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Promotion of Psychological Well-being of Stoneworkers by Eliminating Noise Pollution

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ABSTRACT

Introduction: Noise as a stressor has numerous psychological consequences for workers. To prevent these consequences, workers need to use hearing protection devices. This study tends to compare effect of earmuffs and hocks on psychological well-being of stoneworkers.

Methods: In this quasi-experimental study with pre-test and post-test design, 60 healthy male workers of all stone cutting factories in Gonabad were selected by simple random sampling. Sample size was determined using the formula for calculating sample size in analytic observational studies and interventional studies. Initially, sound intensity was measured by Sound Level Meter and then psychological well-being of workers was determined by Ryff's Psychological Well-being Scales (RPWBS). Then, samples were randomly assigned to two groups of 30 who used earmuffs and hocks for a month. Finally, psychological well-being of both groups was measured. Data was analysed by using pairwise and independent t-test using statistical analysis software, SPSS, version 19.

Results: There was no significant difference in demographic variables between two groups ($p>0.05$). Minimum, maximum and mean of noise level was 88.00, 107.40 and 96.94 ± 3.86 dB (A) respectively. Psychological well-being significantly increased in hocks group, while it decreased in earmuffs group ($p<0.05$). The result showed that, hocks significantly increased positive relations with others, purpose in life, personal growth and environmental mastery ($p<0.05$).

Conclusion: Based on the results of the present study, using personal protective equipment can affect Psychological Well-being of workers; however, some equipment can play a more effective role. The result showed that hock outperforms earmuff in eliminating noise pollution and promoting psychological well-being of stoneworkers. Thus, hocks are recommended in factories which produce noise pollution.

Key words: Well-being, Psychological, Noise, Earmuff, Hock, Worker

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INTRODUCTION

Noise is unwanted sound waves, which influence activities of living organisms, particularly human, under certain spatial and temporal conditions; noise may cause numerous physical and mental complications. Recently, the concept of psychological well-being has presented a new aspects of mental health in which health does not mean absence of disease but promotion of positive aspects of mental health [1]. Positive criteria of mental health and psychological well-being have been widely evaluated.

Ryff [2] was the first to present a multidimensional definition of psychological well-being and considered six components of positive psychological performance as self-acceptance, positive relations with others, autonomy, environmental mastery, purposefulness and personal growth. Psychological well-being refers to positive self-esteem, positive relations with others, potential development through personal growth, and purpose in life, ability to choose or create appropriate environments for mental conditions, self-determination and autonomy [3].

Job stress is an important factor which imposes pressure on psychological well-being; it influences both positive psychological performance and psychological damages. Noise is undoubtedly a factor which has been most focused in literature. There is clear evidence that exposure to noise imposes a wide range of long-term physiological and psychological effects on people [3]. These effects include hearing loss, cardiovascular diseases, sleep disturbances, decreased job satisfaction and psychological well-being [4], communication problems [5], and increased aggression [6].

Some studies have shown acute effects of noise exposure on systolic and diastolic blood pressure and heart rate. Although its long-term effects are still unknown, other studies concluded that these effects could also be harmful for blood pressure and heart rate [7]. Studies have shown that noise (such as noise caused by aircraft) is followed by lasting negative effects on physiological parameters (e.g., cardiovascular disease), cognition (such as memory loss) and psychological well-being (such as feelings of satisfaction). Moreover, this noise may be associated with increased risk of mental health. Studies have shown that noise in workplaces is often associated with negative effects of psychological well-being, job satisfaction and motivation [4,8,9]. Exposure to high levels of noise in industries may interfere with satisfaction and well-being of workers and reduce their productivity and increase accidents and absenteeism [10]. In addition, hearing loss following exposure to high frequency noise can be associated with physical health problems such as hypertension and psychological problems such as anxiety and depression, social isolation, low psychological and social well-being, poor cognition and mortality [11-17]. This hearing damage often influences communication and social interaction which in turn can negatively influence well-being. All physical and psychological effects caused by noise, include hearing loss can be prevented. These effects depend on sound quality, duration of exposure, individual susceptibility and sound protection. Thus, they can be prevented by regulating noise criteria in workplaces and recreational activities.

