Fatigue Measurement of Elderly Workers in Small and Medium Enterprises

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Kristiana Asih Damayanti*
Industrial Engineering Department, Parahyangan Catholic University,

Ceicalia Tesavrita
Industrial Engineering Department, Parahyangan Catholic University,
Bandung, Indonesia

ABSTRACT

Objectives—The study aims to assess the physical aspect of elderly workers (above 60 years old) in small and medium enterprises (SMEs) to recommend the improvement of work facilities and methods.

Methods—Elderly workers (n = 17) were observed and interviewed whilst they were doing their jobs to identify subjective fatigue and muscle pain based on the Nordic body map. The Rapid Entire Body Assessment (REBA) and Rodgers Muscle Fatigue Analysis Method (MFA) were used to assess the physical risks of elderly workers. Results were compared with younger workers in the same jobs. Observation was also done to identify the characteristics of the elderly when they were at work.

Findings—The study corroborates that subjective fatigue measured from the musculoskeletal complaints of elderly workers was not significantly different from that of young workers ($p = 0.056$) although the result of the REBA and Rodgers MFA methods verifies that the posture and position of elderly workers when they do their jobs greatly cause muscle fatigue. The same result is consistent with the subjective fatigue measurement result. Moreover, the posture and fatigue analysis result is used to develop recommendations to improve methods and facilities for elderly workers.

Application—This study was conducted by considering many elderly who still work in SMEs in Indonesia. A preliminary study was needed to identify the characteristics of elderly work for the basis of making the workplace safe for the elderly.

Keywords: elderly, elderly worker, musculoskeletal complaints, fatigue analysis

1. BACKGROUND

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The industrial sector in Indonesia is one of the sectors used by the government to drive the economy. Labor absorption rate in this sector is also the greatest. On the basis of data from the Indonesian Central Bureau of Statistics (2012), among all industries that absorb labor, the home industry or small and medium enterprises (SMEs) was recorded to have the highest absorption rate (61.57%). The absorbed manpower is on productive age, but, in many SMEs, elderly workers (>60 years old) are still doing labor. This scenario usually occurs in SMEs that operate around residential areas. According to the Ministry of Health of Republic Indonesia, elderly are those above 60 years old. Most reasons why these elderly workers continue to work are due to economic demands and the desire to remain independent and build social relationships.

In the 2010 population census, Indonesia ranked fifth place in terms of the elderly population. According to WHO, approximately 8% of the elderly or 142 million inhabitants make up the Southeast Asia population. By 2050, the elderly population is estimated to increase 3-fold from this year. In 2000, the elderly population was 5,300,000 (7.4%), whereas in 2010, it was 24,000,000 (9.77%) of the total population. The elderly population is estimated to reach 28,800,000 (11.34%) of the total population in 2020. In the same year, the elderly population in Indonesia is expected to be approximately 80,000,000, and this proportion is projected to increase to 11.34% or roughly 30–40 million people. The increasing elderly population in Indonesia cannot be separated from the life expectancy increase of Indonesians. On the basis of data from the United Nations Development Program (2017), the life expectancy of Indonesians in 1990 was 62.1 years, which continued to increase until 65.7 years was reached in 2000 and 68.9 years in 2010. The life expectancy increase of Indonesians is mainly caused by the increasing public awareness of healthy lifestyle by maintaining diet, all forms of stress and pressure and reduced smoking habits.

Ageing is difficult for people to face. The ageing process brings a significant influence on their life because the decline in functional, physical, psychological and cognitive abilities of the elderly cause many limitations. The limitations faced by the elderly generally include weakening of the body, slow and less forceful body movements, reduced body balance, decreased information processing capacity, decreased body muscle strength, such as hand grip and arm muscle, and decreased movement coordination between limbs. These limitations commonly lead to decreased mobility and elderly dependency (Steenbekkers and VanBeijisterveldt, 1998). The condition also contributes to the productivity level of workers (Santiago and Tubayan, 2016).

A preliminary study is conducted at a knitting industry centre in Bandung. The observation of elderly workers is done during the production process which requires strength and physical skills. Generally, work performed by elderly workers is not different from that of the younger workers, even if production target must also be pursued at times.

The physical deterioration of elderly workers causes their inefficiency. Various jobs in the knitting process are usually related to the physical condition of a person. For instance, good eyesight is necessary in the quality control process. Another example is operating machines requires elbow and hand force. Therefore, this study is conducted to identify

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the characteristics and limitations of elderly workers from the physical aspect. Other aspects are discussed in other studies.

2. METHOD

The study was conducted at an SME in West Java, Indonesia, involving 17 elderly respondents above 60 years old (average 64.41 years.) The oldest is 73 years old. They agreed to participate in this study.

