methods: This descriptive cross-sectional study included 164 participants, aged 50 to 59 years, from the Department of Rehabilitation Medicine, Faculty of Medicine Ramathibodi Hospital, Mahidol University. Patient data encompassing demographics, physical activity (International Physical Activity Questionnaires, IPAQ), and quality of life (European Quality of Life 5-Dimension 5-Level, EQ-5D-5L) were collected. Sarcopenia criteria, following the consensus of the Asian Working Group of Sarcopenia (AWGS) 2014, were evaluated through bioelectrical impedance analysis, handgrip dynamometry, and/or the 6-meter walk test. Participants with chronic low back pain underwent assessments of pain severity and functionality.

Results: Of 164 participants (mean [SD] age, 55.1 [2.6] years; mean [SD] body mass index, 24.7 [4.3] kg/m^2), IPAQ responses indicated a range from low to moderate activity levels. The health-related quality of life score (median [range]) from EQ-5D-5L assessments stood at 0.94 [0.34 - 1.00]. Sarcopenia was detected in 10 out of 58 subjects (17.2%) with chronic low back pain, and in 6 out of 106 normal subjects (5.7%).

Conclusions: The prevalence of sarcopenia among individuals within the preretirement age group experiencing chronic low back pain was notably high when compared to non chronic low back pain cases, without associated factors.

Keywords: Sarcopenia, Chronic low back pain, Preretirement aged

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Introduction

Sarcopenia stands as a condition involving the loss of musculoskeletal mass, posing a significant health challenge. Its impact on physical well-being and quality of life arises from the heightened risk of myocardial infarction, falls, bone fractures, and osteoporosis. Consequently, it diminishes the capacity for daily activities and work, resulting in disability, elevated morbidity rates, extended hospital stays, and increased mortality rates.[1-3]

In the Asian region, the prevalence of sarcopenia ranges from 9.6% to 22.1% in males and 7.7% to 21.8% in females, with a higher incidence noted among the elderly population. The reduction in muscular mass initiates as early as the age of 40, with a decline of 1% to 2% in muscular mass annually, a 1.5% drop in muscular strength per year, and up to 3% yearly after reaching 60.[1, 4]

Currently, the Asian Working Group of Sarcopenia (AWGS) 2014 consensus defines sarcopenia. This involves gauging muscle mass via dual-energy x-ray absorptiometry (DXA), measuring less than 7.0 kg/m^2 in males and less than 5.4 kg/m^2 in females. Alternatively, bioelectrical impedance analysis (BIA) can be used, with criteria of less than 7.0 kg/m^2 in males and less than 5.7 kg/m^2 in females. Additionally, handgrip strength should decline to less than 26 kg in males and less than 18 kg in females, or the 6-meter walk gait speed should be less than 0.8 m/s.[2]

Studies conducted in Thailand revealed that among the elderly, sarcopenia affected 35.33% of males and 34.74% of females.[4, 5] The prevalence extended to the age group of 50 to 59 years, with 38.18% of males and 51.96% of females experiencing sarcopenia before retirement. While females showed higher sarcopenia rates compared to the 40 to 49 age group, males exhibited an incremental rise in sarcopenia cases with advancing age.[4]

Utilizing the disability-adjusted life year (DALY) metric, musculoskeletal disorders were predominantly observed in cases of neck and back pain, falls, and osteoarthritis.[6] Notably, the most prevalent condition was back pain, accounting for a significant 33%.[7] Presently, the ramifications of acute and subacute back pain on physical activities remain ambiguous, while chronic lower back pain has been identified as a contributor to diminished physical engagement.[8] A recorded prevalence of chronic lower back pain reached up to 25.4% in elderly individuals,[9] along with figures ranging from 8.2% to 27.7% among those aged 50 to 59 years.[10, 11]

The incidence of chronic lower back pain exhibited a rising trend from the age of 30 onwards, with a particularly pronounced surge in the 50 to 59 age range. Notably, the prevalence of chronic lower back pain was 3 to 4 times higher in individuals aged over 50 compared to those in the 18 to 30 age bracket.[9] In Thailand, chronic lower back pain affected 29.7% of individuals over 45 years, consequently leading to limitations in daily activities.[12]

Park et al[13] investigation in 2016 found a connection between chronic lower back pain and sarcopenia in elderly individuals. They noted a higher incidence of sarcopenia in patients with lumbar spinal canal stenosis in comparison to those without lower back pain. This relationship impacted their ability to undertake the Time Up and Go (TUG) test, and their daily activity limitations were measured by the Oswestry Disability Index (ODI).[14] Similarly, Sakai et al[15] study revealed a correlation between chronic lower back pain, measured by the visual analogue scale (VAS), and limitations in daily activities, as assessed by the Roland Morris Disability Questionnaire (RMDQ).