Noise exposure can be reduced by hearing protection plans, particularly job training in the use of protective devices [17]. There is an extensive research literature suggesting that noise can have a devastating effect on health, particularly mental health. These effects can be divided into three main areas: physical damages, mental damages and psychological well-being. In the field of physical damages, adverse effects of noise have been shown on blood pressure, stress hormones, blood glucose, cholesterol and triglycerides [18,19], blood pressure and heart rate [7] and myocardial infarction [20]. In the field of mental damages, studies have shown adverse outcomes of noise on increased anxiety, psychological distress and depression [21], sleep disturbances [18], increased stress and aggression [22], problems with memory and attention [23,24].

In the field of psychological well-being, studies have shown a negative relationship between noise and emotional well-being [25,26], communication, well-being and general welfare [27-29] and a positive relationship between noise and annoyance [30,31], lack of motivation, frustration, lack of persistence and aggressiveness [23]. Given the important role of satisfaction and happiness in psychological well-being, some studies highlighted job tasks as determining job satisfaction. For example, tasks which require autonomy provide self-actualization and lead to higher job satisfaction. In this context, self-actualization may depend on a significant level of engagement allowed in a job [32]. In workplaces where colleagues can interact with each other, interaction and communication are considered as a determinant of job satisfaction, while a noisy workplace is a source of job dissatisfaction [33]. According to these findings, noise control and safety is particularly important for prevention of noise pollution. One of the most common methods used for prevention of hearing defects related to noise is noise elimination by hearing protection devices and their continuous use [34]. There are various types of hearing protectors such as earmuffs and hocks which are selected in terms of noise exposure, comfort and personal convenience. In fact, the best protective device is the one preferred by the user [34]. Although hocks are lightweight, portable and easy to use and completely block noise, earmuffs are bulky, difficult to use and inappropriate for hot workplaces [35-37]. By reviewing literature, no study was found on effect of these devices on psychological well-being of workers, particularly stoneworkers who are exposed to severe and annoying sounds. Thus, the present study tends to compare effect of hocks and earmuffs on psychological well-being of stoneworkers in Gonabad.

MATERIALS AND METHODS

This is a quasi-experimental study with pre-test and post-test design; the samples included 60 healthy male workers who were randomly selected from all stone cutting factories in Gonabad. Inclusion criteria included at least one year of experience in stone cutting, willingness to use hearing protectors, no history of mental disorders, no sensitivity to drug or food, no substance abuse and drug dependence, no history of diseases such as congenital disabilities and mental retardation, no mental retardation and other cases, no history of thyroid disorders, diabetes, metabolic disorders, hypertension, genetic diseases, hyperlipidemia, and hearing loss. The Research Ethics Committee of Gonabad University of Medical Sciences approved the study. The workers were asked to fill the consent form; then, they were randomly assigned to two groups (each containing 30 workers); one group used earmuffs and the other used hocks for one month while working in the factory. Both groups were asked to fill in the anxiety and depression inventories before and after the intervention. Noise involves unwanted sound waves which, under certain spatial and temporal conditions, are effective on activities of living organisms, particularly human; numerous physical and mental complications can be caused by noise. The voices higher than national occupational exposure limit (85 dB) were considered as