Data were collected through a questionnaire divided into two parts: sociodemographic and musculoskeletal complaints. Musculoskeletal complaints were analyzed by a body map questionnaire (Kourinka, et al., 1987) that was adapted to Bahasa. Observation was done to assess musculoskeletal risks with the REBA (Illignet and McAtamncy, 2000) and Rodger MFA (Bernard, 2006) method. Data processing involved descriptive statistics.

These elderly data were compared with non-elderly workers data of the same type of work and SMEs to see significant differences in the data obtained. Table 1 exhibits the profile of respondents.

Table 1. Sociodemographic

Age (years old)	mean: 64.82 ± 4.14
Working hour (hour/day)	mean: 7.33 ± 0.52
Distance from home to workplace (km)	mean: 1.59 ± 1.97
Transportation to work	by walk: 86%, by motorcycle: 14%
Number of family covered	mean: 1.17 ± 1.16
Reason for work	economic reason: 90%, for activity: 10%

Most elderly worked in the packing and quality control area, and only two participants operated the machine. They were considered for the job because it does not need any special skill.

Respondents worked as part-time workers, whose salaries are paid weekly or daily. Approximately 90% of previous respondents did not work in SMEs. The reason why most of them work is to make ends meet (90%), whereas the remaining sees it as an activity (10%).

3. RESULT

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Figure 1 exhibits that the lower back, leg, ankle and neck cause high levels of musculoskeletal complaints because most elderly workers in the quality control and packing area work without sitting.

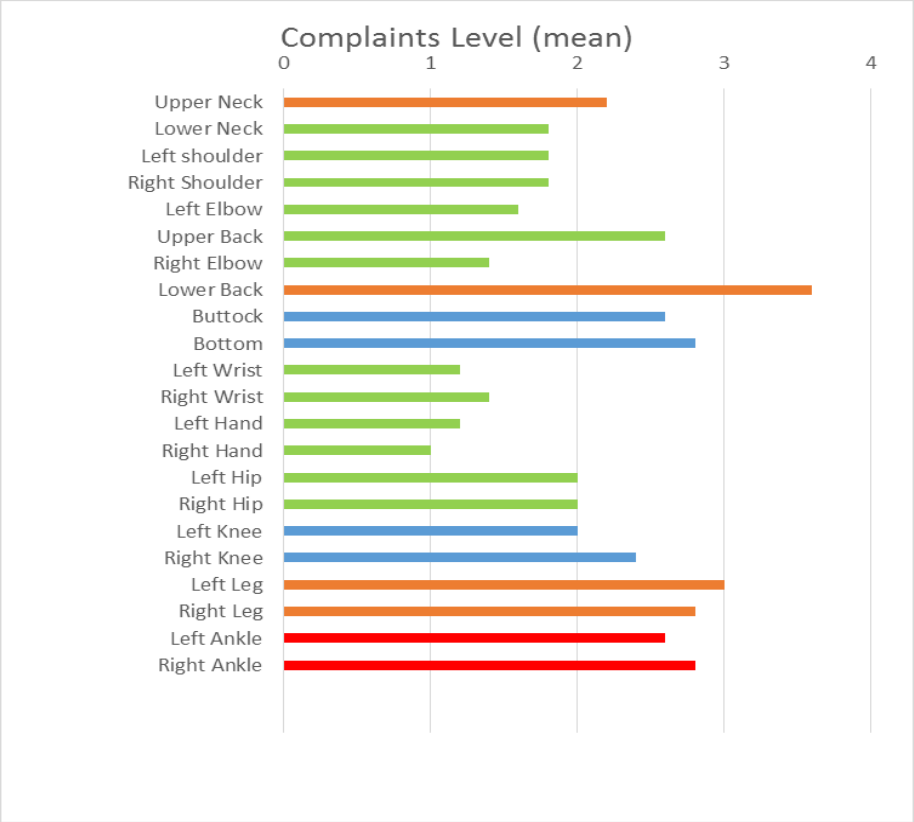

Figure 1. Musculoskeletal complaint levels of elderly workers in the quality control and packing area

Figure 2 shows the musculoskeletal complaint levels of machining workers. These complaints include the lower back, ankle and knee because elderly workers operate machines during their entire work period.

The significance test (T-test) was conducted to see the differences with younger workers. The result of musculoskeletal complaints was not significantly different from p-value 0.56.

The physical risk measurement result by Roger MFA and REBA is shown in the appendix section. From the REBA, the medium risk of physical injury was possible because of bad posture whilst doing the job. Another cause could be the design of work facilities. The MFA assessment result strengthened musculoskeletal complaints and affirmed that ankle and neck were in high risk for injury.

