**The correlation between hearing loss and the quality of life of workers exposed to the noise of the textile industry**

Sumardiyono1, Reni Wijayanti1, Hartono2, Ari Probandari1

*1Department of Public Health, Faculty of Medicine, Sebelas Maret University, Surakarta, Indonesia.*

*2Department of Physiology, Faculty of Medicine, SebelasMaret University, Surakarta, Indonesia.*

*{sumardiyono, reniwijayanti, hartono65*, *ari.probandari*[*}@staff.uns.ac.id*](mailto:prabangsetyono%7d@staff.uns.ac.id)*.*

***Abstract***

*Noise is a stressor for hearing loss among workers. Unfortunately, workers who have loss hearing will affect their quality of life. This study aimed to investigate the correlation between hearing loss and quality of life among workers in textile industry. The study design was a cross-sectional survey. The study population was 200 workers exposed to the noisy textile industry. The findings showed a significant relationship between hearing loss and the quality of life of the workers in all dimension.*

*Keywords: hearing loss, quality of life, workers, noise, occupational health*

**1 INTRODUCTION**

In general, quality of life is perceived related to wellness. Persons who have the high quality of life will be perceived of achieving wellbeing, and vice versa. World Health Organization (WHO) defines the quality of life as, an individual perception on their position in life within the context of their culture and value systems in relation to aim, expectation, standard, and worries (World Health Forum, 1996). Quality of life is a concept consisted of values related to social, environment, psychology, and physical (Theofilou, 2013).

Previous studies on the quality of life have been conducted, including the one by Kim et al. (2014), that concluded about the relationship between daily life situation of patients with chronic stroke with the quality of life particularly mobility and social cognitive dimensions. A research by Serra et al. (2015) among elderly has shown a relationship between six minutes walking test (6WMT) with the quality of life. However, there was no relationship between 6WMT with the dimensions of emotional role, mental health, and vitality. A research by Hong et al. (2016) found that quality of life decreased significantly among people with osteoarthritis. A study about quality of life in Indonesia had been conducted by Rahmani & Andean (2015) that showed the relationship between 6WMT and quality of life of the patients at Hasan Sadikin hospital Bandung. The findings from Zainuddin et al. (2015) showed that stress was related to the quality of life among the diabetes mellitus type 2 patients at Arifin Achmad hospital Pekanbaru.

Based on the previous studies, we synthesized that quality of life has been studied among various types of patients and among elderly. However, there is lacking evidence about the quality of life among workers who received hazards from their working environment e.g. noise. Nada et al. (2014) argued for the effect of high-level noise from the textile industry affected the hearing function among workers. Neverthless, the progressive hearing loss is one of the chronic problems, which potentially influence the quality of life among workers.

Our study aimed to observe the relationship between hearing loss with the quality of life among workers in the textile industry. The findings would benefit the development of model to control noise as a prevention to hearing loss so that the quality of life would be better. The findings would contribute to efforts to improve the safety and health of workers in the textile industry.

**2 METHODS**

**2.1 Study Design and Sampling**

The study design was a cross-sectional study to analyze the relationship between hearing loss and quality of life among workers in the textile industry, who received noise in the working environment. The sampling technique was simple random sampling among workers in the textile industry Iskandar Indah Printing Textile Surakarta Co., Indonesia. The inclusion criteria were female, more than a year of working period, age between 20-50 years old. The sample size was using the sample size formula for correlative analysis by Hulley et al. (2013), with Zα(5%) = 1.96, Zβ(10%) = 1.28. The value of r was defined using a pilot study (r=0.227). An online software from Clinical & Translational Science Institute was used to finally get n=200 individuals.

This research used four instruments. Firstly, the questionnaire on demographic characteristics of workers. Secondly, the Short-Form Health Survey (SF-36) to assess the quality of life of workers. SF-36 had been validated among the general population and other subpopulations (Ware et al., 1992). The third instrument was height and weight scale to measure body mass index (BMI), and the last one was audiometry which was calibrated to measure the level of hearing loss.

**2.2 Statistical analysis**

Data were analyzed using IBM Statistics software version 23. Descriptive analysis used minimal, maximal and median value. To analyze the bivariate relationship between hearing loss, demographic characteristics, and quality of life, we used Spearman's rank correlation coefficient. To study the size of the relation between hearing loss and quality of life among the workers, we used *Chi-Square Test*.