noise in this study [18]. Hearing protection limits are provided by personal hearing protection devices [18]. Hearing protectors included earmuffs and hocks in this study. Earmuff, as a protective device, covers the auricle and prevents sound waves. Sound energy is converted into heat energy by hocks (the Hocks Noise Braker). Annoying sounds are filtered by hocks and sounds less than 80 dB are allowed. Anxiety symptoms are measured by Hamilton anxiety scale which is one of the first scales developed for this. This scale is widely used in clinical research. This scale includes 14 items, each defined by a series of anxiety symptoms. This scale is rated on five points ranging from zero to 4. Hamilton anxiety scale is able to evaluate both psychological anxiety (mental distress) and physical anxiety (physical pain and physical complaints). Coefficient of correlation (0.75) and reliability (0.85) of this scale were reported in Iran [22,23]. Beck depression inventory evaluates cognitive, behavioral, physical and mood components of depression. This self-report inventory contains 21 items which are rated on four points ranging from zero to 3. Cronbach's alpha (0.87) and split-half reliability (0.84) of this inventory were reported in Iran [24]. The two groups filled in anxiety and depression inventories. Then, instructions were given to workers for using earmuffs and hocks for one month. The inventories were used to determine anxiety and depression. Demographic variables and noise intensity in different parts of the factories were determined at baseline and end of the project. Noise intensity was determined by CEL-450 Sound Level Meter, CASELLA Co., UK. Blood pressure was determined by mercury sphygmomanometer, Erkameter 3000, Germany. SPSS, version 19, was used to analyze data. Kolmogorov-Smirnov (K-S) test was used to determine normal distribution of data in each group; pairwise and independent t-tests were used for analysis ($p<0.05$).

RESULTS

The samples were all healthy male workers; demographic variables are listed in Table 1.

According to Table 1, independent t-test showed no significant difference between two groups using earmuffs and hocks ($p>0.05$). As shown in this table, minimum, maximum and mean noise levels were equal to 88.00, 107.40 and 96.94 ± 3.86 dB (Network A), respectively.

Table 1: Mean and standard deviation of demographic data

Characteristics	Group	N	Mean	SD	p-value
Age (year)	Ear muff	30	33.4	6.61	0.757
	Hocks	30	33.93	6.68	
	Total	60	33.66	6.59	
Experience (year)	Ear muff	30	5.93	2.57	0.343
	Hocks	30	6.66	3.32	
	Total	60	6.3	2.97	
Diastolic blood pressure (cmHg)	Ear muff	30	7.5	0.83	0.537
	Hocks	30	7.66	1.21	
	Total	60	7.58	1.08	
Systolic blood pressure (cmHg)	Ear muff	30	11.85	1.05	0.885
	Hocks	30	11.8	1.55	
	Total	60	11.82	1.75	
Noise level A (dB)	Ear muff	30	97.55	3.97	0.222
	Hocks	30	96.32	3.72	
	Total	60	96.94	3.86	
Noise level B (dB)	Ear muff	30	99.89	3.58	0.248
	Hocks	30	98.88	3.07	
	Total	60	99.38	3.34	

Table 2 shows that psychological well-being significantly increased in hock group and decreased in earmuff group ($p<0.01$). This finding supports the first hypothesis that hock is more effective than earmuff on psychological well-being of stoneworkers at 95% confidence. This table shows that hock significantly increased positive relations with others, purpose in life and personal growth, while earmuff significantly decreased these components ($p<0.05$). Moreover, hock significantly increased environmental mastery, while hock had no significant effect on autonomy and self-acceptance ($p>0.05$). In addition, earmuff significantly reduced autonomy, while earmuff had no significant effect on self-acceptance and environmental mastery ($p>0.05$). Thus, findings support

the second hypothesis on different effect of hock and earmuff on components of psychological well-being of stoneworkers at 95% confidence.

Table 2: Comparison of mean and standard deviation of psychological well-being between-subject differences