From the insights of these studies, a nexus between chronic lower back pain and sarcopenia becomes apparent, particularly in the preretirement group (50 - 59 years). The study endeavors to explore the prevalence and associated factors of sarcopenia in this demographic affected by chronic nonspecific lower back pain. The objective is to elucidate the public health implications and scope, while uncovering risk cofactors for these conditions. This would facilitate swift monitoring and screening, subsequently guiding the development of health promotion strategies aimed at enhancing the overall quality of life.

This study aimed to investigate the occurrence of sarcopenia in a preretirement group afflicted by chronic lower back pain, along with identifying the interrelationships between sarcopenia and chronic lower back pain.

Methods

Study Design and Participants

This study was designed in the form of a descriptive cross-sectional study. Participants were recruited at the Department of Rehabilitation Medicine, Faculty of Medicine Ramathibodi Hospital, Mahidol University, from September 20, 2018, to September 19, 2019. Inclusion criteria were a person between the ages of 50 to 59 years with or without chronic lower back pain longer than 3 months, but without any dangerous signs of lower back pain, sciatica pain, neurological symptoms, able to walk continuously for at least 10 minutes, and give written consent to join the study.

Subjects with a history of scoliosis, spinal fracture, spondylolisthesis, osteomyelitis, neurological disorder, myasthenia gravis, underlying disease such as acute coronary syndrome, cancer, severe muscular or joint disease that affects the ability to walk continuously for at least 10 meters, implanted with a pacemaker or electrical device, and subjects who refuse or withdraw from the study were excluded.

According to the study of Sakai et al[15] the prevalence of sarcopenia in elderly people with chronic lower back pain was 40%. Therefore, this study determined the confidence interval at 95% and the error at 7.5%, the sample size of the study was 164 participants in total.

Ethics

This study was approved by the Human Research Ethics Committee of the Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Thailand (No. MURA2018/520 on September 20, 2018).

Procedures

The researcher explained the details, objectives, and methods of the study to the participants to consider. Participants were then asked to give written consent to join the study. Then the researcher collected the participants' basic data such as gender, age, weight, height, body mass index (BMI), physical activities (International Physical Activity Questionnaire, IPAQ),[16] quality of life (European Quality of Life 5-Dimension 5-Level, EQ-5D-5L) questionnaire,[17] underlying diseases, and history of alcohol drinking and cigarette smoking.

Participants were assessed for sarcopenia by considering the decline of muscle mass, measured with the BIA (InBody 720, Biospace, Tokyo, Japan).[18] The values of the appendicular skeletal muscle index were calculated by using the total appendicular skeletal muscle per height squared. The decline of handgrip muscular strength, measured with a handgrip dynamometer (JAMAR, Sammons Preston Rolyan, Illinois, USA).[19, 20] Each participant was asked to sit with the elbows close to the body in 90° flexion, arms in the middle position, wrist in the middle or tilting not more than 30°, and a dominant hand squeezing with full force 3 times with a 1-minute interval each time. And the physical fitness assessed by measuring 6-meter walk gait speed. Participants walked 10 meters at the usual speed in daily life, timing at 2 to 8 meters to get the actual distance of 6 meters.

Participants were considered to have sarcopenia when the appendicular skeletal muscle index was less than 7.0 kg/m^2 in males and less than 5.7 kg/m^2 in females, together with handgrip strength less than 26 kg in males and less than 18 kg in females, or walking speed less than 0.8 m/s.[2]

Participants with chronic lower back pain for longer than 3 months without any dangerous signs of lower back pain, sciatica pain, or neurological disorder completed the questionnaire for the 100-mm horizontal VAS and ODI.[21]

Data were analyzed to find out the prevalence and factors associated between sarcopenia and chronic lower back pain in preretirement aged adults.

Statistical Analysis

Data were analyzed with the SPSS version 21 (IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp; 2012). Participants' basic data were analyzed with descriptive statistics in mean and standard deviation (SD) in the case of normal distribution, but in median and range in the case of nonnormal distribution. Regarding the between-group comparison, the unpaired *t* test was used in the case of normal distribution, whereas the Mann-Whitney *U* test was used in the case of nonnormal distribution.

Prevalence was presented in numbers and percentages by analyzing sarcopenia and chronic lower back pain with a chi-square test, while the associated factors were analyzed with univariate analysis. The results were interpreted at a statistical significance of $P < .05$.