**2.3 Ethical Approval**

Before the study was conducted, the respondents received information about the aim of the research. The respondents had been informed that their participation in the study is voluntary, by signing the statement form before the interview. All information from the interviews and measurements are used for the study purpose and kept for its confidentiality. Ethical clearance of the study was obtained from the Ethics Committee of Dr. Moewardi hospital/Faculty of Medicine Universitas Sebelas Maret. No. 753/VII/HREC/2017.

**3 RESULTS**

**3.1 Sociodemographic Characteristics**

There were 200 respondents of the study. All were women, Indonesian, 25-30 years old, with the mean of age was 42 years old. The age of the respondents when they started to work was 24.7 years. The body mass index was between 18.7 kg/m2 to 29.9 kg/m2 with average of 24.1 kg/m2. All respondents did not smoke (100%) and neither (100%).

**3.2 Noise**

There were 106 workers (53%) exposed to over normal noise, who was working at the weaving related units. Ninety-four people (47%) who exposed to normal noise were working at the units of warehouse and office. The highest level of noise was 104 dBA while the lowest was 64.4 dBA with the average of 86.6 dBA. The source of noise was from machines in the textile industry. The type of noise was the continue one. The standard level of noise was 85 dBA per 8 hours of working per day.

The working years of the respondents were between 2-23 years with the average of 17.1 years. Forty-two workers (42%) used cotton as the protection device. Meanwhile, the Occupational Safety and Health Administration (OSHA), United States Department of Labor considered that cotton was not a good hearing protection device.

**3.3 The types of work**

The textile industry is basically divided into three departments: spinning, weaving and printing. The department of spinning is the unit working with raw material of cotton or synthetic material to process to be yarns. The department of weaving is working with the process from yarns to fabrics. The department of printing process the raw fabrics (the grey fabrics) to colour fabrics or ready fabrics. The working hours were divided into three shifts: morning (07.00 am – 3 pm), afternoon (3 pm – 11 pm), and night (11 pm – 7 am). The change of shift was conducted in everyweek, starting from Monday. This research was conducted only among the workers during the morning shift. The respondents were the workers at the weaving related units. The intensity of noise was measured on 10 am, 1 pm and 3 pm, and the results were assed for Leq 8 working hours (L*Aeq*,8h).

**3.4 Working Environment**

Besides noise, we measured other working environments such as level of dust, light intensity, mechanical vibration and heat stress. The level of dust was measured by low volume dust sampler, with the result of 0.29 mg/m3 in average. The light intensity was measured by Luxmeter. The results showed the light intensity average was 163.3 lux. The mechanical vibration was measured by Vibration meter; the results showed the average mechanical vibration was 2.14 m/s2. Heat stress was measured by Area heat stress Monitor using the parameter of Web bulb Globe Temperature (WBGT). The result of average WBGT was 28.3oC.

**3.5 Hearing Loss**

The hearing loss included the one for the right and left ear. In this study, the level of hearing loss was measured by Audiometry with the standard of conduction among the two ears at the frequency of 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz in dB through headphone, which then was measured for its average (Beck et al., 2014; Al-Abri et al., 2016). The measurement of hearing loss was conducted during the morning 6 to 8 am. To calculate the average value of hearing loss of the ears = (monaural of the better ear x 5 + monaural of the worst ear x 1)/6. Based on The American Speech-Language-Hearing Association (ASHA), the criteria of hearing loss is categorized as Normal (-10 to 15 dB), Slight (16 to 25 dB), Mild (26 to 40 dB), Moderate (41 to 55 dB), Moderately Severe (56 to 70), Severe (56 to 90), and Profound (91 dB or more). Based on those criteria, we analyzed the hearing loss among 200 respondents descriptively. The findings showed that 6 workers (3%) had Moderately Severe level, 44 workers (22%) had Moderate, 130 workers (65%) had Mild, and 20 workers (10%) had Slight hearing loss.

**3.6 Quality of Life**

The category of quality of life use the one from Ware *et al.* (1993), which was the score of 100 for Perfect, 84 to 99 for Very Good, 61-83 for Good, 25-60 for Less, under 25 for Poor. In this study, we categorized the quality of life into two groups, the score of 61 or more for Good and the one less than 61 as Not Good. Our finding showed that among 200 respondents there were 116 persons with Good Quality of Life (58%), while the rest had Not Good quality of life (84 workers, 42%).

**3.7 The relationship between hearing loss and quality of life**

The relationship between hearing loss and quality of life and its dimensions have been shown in Table 1.

