

ASSOCIATION BETWEEN ERGONOMIC RISK FACTORS AND WORK-RELATED MUSCULOSKELETAL DISORDERS IN BEVERAGE FACTORY WORKERS, INDONESIA

Ratih Pramitasari, Somsak Pitaksanurat, Teerasak Phajan, Wongs Laohasiriwong
Faculty of Public Health, KhonKaen University,
email: drwongsa@gmail.com

Abstract

Musculoskeletal disorders (MSDs) are the major causes of illness among working age group. This cross-sectional study aimed to identify prevalence of MSDs, the influences of between ergonomic riskson (MSDs) among beverage factory workers, Indonesia.

This cross sectional study systematic randomly selected 309 samples from all 3 sectors of a beverage factory proportional to size of the population to response to a structured questionnaire, standardized Nordic questionnaire and physical assessment by physiotherapists. The relationships between ergonomic risk factors and MSDs when controlled covariates were assessed using multiple logistic regression.

The prevalence of MSDsusing standardized Nordic questionnaire was 71.84% during the last 7 daysand58.90% for the past 12months.The prevalence of MSDs diagnosed by physiotherapist was 56.31%. The multivariate analysis identified that when control other covariatesHigh ergonomic risks on the left of shoulders were significantly increased MSDs during past 12 months (AdjOR:3.54-95%CI:1.49 to 8.37) and MSDs diagnosed by physical assessment (AdjOR:2.91-95%CI:1.30 to 6.52). High ergonomic risks on the neck lead to the increasing of MSDs during the last 7 days (AdjOR:2.15-95%CI:1.27 to 3.65), past 12 months (AdjOR:5.31-95%CI:2.53 to 11.11) and also MSDs diagnosed by physical assessment (AdjOR:4.35-95%CI:2.11 to 8.96) with all of them. Smoking and education also had influences on MSDs.

Ergonomic risks had impacts on MSDs both in long and short terms with the super imposed of smoking and socioeconomic status.

Keywords: Musculoskeletal disorders (MSDs), Ergonomic risks, smoking, socioeconomics

A. Introduction

Nerves, tendons, muscles and supporting structures, such as the vertebral discs are affected in individuals suffering from musculoskeletal disorders (MSDs). Symptoms include pain, discomfort, numbness and tingling in the affected area. The severity could range from mild and periodic to severe, chronic and debilitating conditions. The conditions had high impact on worker health and economics consequences (1). In the United States, MSDs are the largest categories of workplace injuries and are responsible for nearly 30% of all workers' compensation costs. US companies spent 50 billion dollars on direct costs of MSDs in 2011, its indirect costs can be up to five times the direct

costs of MSDs. The average MSDs come with a direct cost of almost \$15,000 (2). HSE figures show that in Great Britain an approximately 439,000 workers in 2011/12 suffered from musculoskeletal disorders caused or aggravated by their current or past work. Around 176,000 of these workers suffered from back pain, approximately 177,000 from problems related to upper limbs and neck and approximately 86,000 with lower limb problems. An estimated 7.5 million working days were lost in 2011/12 through work-related musculoskeletal disorders that were caused or aggravated by work. On average, each person suffering took an estimated 17 days off in 2011/12 (3).

In Indonesia, the Health Department report in 2005 concluded that among all ill health of workers, 40.5% was related to their work. A study including 9482 workers residing in 12 Indonesian counties/cities explored health problems experienced by the workers found that 16% were related to MSDs(4).

MSDs have been found to be associated with several factors, include socio-demographic, psychosocial and physical. Socio-demographic factors are age, education level, physical fitness and duration of employment, gender, smoking habit and marital status, working hours, psychosocial factors include job demands, job control, job satisfaction, support. Physical factors are exerting excessive force, excessive repetition of movements, awkward postures, static postures, motion, compression, inadequate recovery time due to overtime, excessive vibration, whole-body vibration, working in cold temperatures (CCOHS). In an beverage production company, almost at every step within the production process have potential risk for MSDs, therefore the occupational health and safety (OHS) are main concerns (5).

Staffs working in supporting office dealing with administration, advertisement, book keeping, etc. have to sit for hours in front of a computer screen. Workers in the production halls have to stand in front of machinery and even when someone can sit throughout his or her working times as inspector, he or she has to observe the bottle pass through the conveyor which is very monotonous activity which can cause strain. For workers packing and palletizing the bottles have excessive physical activities, while the operator of the forklift truck have to move crates of drinks and arrange these products on pallets located on the top floor and then stored in the warehouse (6). Knowing the MSDs situation and its possible risk factors could help managing the situations and risk factors. Therefore, the current study aimed to investigate the prevalence of MSDs in this industry and identify the influences of ergonomic risks on MSDs among beverage factory workers in Indonesia.