Results

Of 164 participants (mean [SD] age, 55.1 [2.6] years; mean [SD] BMI, 24.7 [4.3] kg/m^2), 135 (82.3%) individuals were females. IPAQ responses indicated predominantly low to moderate activity levels, while results from the EQ-5D-5L assessments revealed a median (range) of 0.94 (0.34 - 1.00). In terms of underlying health conditions, 27 (16.4%) participants exhibited hypertension and 43 (26.2%) participants displayed dyslipidemia. Furthermore, 13 (7.9%) participants reported alcohol consumption, while smoking was noted in 4 (2.4%) participants (Table 1).

Among the 58 participants experiencing chronic lower back pain (mean [SD] VAS score, 4.8 [2.3]; mean [SD] ODI, 13.2 [11.7]), sarcopenia was identified in 10 (17.2%) participants. In contrast, out of the 106 (64.6%) participants

Table 1. Demographic Data of Participants

Variable	No. (%)		
	Total (N = 164)	CLBP (n = 58)	Non CLBP (n = 106)
Sex			
Female	135 (82.3)	46 (79.3)	89 (84.0)
Male	29 (17.7)	12 (20.7)	17 (16.0)
Age, mean (SD), y	55.1 (2.6)	55.5 (2.4)	54.8 (2.7)
BMI, mean (SD), kg/m^2	24.7 (4.3)	25.1 (4.6)	24.4 (4.1)
IPAQ			
Low	62 (37.8)	24 (41.4)	38 (35.8)
Moderate	68 (41.4)	24 (41.4)	44 (41.5)
High	34 (20.7)	10 (17.2)	24 (22.6)
EQ-5D-5L, median (range)	0.94 (0.34 - 1.00)	0.88 (0.34 - 1.00)	0.96 (0.50 - 1.00)
Underlying disease			
Hypertension	27 (16.4)	11 (18.9)	16 (15.1)
Diabetes mellitus	11 (6.7)	5 (8.6)	6 (5.7)
Dyslipidemia	43 (26.2)	17 (29.3)	26 (24.5)
Coronary artery disease	1 (0.6)	1 (1.7)	0
Chronic obstructive pulmonary disease	1 (0.6)	1 (1.7)	0
Chronic kidney disease	1 (0.6)	0	1 (1.7)
Alcohol drinking	13 (7.9)	7 (12.1)	6 (5.7)
Smoking	4 (2.4)	2 (3.4)	2 (1.9)
VAS, mean (SD)	1.7 (2.7)	4.8 (2.3)	-
ODI, mean (SD)	4.66 (9.3)	13.2 (11.7)	-

Abbreviations: BMI, body mass index; CLBP, chronic low back pain; EQ-5D-5L, European Quality of Life 5-Dimension 5-Level; IPAQ, International Physical Activity Questionnaire; ODI, Oswestry Disability Index; SD, standard deviation; VAS, visual analogue scale.

without chronic lower back pain, only 6 (5.7%) participants were found to have sarcopenia. A statistically significant difference in sarcopenia prevalence was observed between the 2 groups (Table 2).

The study examined a range of associated factors, encompassing age, BMI, IPAQ levels, EQ-5D-5L scores, underlying conditions, alcohol consumption, cigarette smoking, and muscular mass. The outcomes unveiled a median (range) age of 55.5 (50 - 58) years, a mean (SD) BMI of 20.3 (1.5) kg/m^2, IPAQ responses indicative of a low level in 5 (50%) participants and a high level in 1 (10%) participant, mean (SD) EQ-5D-5L score of 0.81 (0.13), along with underlying conditions hypertension in 1 (10%) participant and dyslipidemia in 3 (30%) participants.

Nonetheless, no instances of alcohol consumption or cigarette smoking were identified. The mean (SD) value for body muscular mass was 13.5 (0.8) kg/m^2. With these variables considered, the group with sarcopenia did not exhibit notable distinctions from the group without sarcopenia (Table 3).

Table 2. Prevalence of Sarcopenia in Preretirement Aged With Chronic Nonspecific Low Back Pain

Sarcopenia	No. (%)		*P* Value*
	CLBP (n = 58)	Non CLBP (n = 106)	
No	48 (82.8)	100 (93.3)	-
Yes	10 (17.2)	6 (5.7)	.02

Abbreviation: CLBP, chronic low back pain.

* $P < .05$ indicated a statistical significance.