In the table 1, it is shown that the median value of hearing loss is categorized in Moderate/Mild i.e. 26-40 dB. There was a statistical significant relationship between hearing loss and quality of life even in it’s all dimensions. The increase of level of hearing loss was related to the decrease of quality of life. The size of risk of hearing loss to quality of life, was measured by contingensi coefficient test (C), see Table 2.

Table 2 gives a description of the statistical test results, which showed an effect between hearing loss and quality of life among workers. The size of risk between the hearing loss to quality of life was 23.6%, meanwhile 76.4% of variation of quality of life was influenced by other factors. The other factors that was related to the decrease of quality of life were: age, body mass index and working years. The relationship between the demographic characteristics and quality of life was showed in Table 3.

Tabel 1: The relationship between Hearing loss and Quality of life (n=200) in 2018

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Independent Variable | Min  (dB) | Max  (dB) | Median  (dB) | Dependent Variable | Min  (%) | Max  (%) | Median  (%) | rs | p |
| Hearing loss | 17.9 | 69.0 | 34.1 | Quality of life | 36.6 | 97.8 | 75.6 | -0.698 | 0.000\* |
| Physical Functioning | 20.0 | 100.0 | 80.0 | -0.493 | 0.000\* |
| Role-Physical | 25.0 | 100.0 | 75.0 | -0.501 | 0.000\* |
| Bodily Pain | 21.0 | 100.0 | 69.5 | -0.516 | 0.000\* |
| General Health | 37.5 | 100.0 | 72.5 | -0.497 | 0.000\* |
| Vitality | 20.0 | 100.0 | 67.5 | -0.527 | 0.000\* |
| Social Functioning | 12.5 | 100.0 | 75.0 | -0.521 | 0.000\* |
| Role-Emotional | 33.3 | 100.0 | 66.6 | -0.521 | 0.000\* |
| Mental Health | 32.0 | 100.0 | 72.0 | -0.517 | 0.000\* |

\* are significant at p < 0.05 (2-tailed)

Table 2: The size of risk of hearing loss to quality of life in 2018

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Hearing loss | Quality of life | | | *X*2 | p | C |
| Not Good | Good | Total |
| n (%) | n (%) | n (%) |
| Moderately severe | 4 (66.7) | 2 (33.3) | 6 (100) | 11.817 | 0.008 | 0.236 |
| Moderate | 23 (52.3) | 21 (47.7) | 44 (100) |
| Mild | 55 (42.3) | 75 (57.7) | 130 (100) |
| Slight | 2 (10.0) | 18 (90.0) | 20 (100) |

\*significant at p < 0.05 (2-tailed)

Table 3: Relationship between demographic characteristic with quality of life in 2018

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Demographic characteristic | Min | Max | Median | Variable | Min | Max | Median | rs | p |
| Age (year) | 25 | 50 | 43.0 | Quality of life (%) | 36.6 | 97.8 | 75.6 | -0.160 | 0.024\* |
| BMI (kg/m2) | 18.7 | 29.9 | 24.0 | -0.126 | 0.076 |
| Working period (years) | 2 | 23 | 19.5 | -0.115 | 0.104 |

\*significant at p < 0.05 (2-tailed)

Table 3 shows the relationship between the demographic characteristics and quality of life among workers. The increase of values of the demographic characteristics would decrease the quality of life, however, only age of the workers was shown as a significant variable. Referring to table 1 and 3, hearing loss and age had relationships with quality of life among the workers.

**4 DISCUSSION**

This research found a negative relationship between hearing loss and quality of life among the workers in the textile industry who suffered from noise that over the normal standard. The intensity of noise will impact the increase of hearing loss. The workers with the increased level of hearing loss will have the lower quality of life. Hearing loss is related to all dimensions of quality of life, i.e. Physical Functioning, Role-Physical, Bodily Pain, General Health, Vitality, Social Functioning, Role-Emotional, dan Mental Health.

The overexposure to the noise will affect to irreversible disease, nevertheless, workers always have exposure to noise. A previous study by Afiah et al. (2016) among workers at automotive industry foud lacking knowledge, attitude and practice to hearing loss due to noise. It means that there should be right efforts to prevent hearing loss among workers.