B. Methods

This cross-sectional study was designed to describe the situation of MSDs and key risk factors, ergonomic, psychosocial and socio-demographical factors. It also aimed to determine the association between ergonomic risks factors using BRIEF Questionnaire for ergonomic susceptibility screening and MSDs when controlled other covariates including psychosocial and socioeconomic factors. MSDs were diagnosed using both the standardized Nordic questionnaire for MSDs conditions during the past 7 days, 12 months and at present by physical assessment by physiotherapists. The study was conducted in one of beverage industry in Central Java, Indonesia from May to July 2015. The study population was 1839 workers who work in the beverage company. The illegible workers included in the study were those who have been working in this company for at least 6 months both under temporary contract and permanent workers. Preexisting conditions of either bone or muscle disease such as rheumatic, arthritis, osteoporosis and others were excluded. Disabled respondents or respondents who had a disability, both mentally and physical disabilities was also excluded. A sample size of 309 (Hsieh, 1989) was required to detect a change in probability of having MSDs among factory workers who had an approximately 79% of reported MSDs with a power of 84% and 0.05 significant level. The samples was systematic randomly selected proportional to size of the population of each three sectors of the factory.

C. Result and Discussion

In this study, almost all respondents were male (98.71%). This sex composition was not intentional since almost all of the study population was males. This study was similar sex composition with a study conducted by Osborne in 2012 entitled Work-Related Musculoskeletal Disorders Among Irish Farm Operators roomates conducted among predominantly male (95%) as the samples (7). Respondents were randomly selected from 3 sectors: administration (6:15%), production (40.13%) and distribution (53.72%) since there were difference in nature of works.

The work characteristics involve difference postures and forces and times in performing which put the workers at risk of musculoskeletal complaints. In average there were in middle age group that should be healthy (35.40 years old) but might starting being consider as risk group for non-communicable diseases (NCDs) (≥ 35 years old). In addition their mean BMI was 24.27 kg./m² with a median of BMI was 24.09 27 kg./m², indicated the overweight nutritional status that also increased the NCDs risks. This characteristic of age and BMI were similar to the study of Chang, 2014 conducted in betel quid cross among workers in Taiwan (8). Majority of the samples smoked (52.27%), considered as another risk factors. Regarding the level of education, most of the employees finished high school (71.01%). This is in accordance with the job that does require skills, although not high just enough for employees to be able to operate a machine used for the production process, may be supporting the future the health related behavior modification in the future. The mean duration of working period was 112.84 months with the median duration of 91 months. The working period is similar to a study conducted by Zulfikar Taufik PT Caterpillar Indonesia in 2012 (9). Most of them were full time (65.37%).

Most of the respondents (71.84%) complaints of having MSDs in the last 7 days, 58.90% for the past 12 months. MSDs diagnosed by physiotherapist were 56.31%. The prevalence of MSDs during the last 7 days was highest. May be it was the contribution of the data collection was conducted in the weekdays and in the middle of their work hours. They might felt exhausted at that time. Therefore perceived MSDs were higher for the last 7 days. On the other hand for the past 12 moth, they might have MSDs, however after taking some rests they would recovered and might not remember that they had MSDs except the problems that were rather serious (mild to severe), therefore the 12 moths-prevalence was lower. It was confirmed by that, the prevalence of MSDs by physical assessment is similar with MSDs during the past 12 months. The physiotherapist found some strain muscle or stiff muscle in some particular of

musculoskeletal system that could make remained discomfort to the people who suffer from it, therefore they could remember and reported their MSDs to the researcher.

Based on BRIEF survey by humantech the highest ergonomic risk was in the both left and right of elbows (73.14%). Almost all parts of body, medium ergonomic risk was dominate, even though it was just slightly different prevalence between workers who had medium ergonomic and high ergonomic risks. The prevalence of medium ergonomic risk on the left hand and wrist was 55.99% and the right was 55.02%. That of left shoulder was 77.02%, 63.11% for the right and 55.02% for the back .