Table 3. Associated Factor Between Sarcopenia in Preretirement Aged With/Without Chronic Nonspecific Low Back Pain

Data	Sarcopenia		*P* Value*
	CLBP	Non CLBP	
Female, No. (%)	10 (100)	6 (100)	.10
Age, median (range)	55.5 (50 - 58)	54.5 (51 - 59)	.44
BMI, mean (SD), kg/m^2	20.3 (1.5)	20.6 (2.2)	.81
IPAQ, No. (%)			
Low	5 (50)	3 (50)	.71
Moderate	4 (40)	3 (50)	
High	1 (10)	0	
EQ-5D-5L, mean (SD)	0.81 (0.13)	0.90 (0.08)	.17
Underlying disease, No. (%)			
Hypertension	1 (10)	0	.62
Dyslipidemia	3 (30)	0	.21
Alcohol drinking, No. (%)	0	0	-
Smoking, No. (%)	0	0	-
Trunk muscle mass, mean (SD), kg	13.5 (0.8)	13.8 (0.9)	.42

Abbreviations: BMI, body mass index; CLBP, chronic low back pain; EQ-5D-5L, European Quality of Life 5-Dimension 5-Level; IPAQ, International Physical Activity Questionnaire; SD, standard deviation.

* $P < .05$ indicated a statistical significance.

Within the entire cohort of 164 participants, 16 (9.8%) individuals with sarcopenia displayed a significantly lower average BMI when compared to those participants without sarcopenia (median [range] BMI, 19.8 [17.9 - 24.3] vs 24.2 [17.0 - 44.9], $P = .001$). Analyzing the outcomes of the EQ-5D-5L assessments, 58 (35.4%) participants experiencing chronic lower back pain demonstrated a notably reduced quality of life in relation to health and a diminished sense of well-being satisfaction, in comparison to participants without chronic lower back pain (median [range] EQ-5D-5L score, 0.88 [0.34 - 1.00] vs 0.96 [0.50 - 1.00], $P = .001$).

Discussion

Chronic nonspecific low back pain in sarcopenic group was higher than in without sarcopenic group in this study. Low back pain is correlated with skeletal muscle mass index rather than bone mineral density.[15] While trunk muscle atrophy (particularly in the lumbar multifidus was previously identified as the cause of chronic low back pain.[22]

This study delved into investigating the prevalence of sarcopenia within the preretirement age group (50 - 59 years). The assessment employed BIA to evaluate sarcopenia using the appendicular skeletal muscle index in conjunction with handgrip strength or walking gait speed. The identified prevalence was noted at 17.2% with the mean age 55.1 years, a figure lower than that reported in Sakai et al[15] study, which highlighted a 40% prevalence of sarcopenia in participants aged 65 and older with chronic lower back pain with the mean age 74.4 years. A plausible explanation for the difference lies in the methodology utilized for assessing sarcopenia. While the present study embraced both skeletal muscle mass index and strength or fitness metrics, Sakai et al[15] exclusively employed skeletal muscle mass index through DXA. Notably, in another investigation by Park et al,[14] sarcopenia was found to affect 24% of patients aged 55 to 85 with lumbar spinal canal stenosis. This prevalence was higher than our findings, albeit comparable due to the consistent employment of BIA for assessment.

Of particular note is the contemporary utilization of both DXA and BIA for assessing sarcopenia. In this study, BIA was chosen for its user-friendly attributes. The relationship between these methods was explored, and previous studies have shown no significant difference between DXA and BIA in assessing appendicular skeletal muscle mass. The current study aligns with this trend, using BIA consistently with studies like Wang et al,[18] while also confirming the reliability of BIA in comparison to DXA, as evidenced by McLester et al[23] and Fujimoto et al.[24] Additionally, this study revealed that among the cohort of 164 participants, 16 individuals were diagnosed with sarcopenia, constituting 9.7% of the sample. Notably, this prevalence was lower than that observed by Pongchaiyakul et al,[4] who reported a prevalence of 38.18% in males and 51.96% in females aged 50 to 59 using DXA for muscular mass assessment. Similar variation was evident in Khongsri et al[5] study which identified sarcopenia prevalences of 33.9% in males and 29.3% in females older than 60. This disparity could be attributed to the distinct assessment methodologies employed.

In terms of factors influencing sarcopenia, this study did not identify specific factors affecting the preretirement group with chronic lower back pain. However, the group with sarcopenia displayed a lower BMI, resonating with Khongsri et al[5] findings, which indicated that advanced age, weak quadriceps force, and low BMI contributed to sarcopenia. Cherin et al[25] study corroborated these results, identifying a connection between low BMI and sarcopenia, with a BMI above 22 kg/m^2 found to mitigate the risk compared to a BMI under 21 kg/m^2.

