

## 博士論文の要旨及び審査結果の要旨

氏名	SOLOVEV ALEKSANDR
学位	博士 (医学)
学位記番号	新大院博 (医) 第 1012 号
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論文審査委員	主査 教授 赤澤 宏平 副査 特任教授 菖蒲川 由郷 副査 講師 近藤 直樹

### 博士論文の要旨

#### Background and Aims

Chronic pain is recognized as pain which persists past the normal duration required for healing, i. e., more than 3-6 months. The low back and knee are common areas of chronic pain that can cause physical disability and adversely affect quality of life. Physical activity is a predictive factor for the development of chronic low back pain (CLBP) and chronic knee pain (CKP). Specific components of physical activity, such as vigorous exercise and heavy occupational work, are known to increase the risk of CLBP and CKP, but impacts of other components are less known. This study aimed to assess the relationship between total physical activity and risk of CLBP and CKP from a public health perspective.

#### Methods

Participants were 7,565 individuals of the Murakami region, aged between 40 and 74 years, who did not have CLBP or CKP, and who participated in the 5-year follow-up survey. A self-administered questionnaire was used to obtain information on demographics, height, weight, physical activity, smoking habit, and alcohol consumption in the baseline survey, which was conducted between 2011 and 2013, and on CLBP and CKP using Short Form 36 (SF-36) in the follow-up survey, which includes six items: 1) no pain, 2) very mild, 3) mild, 4) moderate, 5) severe, and 6) very severe pain. Moderate-very severe chronic pain was defined as "serious pain.". Sitting, standing, walking, and strenuous work for occupational activity were assessed for total physical activity, and walking slowly, walking quickly, light to moderate exercise, and strenuous exercise were assessed for leisure-time physical activity using metabolic equivalent hours/day (METs score). The 5-year follow-up survey was conducted in 2016 and 2017. After excluding participants who died or moved out of the study region, a self-administered questionnaire, which included the same chronic

pain questions as the baseline survey, was distributed to the participants and collected by mail.

#### Results

Mean age of participants was 60.6 years (SD, 8.7) for men and 59.7 years (SD, 8.8) for women. Participants with higher MET scores had a significantly higher risk of CKP (adjusted P for trend = 0.0089, OR for 4th quartile = 1.29, 95% CI: 1.04-1.59 compared to 1st quartile), however, the MET score was not dose-dependently associated with CLBP in the adjusted models. An intermediate leisure-time METs score was associated with a lower risk of CLBP (OR=0.75, 95%CI: 0.61-0.92 vs. 0 METs-group). There were no dose-dependent associations between leisure-time METs score and CKP. In subgroup analyses by sex, higher levels of total and leisure-time physical activity were associated with CKP in men, but not in women.

#### Discussion:

The present study showed that total physical activity levels were positively associated with both any and serious CKP. Also, our sex-stratified analysis revealed that total physical activity levels were associated with CKP in men, but not in women, suggesting an interaction between total physical activity and sex. This may explain the variation in strength of the association between total physical activity and CKP.

Numerous studies have reported on the favorable effects of leisure-time physical activity on CLBP. For instance, Shiri and Falah-Hassani (2017) reported in their meta-analysis of three cohort studies that moderate-high levels of leisure time physical activity may reduce the risk of CLBP in adults and older populations. In contrast, we found that an intermediate level, but not a low or high level, of leisure-time physical activity was protective against both any and serious CLBP. Thus, our findings are inconsistent with those described in Shiri and Falah-Hassani's (2017) report, possibly due to the fact that none of the three cohort studies used a METs-based assessment measure for leisure-time physical activity levels.

This study has limitations worth noting. First, the presence of chronic pain was self-reported, and thus misclassification bias may have occurred. Second, although we adjusted for major confounding factors of CLBP and CKP, we could not control for other potential confounders. Finally, around 1/3 of the baseline participants did not respond the follow-up survey, and thus there may have been selection bias which could have affected the ORs for chronic pain.

#### Conclusion

A high level of total physical activity may increase the risk of CKP, whereas an intermediate level of leisure-time physical activity may decrease the risk of CLBP, in middle-aged and elderly individuals.

#### 審査結果の要旨

腰・膝の慢性疼痛は生活の質に悪影響を与える。本研究の目的は、総身体活動量と慢性腰痛および膝痛発症の関連性を明らかにすることであった。対象は、村上コホート研究のベースライン調査参加者（40～74歳）で慢性腰痛または膝痛を持たない者のうち、5年後追跡調査票に回答した7,565人であった。自記式質問票によりベースラインにおける総身体活動量（余暇身体活動量を含む）およびその他の関連情報を得た。総身体活動量はMETスコア（MET-時間/日）で評価した。5年後調査において、慢性疼痛の有無と程

度を Short Form 36 に準じて 5 段階で評価した。多重ロジスティック回帰分析により調整オッズ比 (OR) を算出した。総身体活動量が多いほど慢性膝痛の OR が高かった (調整傾向 P 値=0.0089) が、慢性腰痛との関連は見られなかった。総余暇身体活動量に関して、慢性腰痛の中等度グループ (1~3 MET スコア) の OR は対照グループ (0 MET スコア) より有意に低かった (調整 OR=0.75)。結論として、中高年者の高いレベルの総身体活動量は慢性膝痛のリスクを上昇させ、中等度の余暇身体活動は慢性腰痛のリスクを低下させる。慢性腰痛・膝痛予防を目的として、それらに対する総身体活動の役割を明らかにした点に博士論文としての価値を認める。