The multivariate analysis identified that when control other covariates smoking was statistically significantly associated with MSDs during past 12 months (AdjOR:1.47-95%CI:0.83 to 2.60) with (p-value<0.001). Some researchers have found a similar positive association between smoking and musculoskeletal symptoms (10). Several studies has shown that smokers have likely to suffer from back problems than non-smokers. Relationship smoking with complaints MSDs caused by cough increase pressure on the stomach and cause tension in the spine or backs (11). Education was significantly associated with MSD during the last 7 days (p-value=0.012) (AdjOR:3.29-95%CI:0.89 to 12.16), past 12 months (p-value<0.001)(AdjOR:4.95-95%CI:1.35 to 18.11) and MSDs diagnosed by physical assessment (p-value<0.001)(AdjOR:14.74-95%CI:3.79 to 57.38) among beverage industry workers. Education might give different perspective to see the pain. Persons with high educational level might also have better possibility to find another job opportunity that helps them to reduce their musculoskeletal pain. Their knowledge and education might give them better opportunities to adjust them self to a new situation if they experience much pain. All situations has its positive and draw back consequences, but education might help to over come it little easier than people who does not have enough educational background (12). But in this study showed slightly different results, workers with

higher education who actually have a higher likelihood of developing MSDs. The reason that most likely was in the case of this disease in our study is related to the work attitude and relationship with MSDs, here someone who has high the education not necessarily be aware of the diseases they experienced because of the attitude of the working and MSDs is not a common disease that can be known to everyone though with higher education though. Then another possibility was that workers with higher education in this company generally works as a supervisor, head, finance and so on are always being targeted by companies that sometimes they work very hard and are too focused to achieve the targets so they are not too concerned with the work attitude or complaints of muscle feels. Also muscle complaints here is not acute disease but a chronic disease that most likely of sufferers are unaware of the disease. High ergonomic risks on the left of shoulders were significantly increased MSDs during past 12 months (AdjOR:3.54-95%CI:1.49 to 8.37) and MSDs diagnosed by physical assessment (AdjOR:2.91-95%CI:1.30 to 6.52) with (p-value<0.001). High ergonomic risks on the neck lead to the increasing of MSDs during the last 7 days (AdjOR:2.15-95%CI:1.27 to 3.65), past 12 months (AdjOR:5.31-95%CI:2.53 to 11.11) and also MSDs diagnosed by physical assessment (AdjOR:4.35-95%CI:2.11 to 8.96) with all of them (p-value<0.001). High ergonomic risks on the left of shoulders and neck possibly because of their responsibilities were mostly pouring sugar into the mixing tank. Postures when poured sugar is not a natural position, workers perform movements such as half-squat to pick up the sugar and then stand by lifting sacks of sugar, weigh 25 kgs, and pour it into the tank and carried out continuously. Neck is also considered as the high risk category, typing and focus in front of the computer screen. Sometimes the effects of the from head concentrating on the computer screen were not only on the eye, but also the neck which supports the head to remain upright when typing continuously fairly and correctly without a break. This activity is also effect to the shoulders because the employee do

not use a proper chair without backrest while they type.

D. Conclusion

A total of 309 employees at the beverage industry at this factory has been taken based on systematic random sampling techniques. The socio-demographic characteristics of the respondents were summarized, most of them were from distribution department followed by production and administration departments. Almost all of the respondents were male. Their mean age was 35.40 years old. Most of the workers completed high school followed by bachelor degree, secondary and primary education. The average BMI was 24.27 kg/m² of which most of them had normal BMI. The average working in monthly was 112.84 then median duration of working was 91. Most of them were not working in shift. More than half were smoker. Based on BRIEF survey by humantech the biggest prevalence of high ergonomic risk was in the both left and right of elbows part (73.14%). Almost on all of part of body, medium ergonomic risk was dominate, eventhought it was just slightly different number between workers who have medium ergonomic risk and high ergonomic risk. The prevalence of medium ergonomic risk on the Hand and wrist left side was 55.99% and right side 55.02% then shoulder left side was 77.02% and right side 63.11% after that on the back was 55.02%.

The multivariate analysis identified that when control other covariates smoking was statistically significantly associated with MSDs during past 12 months. Education was significantly associated with MSD during the last 7 days, past 12 months and MSDs diagnosed by physical assessment among beverage industry workers. High ergonomic risks on the left of shoulders were significantly increased MSDs during past 12 months and MSDs diagnosed by physical assessment. High ergonomic risks on the neck lead to the increasing of MSDs during the last 7 days, past 12 months and also MSDs diagnosed by physical assessment.

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