Regarding the EQ-5D-5L quality of life questionnaire, participants experiencing chronic lower back pain exhibited diminished well-being and health-related satisfaction in comparison to those without such pain. This discovery mirrors findings by Soer et al,[26] which indicated a functional EuroQol-5D (EQ-5D) questionnaire that demonstrated a moderate to strong correlation with pain-related metrics.

This study had certain limitations including the limited sample size, precluding in-depth subgroup analysis

of factors associated with sarcopenia and chronic lower back pain in the preretirement group, and the cross-sectional nature of the study prevented establishing causality between chronic lower back pain and sarcopenia. Long-term investigations are thus warranted.

Conclusions

The prevalence of sarcopenia within the preretirement age group, in the context of chronic low back pain, was observed at 17.2%, surpassing the prevalence among non chronic low back pain cases. Notably, this study did not reveal any significant associations between sarcopenia and chronic low back pain within the preretirement age group.

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การศึกษาความชุกและปัจจัยที่เกี่ยวข้องต่อภาวะมวลกล้ามเนื้อน้อยในกลุ่มก่อนวัยเกษียณอายุที่มีอาการปวดหลังเรื้อรัง

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บทนำ: ภาวะมวลกล้ามเนื้อน้อยเป็นหนึ่งในปัญหาสุขภาพที่สำคัญในปัจจุบัน โดยอาการปวดหลังเรื้อรังมีความสัมพันธ์กับภาวะมวลกล้ามเนื้อน้อยในผู้สูงอายุ และมีแนวโน้มของภาวะมวลกล้ามเนื้อน้อยและอาการปวดหลังเรื้อรังเพิ่มมากขึ้นในกลุ่มก่อนวัยเกษียณอายุ

วัตถุประสงค์: เพื่อศึกษาความชุกของภาวะมวลกล้ามเนื้อน้อยในกลุ่มก่อนวัยเกษียณอายุที่มีอาการปวดหลังเรื้อรัง และปัจจัยที่เกี่ยวข้อง

วิธีการศึกษา: การวิจัยเชิงพรรณนาแบบตัดขวางในกลุ่มตัวอย่างอายุ 50 ถึง 59 ปี จำนวน 164 คน ณ ภาควิชาเวชศาสตร์ฟื้นฟู คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล โดยเก็บข้อมูลพื้นฐาน รวมถึงแบบสอบถามกิจกรรมทางกาย (International Physical Activity Questionnaires, IPAQ) และแบบสอบถามคุณภาพชีวิต (European Quality of Life 5-Dimension 5-Level, EQ-5D-5L) การประเมินภาวะมวลกล้ามเนื้อน้อยใช้เกณฑ์ของชาวเอเชีย (Asian Working Group for Sarcopenia, AWGS 2014) โดยอาศัยเครื่องวัดมวลกล้ามเนื้อ เครื่องวัดแรงบีบมือ และอัตราเร็วในการเดิน 6 เมตร ในกลุ่มที่มีอาการปวดหลังเรื้อรังทำการประเมินความรุนแรงของความเจ็บปวดและการจำกัดกิจวัตรประจำวันจากอาการปวดหลัง

ผลการศึกษา: กลุ่มตัวอย่างทั้งหมด จำนวน 164 คน (อายุ mean [SD], 55.1 [2.6] ปี; ค่าดัชนีมวลกาย mean [SD], 24.7 [4.3] kg/m^2) พบว่า แบบสอบถามกิจกรรมทางกายอยู่ในระดับต่ำถึงปานกลาง และแบบสอบถามคุณภาพชีวิตมีคะแนน (median [range] เท่ากับ 0.94 [0.34 - 1.00] คะแนน โดยกลุ่มที่มีอาการปวดหลังเรื้อรัง จำนวน 58 คน มีภาวะมวลกล้ามเนื้อน้อย จำนวน 10 คน (ร้อยละ 17.2) และกลุ่มที่ไม่มีอาการปวดหลังเรื้อรัง จำนวน 106 คน มีภาวะมวลกล้ามเนื้อน้อย จำนวน 6 คน (ร้อยละ 5.7)

สรุป: กลุ่มก่อนวัยเกษียณอายุที่มีอาการปวดหลังเรื้อรังมีความชุกของภาวะมวลกล้ามเนื้อน้อยในระดับสูง เมื่อเปรียบเทียบกับกลุ่มที่ไม่มีอาการปวดหลัง โดยไม่พบปัจจัยที่มีผลต่อภาวะมวลกล้ามเนื้อน้อยและอาการปวดหลังเรื้อรัง

คำสำคัญ: ภาวะมวลกล้ามเนื้อน้อย ปวดหลังเรื้อรัง ก่อนวัยเกษียณอายุ

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