Variables	Group	Before Intervention	After intervention	Difference	p-value
Self-acceptance	Ear muff	51.83 ± 5.76	49.83 ± 5.00	-2.00 ± 5.48	0.055
	Hock	50.06 ± 4.46	51.16 ± 4.21	1.10 ± 3.88	0.132
	p-value	0.189	0.269	0.015	-
Positive relations with others	Ear muff	52.73 ± 4.37	48.53 ± 4.13	-4.30 ± 4.76	<0.001
	Hock	47.20 ± 4.49	57.90 ± 4.24	10.70 ± 4.50	<0.001
	p-value	<0.001	<0.001	<0.001	-
Autonomy	Earmuff	52.00 ± 5.15	48.96 ± 4.51	-3.03 ± 5.43	0.005
	Hock	50.16 ± 3.69	51.53 ± 3.79	1.36 ± 4.39	0.099
	p-value	0.12	0.02	<0.001	-
Environmental mastery	Earmuff	47.23 ± 5.38	46.70 ± 4.89	-0.53 ± 7.41	0.697
	Hock	52.66 ± 4.61	53.76 ± 5.85	11.10 ± 6.50	<0.001
	p-value	0.001	<0.001	<0.001	-
Purpose in life	Earmuff	48.50 ± 3.51	45.23 ± 5.41	-3.26 ± 6.38	0.009
	Hock	46.73 ± 5.24	50.46 ± 5.72	3.73 ± 6.34	0.003
	p-value	0.131	0.001	<0.001	-
Personal growth	Earmuff	46.10 ± 4.21	43.53 ± 4.56	-2.56 ± 5.88	0.024
	Hock	43.10 ± 4.90	53.63 ± 4.83	10.53 ± 5.76	<0.001
	p-value	0.014	<0.001	<0.001	-
Total	Earmuff	298.50 ± 11.00	282.80 ± 9.90	-15.70 ± 15.38	<0.001
	Hock	279.93 ± 11.70	318.46 ± 12.43	38.53 ± 12.50	<0.001
	p-value	<0.001	<0.001	<0.001	-

DISCUSSION

Results of this study support the first hypothesis. As findings showed, psychological well-being significantly increased in hock group and decreased in earmuff group. Some of these results are consistent with similar studies which showed that noise-induced stress could have a negative effect on mental health [14,10,21-24] and reduce their psychological well-being [25-31,38]. Although it was not possible to compare this part of results that hock outperforms earmuff in increasing psychological well-being of workers due to lack of similar interventional studies, the increase in psychological well-being of hock group can be attributed to the fact that hock could improve psychological well-being by its technical features such as lightweight, portability, complete blockage of sound higher than 80 dB and ease of use. However, it seems that bulkiness, difficult use, unsuitability for hot workplaces and complete sound blockage of earmuffs reduce psychological well-being of workers.

As noted earlier, noise pollution ranges from 88 to 108 dB in stone cutting factories of Gonabad; this noise pollution is higher than maximum noise level of 85 dB (A) allowed by NESREA in industrial environments [39]. Hock could increase psychological well-being of workers by controlling noise. Findings also support the second hypothesis. Hock significantly increased positive relations with others, purpose in life and personal growth, while earmuff significantly reduced these components. Moreover, hock significantly increased environmental mastery, while it had no effect on autonomy and self-acceptance. Moreover, earmuff significantly reduced autonomy, while it had no effect on self-acceptance and environmental mastery. This finding is consistent with de Matutuine [40] who found negative effect of noise on interaction and communication. Some studies also highlighted the significant role of job satisfaction in psychological well-being. In this regard, it has been shown that jobs which are associated with high noise lead to job dissatisfaction and finally lack of psychological well-being, while jobs which require autonomy and self-actualization and allow interaction with others lead to higher job satisfaction and improve psychological well-being [27]. To interpret this finding, consider technical features of two devices. For example, hock only prevents sounds higher than 80 dB and does not eliminate all sounds in the workplace; thus, workers

are allowed to communicate with and receive messages of co-workers and supervisors, which increase positive relations between workers. Therefore, hock increases environmental mastery, purpose in life and personal growth by increasing psychological well-being. However, earmuff completely blocks sounds, thereby limits communications between workers and supervisors.

It seems that other components of psychological well-being such as autonomy and self-acceptance could not change over one month. However, this study was conducted within some limitations such as limited information resources and self-report scales, and limited time for intervention. It is essential to consider these limitations in future studies to provide the context for more accurate judgements.

CONCLUSION

Based on the results of the present study, the use of personal protective equipment such as hocks can affect the psychological effects of noise pollution; however, some equipment can play a more effective role in reducing these effects. Based on results, it is concluded that type of hearing protectors is effective on psychological well-being of stoneworkers and some of its components. Hocks are more effective than earmuffs in increasing psychological well-being and some of its components in stoneworkers. Thus, it is recommended to use hocks in factories exposed to noise pollution.

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ETHICAL CONSIDERATIONS

Ethical issues were completely observed by the authors.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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