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Effect of Hearing Protection Devices on Anxiety and Depression of Stone Workers

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ABSTRACT

Introduction: Noise pollution is physically and psychologically effective on workers. As a preventive strategy, workers are required to wear hearing protection devices. The objective of this study was to determine the effect of these devices and compare the effect of earmuffs and hocks on depression and anxiety of stone workers.

Methods and Material: This study is a quasi-experimental study with control-pretest design; simple random sampling was used to select 60 male workers of stone cutting factories existing in Gonabad, Iran. The participants were randomly assigned to two groups (30 people in each group); these groups used earmuffs and hocks for a month. Beck and Hamilton scales were used before and after the intervention to measure anxiety and depression. SPSS-19, paired t-test and independent t-test were used to analyse data.

Results: There was no significant difference between two groups in terms of demographic variables, anxiety and depression before the intervention ($p>0.05$). Anxiety significantly decreased after using protection devices in total samples ($p<0.01$) and after using earmuffs and hocks in two groups ($p<0.01$). Anxiety was significantly lower in hocks group than in earmuff group ($p<0.01$). Moreover, no significant difference was found before and after the intervention in terms of depression in total samples ($p>0.05$), while only depression significantly decreased after using hocks ($p<0.01$).

Conclusions: Hocks reduce anxiety and depression more than earmuffs in stone workers. Thus, workers of factories in which there is noise pollution are recommended to use hocks.

Key words: Noise pollution, Depression, Earmuff, Anxiety, Stone workers, Hocks

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INTRODUCTION

A common health problem is noise pollution; workers are increasingly exposed to harmful noise levels, particularly in industrial jobs [1]. Studies show that noise is recognized as the most common cause of work-related risk in the world; occupational noise affects nearly 600 million workers [2]. Construction industry such as stone cutting and relevant workshops are typically associated with high levels of noise and their workers are highly exposed to noise pollution. This industry produces 85 dBA-120 dBA noises [3]. Exposure to noise is higher in workers this industry than average noise exposure in general population [4]. There are 1806 stone cutting units in Iran, producing nine million tons of stone; in this regard, Iran is the second stone producing country in the world [5]. When noise level exceeds the allowed level, it can be followed by detrimental effects such as noise-induced hearing loss (NIHL); buzzing ears and other physiological effects such as changes in heart rate, blood pressure and increased accidents/diseases; [6-8] psychological effects such as anxiety, depression, stress and decreased job satisfaction [9,10]. Some of these consequences of noise pollution are direct and lead to hearing disorders and permanent hearing loss, while its indirect effects include a wide range of health complications arising from increased anxiety, psychological distress, depression and communication problems [11]. Consequences of noise pollution such as NIHL which is the most common work-related disorder can negatively influence physical and emotional functions, social life and work. In addition, hearing loss is followed by financial losses and high risk of physical hazards [1]. According to studies, noise is an environmental stressor, causing both physical and

psychological injuries [12]. Human reaction to loud noise such as adrenaline secretion, change in heart rate and blood pressure is similar to reaction against an imminent danger; chronic noise exposure can increase blood glucose levels, triglycerides, cholesterol, fibrinogen, stress hormones and leukocyte [13]. Responses to noise are not similar in all people. According to studies, noise exposure is not necessarily associated with psychological complications; instead, it involves noise sensitivity [14,15]. Thus, some studies did not find a direct relationship between ambient noise and mental health, while studies showed that people exposed to high levels of noise [16], particularly those who have severe sensitivity to noise, are more likely to exhibit anxiety and depressive symptoms [17]. However, buzzing of the ears which is related to loud noise can be associated with psychological disturbances such as sleep deprivation, anxiety and depression [18-20]. Some studies have found that stress responses caused by noise can cause negative emotions such as anxiety and aggression [13]. Sound safety and health behaviors of workers to prevent complications of noise pollution are major discussions on construction management, particularly stonework. Scholars have considered a range of basic elements, such as safety design, reliable working methods, surveillance and inspection, and safety training [16]. One way to avoid these complications is to eliminate noise by hearing protection devices. Continuous use of them prevents noise-induced hearing losses [21]. Different types of hearing protectors such as earmuffs are selected based on the type of noise exposure, convenience and personal comfort. Actually, the device preferred by the user is the best device [21]. Reviews revealed no study on the effect of these devices on emotional states of workers, especially stone workers exposed to relatively severe and annoying noise. Thus, this study tends to determine effect of hearing protection devices on anxiety and depression of stone workers, compare two types of these devices (earmuffs and hocks) and test the following hypotheses:

Hearing protection devices reduce anxiety of stone workers;

Hocks and earmuffs are differently effective in reducing anxiety of stone workers;

Hearing protection devices reduce depression of stone workers;

Hocks and earmuffs have different effects in reducing depression of stone workers.

MATERIALS AND METHODS

This is a quasi-experimental study with pretest and posttest 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 workers were male and healthy. Table 1 lists demographic variables.