On the basis of the result above, improving work facilities is necessary to maintain the good posture of elderly workers to avoid physical injury risks.

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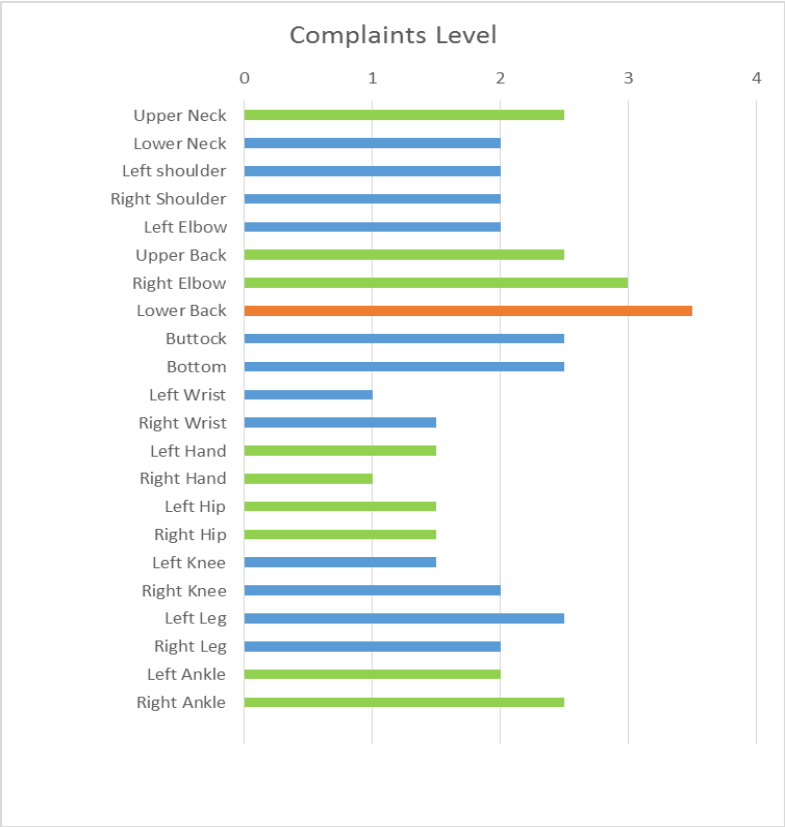

Figure 2. Musculoskeletal complaint level of elderly workers who operate machines

4. CONCLUSION

The Rodgers MFA result confirms that all elderly workers have musculoskeletal complaints in the lower back, legs and neck. On the other hand, the REBA assessment shows medium risks. Both results corroborate that improving work facilities and methods is necessary to reduce physical stress and risk among elderly workers. This way, they can still work healthily and safely.

APPENDIX

Example of posture assessment with the REBA method

Task : pre-sewing preparation			Sight: left		
Group A			Group B		
Neck	Trunk	Leg	Upper arm	Lower arm	Wrist

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26 º	8 º	57 º	0 º	100 º	45 º
Angle > 20º	Angle between 0 º–20 º	Not neutral sitting position	Neutral position angle 0 º	Angle between 60 º–100 º	Angle > 15 º
Adjust: no adjustment	Adjust: no adjustment	Adjust: no adjustment	Adjust: no adjustment		Adjust: no adjustment
2	2	2	1	1	2

Posture score A	4	Posture score B	2
Force/load	0	Coupling	0
Score A	4	Score B	2
Table C score: 4			
Activity score: +1 if 1 or more body parts are held longer than 1 minute (static) +1 for repeated small range actions (more than 4x per minute)			
REBA score: 6 (medium risk)			

Rodger MFA assessment

Region		Score			Change priority
		Effort	Duration	Frequency	
Neck		2	2	2	Moderate
		Head forward about 20º			
Shoulders	Right	1	1	3	Low
		Arms slightly away from sidert			
	Left	1	1	3	Low
		Arms slightly away from sidert			
Back		3	1	1	Low
		Twisting sometimes			
Arms/elbow	Right	1	1	3	Low
		Arms away from the body (very light			

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		weight)			
	Left	1	1	3	Low
		Arms away from the body (very light weight)			
Wrists/hands/fingers	Right	1	1	3	Low
		Lightweights handled near the body			
	Left	1	1	3	Low
		Lightweights handled near the body			
Legs/knees	Right	–	4 (Static)	–	Very high
		(Not neutral sitting position)			
	Left	–	4 (Static)	–	Very high
		(Not neutral sitting position)			
Ankles/feet /toes	Right	–	4 (Static)	–	Very high
		(Not neutral sitting position)			
	Left	–	4 (Static)	–	Very high
		(Not neutral sitting position)			

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