Hearing loss due to noise has been reported in the various setting of the industry including the mining industry with the level of noise over the normal standard of 94 dBA. It particularly happens at underground mining (102 dBA), and underground workshop (103 dBA) that cause for hearing loss among 36.7% workers; the hearing loss will increase by the increase of age (Chadambuka et al., 2013). The hearing loss was also found as a problem in the ceramic industry with the prevalence of slight and mild as 44% (Mehrparvar et al., 2017). A study at textile industry setting in India found hearing loss among 39% of workers with exposure to noise at 87.3 dBA within 8-12 hours per day (Ranga et al., 2014). A research in Malaysia revealed that the cost of noise induces hearing loss/NIHL) has been a financial burden of the country therefore the government of Malaysia developed a regulation to decrease the noise exposure in the industrial setting (Noraita & Aljunid, 2016).

The relationship between hearing loss and quality of life had been studied by Carlsson et al. (2014) that revealed that severe and profound hearing loss was related to higher risk of anxiety and depression among general patients. The incidence of tinnitus and vertigo among the patients with hearing loss has a strong negative correlation with quality of life. Another cause of hearing loss due to other causes is the pesticide, as found by de Sena et al. (2013) in Brazil. The study revealed the hearing loss among the pesticide users that caused the decrease of quality of life among agricultural workers.

The relationship between hearing loss and quality of life was not shown among HIV patients. The treatment among HIV patients does not correlate with the decrease of quality of life. However, further research is argued to study the relationship between aging and quality of life of the patients (Duong et al., 2016).

In the confounding variables, age was negatively associated demographic characteristics and quality of life. The other research about age and the quality of life by Campos et al. (2014) concluded that adults will have a better quality of life if they maintain their personal health, lack of depression. Women with lacking physical activity prone for lower quality of life. Hence, the older adult, if they could maintain their personal health, lacking depression and having adequate physical activity, the quality of life would be optimal. This is synergi with the argue from [Netuveli](javascript:;) & Blane (2008) on the relationship between elderly, adaptation and resilience that that are essentials to the quality of life. Two main factors to quality of life among elderly were dementia and depression.

The demographic characteristics of BMI showed about 31.3% of the respondents with pre-obesity have the Not-Good quality of life. However, the BMI and quality of life in this study did not show a statistically significant relation. This finding differs with the one from Zhu et al. (2015) that revealed the difference in quality of life among the group with obesity level I and normal particularly in mental dimension. In further, Zu et al. (2015) also found that the group of BMI thin had the lower quality of life compared to other groups, particularly in physical and mental dimension. However, the group with obesity type II had the lower quality of life in physical function. Our findings also differed with the study by Søltoft et al. (2009) that used a sample of thin and obesity groups, which revealed a negative relationship between BMI and quality of life. The maximum quality of life is achieved at the BMI 26.0 kg/m2 among men and BMI 24.5 kg/m2 among women. In accordance, the study by Xu et al. (2015), revealed a non-linear relationship between BMI and quality of life. Xu et al. (2015) found the optimal quality of life will be achieved at BMI around 23 kg/m2 for men and 24 kg/m2 for women. A study by Rashidah (2016) concluded that the increase of weight would decrease the quality of life among Melayu household wive. This was an evidence of the need to conduct an intervention program to improve quality of life among household wives.

The working period as a confounding variable is not related to quality of life. The literature about the relationship between working years and quality of life among the workers in the textile industry is still lacking. We found only a study by von Bonsdorff et al. (2017), that concluded that working hours among men would decrease the quality of life due to lacking sleeping duration particularly in the dimension of physical function, vitality and general health. In further, the von Bonsdorff et al.’s study also found that men with long working hours with normal sleeping duration would prone to lack quality of life in the physical dimension in elderly.

The results of our study found that hearing loss is associated with decreased quality of life of workers of the textile industry (rs=-0.698; p=0.000), and the dimensions of quality of life associated with hearing loss were the physical functioning (rs=-0.493; p=0.000), role-physical (rs=-0.501; p=0.000), bodily pain (rs=-0.516; p=0.000), general health (rs=-0.497; p=0.000), vitality (rs=-0.527; p=0.000), social functioning (rs=-0.521; p=0.000), role-emotional (rs=-0.521; p=0.000), and mental health (rs=-0.517; p=0.000). The hearing loss causes a decrease in the quality of life by 23%, and 76% are influenced by other factors, such as age (p=0.024). Thus, the present study found factors that lead to decreased quality of life is hearing loss and age.

**5 CONCLUSION**

Hearing loss has a significant negative correlation with quality of life among the workers at textile industry. The increase of hearing loss level will decrease the quality of life of the workers.

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