According to independent t-test, there was no significant difference between two groups who used earmuffs and hocks ($p>0.05$). According to Table 1, minimum,

maximum noise levels are 88.00 and 107.40 dB (A), respectively (96.94 ± 3.86).

Table 1: Mean and standard deviation of demographic data

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

According to Table 2, hearing protection devices significantly reduced anxiety in all samples ($p<0.01$). Thus, the first hypothesis is accepted at 95% confidence. Moreover, there was no significant difference between two groups in terms of anxiety before the intervention ($p>0.05$), while earmuffs and hocks significantly reduced anxiety in both groups ($p<0.01$), as shown in Table 2. However, this reduction was significantly higher in the group using hocks than the group using earmuffs ($p<0.01$). These findings support the second hypothesis that hocks and earmuffs have different effects in reducing anxiety of stone workers at 95% confidence. This table shows no significant difference in depression before and after using hearing protection devices in all samples ($p>0.05$); this finding rejects the third hypothesis that hearing protection devices reduce depression of stone workers at 95% confidence. Moreover, this table shows that depression was not significantly different between two groups before intervention, while depression significantly decreased in the group using hocks ($p<0.01$) and increased in the group using earmuffs ($p<0.01$) after intervention. This finding supports the fourth hypothesis that hocks and earmuffs have different effects in reducing depression of stoneworkers at 95% confidence.

Table 2: Comparison of mean and standard deviation in anxiety and depression between the 2 groups

Variables	Group	N	Before Intervention	After intervention	p-value
Anxiety	Ear muff	30	14.56 ± 6.02	15.80 ± 5.65	0.001
	Sound breaker	30	16.43 ± 5.81	8.13 ± 4.36	<0.001
	Total	60	15.50 ± 5.94	11.96 ± 6.32	<0.001
	p-value	30	0.227	<0.001	-
Depression	Ear muff	30	6.83 ± 4.57	8.43 ± 4.83	0.001
	Sound breaker	30	5.96 ± 4.72	4.60 ± 2.77	0.003
	Total	60	6.40 ± 4.62	6.51 ± 4.35	0.743
	p-value	30	0.473	<0.001	-

DISCUSSION

The range of noise pollution was 88-108 dB in stone cutting factories of Gonabad, which is higher than maximum noise level (85 dB (A)) allowed by NESREA for industrial environments [24]. The first hypothesis is supported by the findings. As the results showed, anxiety of all samples significantly decreased after using protection devices. This finding is consistent with similar studies conducted in this regard; according to these studies, noise-induced stress can influence and increase emotions, particularly anxiety [13,25]. In stone cutting workshops, excessive noise which is higher than allowed level as well as noise sensitivity which is more important than noise alone [14,15] as a stressor could cause a physical and psychological reaction close to stress and anxiety. In particular, sense of hearing as a warning member, which cannot be closed like eyes, responds to noise, increases stress hormones to increase stimulation in stressful situations [13] and causes stress and anxiety. Regardless of their type, hearing protection devices are able to reduce sensitivities and negative emotional consequences and stresses caused by noise by eliminating noise and reducing the annoying effects of noise. The second hypothesis is supported by findings. Findings showed that anxiety significantly decreased in both groups; however, this reduction was significantly higher in hocks group (96.32 dB) than in earmuffs group (97.55 dB) ($p<0.01$). Although there is no similar interventional study and the results cannot be compared, the decrease in anxiety of hocks group compared to earmuffs group is due to their special properties such as lightness, portability, and ease of use. Hocks only prevent noises higher than 80 dB and do not eliminate all sounds in the workplace. This is more suitable than earmuffs for stoneworkers. Findings reject the third hypothesis and support the fourth hypothesis. Although depression was not significantly different before and after the intervention ($p>0.05$), depression significantly decreased in the group using hocks ($p<0.01$) and increased in earmuffs group ($p<0.01$) after intervention. This can be explained from two perspectives. First, depression compared to anxiety was less associated with hearing protection devices. This can be addressed from a psychopathological perspective; stress as a negative emotion is more sensitive than depression in a relatively short time (1 month) and it is more influenced by reaction to noise-induced stress. Second, earmuffs did not reduce, but increased depression; this can be attributed to its largeness, difficult use, unsuitability for warm workplaces and complete blockage of sounds. These properties, particularly the last one, do not let workers to receive audio messages of peers or supervisors; consequently, this limits communications and influences negative emotions (depression) of workers. Communicational problems, particularly if they lead to conflicts between coworkers, worsen the situation; for example, some studies found that unsolved conflicts in noisy workplaces can be harmful for people and increase stress and aggression and finally lead to emotional exhaustion [26,27]. However, there were some limitations such as limited time for intervention and limited information resources and self-report scales. For more accurate judgments, future studies need to consider these limitations.

CONCLUSION

As the results suggest, hearing protectors are effective in reducing anxiety of stoneworkers. Hocks reduce anxiety and depression more than earmuffs. Thus, hocks can be effectively used in factories exposed to noise pollution.

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CONFLICT OF INTEREST

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

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