

EVALUATION OF DIFFERENT TYPE OF GLOVE USING VIBRATING HAND TOOL

Nurul Hanna Mas'aud*, Bulan Abdullah

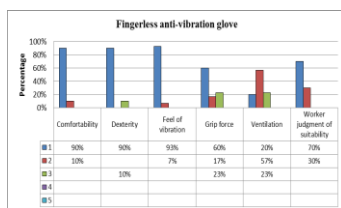
Faculty of Mechanical Engineering, Universiti Teknologi MARA (UiTM), 40450 Shah Alam, Selangor Malaysia

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*Corresponding author
hanna.masaud@gmail.com

Graphical abstract



Abstract

The paper presents satisfaction survey of the glove conditions while using vibrating hand tool in a manufacturing industry. The effects of vibration can cause health issues to the workers especially to those who are using vibrating hand tools. Hand held vibrating tools have become the common use in the manufacturing area. A study stated that many researchers have found that vibration exposures have become a common health problem in manufacturing industries. The research scope and objectives are to evaluate the satisfaction level of the workers using different types of gloves as well as to see how effective they are at reducing vibration exposure. The input data were collected by satisfaction survey among 30 respondents. There are three types of gloves conditions; (i) without glove, (ii) knitted glove and (iii) fingerless anti-vibration glove. The comparison of worker's satisfaction level between these three conditions was summarized. It clearly showed that the use of fingerless anti-vibration glove is the most comfortable among the workers. The main advantage is that the fingers and thumb remain uncovered resulting in unconstructed movements.

Keywords: Ergonomic, vibrating hand tool, vibration exposure, anti-vibration glove, industrial workers

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1.0 INTRODUCTION

In the manufacturing plant, normally, the assembly departments are mostly using vibrating hand tools. Example of tools that they used in the manufacturing industry are vibrating machinery and power tools such as drillers, grinders, nut runners and air guns [1]. Even though nowadays, there are high technology equipments which can reduce human energy there are still some tasks that require human touch.

The industrial workers have usually experienced some health problems due to working environment, such as high workload, work pressure, working injuries and work stress [3]. There are various factors that contribute to the health problems. One of the factors is vibration exposure. A lot of workers do not think that their exposure to vibration could be a health hazard. Many researchers have found that vibration exposures

have become a common health problem in manufacturing industries [1, 2]. These problems have been reported throughout the year around the world. It is mainly because vibrating hand tools are highly used in this industry [4]. Hand held vibrating tools have come the common use in the manufacturing area [5]. This exposure to vibration can cause health problems for the workers. However not much workers are aware with this problem since the vibration exposure cannot be seen. The effects of vibration will only affect the workers after a long period of hand tool usage [6]. Generally, little is known about the effects of vibration exposure making the workers ignore their safety. Some of them do not wear Personal Protective Equipment (PPE) while performing their tasks [7]. For the workers that are using vibrating hand tools, they should wear anti-vibration gloves in order to reduce the vibration exposure [8, 9]. Therefore, in order to validate the satisfaction levels of these three types of gloves, it is

necessary to conduct a survey among the workers and used the collected data to do the improvements and preventative action.

The major cause of HAVs is by the increase of vibration magnitude during the job performance as well as the duration that the workers expose to [10]. As in all occupational exposures, individual sensitivity to vibration differs from person to person. There three major factors affects the health effects that can result from vibration exposure which are: (1) the amount of

vibration exposure, (2) the dose-response relationship (how the severity of the ill health effects is related to the amount of exposure), and (3) latent period of exposure. There are specific exposure limits that are required to be following in order to reduce the vibration exposure. The workplaces should try to maintain exposures as much below the limits as possible. Figure 1 show the example of exposure limit.

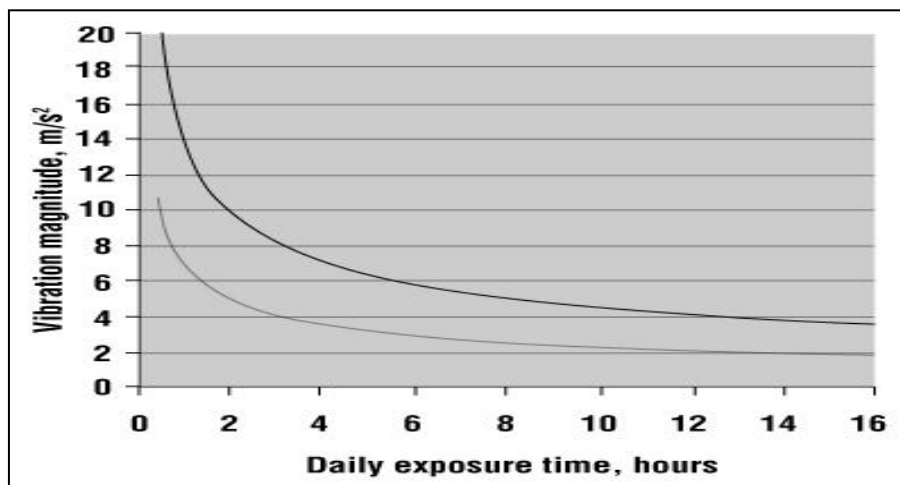


Figure 1 Vibration exposure limit [10]

The workers are required to take action to control vibration exposures that exceed a prescribed level of vibration (the action value) and state the maximum vibration exposure (exposure limit) that a worker can

be exposed to (**Error! Reference source not found.**). Exposures above these limits are considered to pose unacceptable risks to worker health.

Table 1 ACGIH threshold limit values [11]

Hand-Arm Vibration	Vibration Value
Four hours and less than eight hours	4ms ⁻²
Two hours and less than four hours	6ms ⁻²
One hour and less than two hours	8ms ⁻²
Less than one hour	12ms ⁻²

2.0 METHODS

Thirty respondents were randomly selected to perform the trial. The workers are required to drive the screw using vibrating hand tool. Three conditions involved in the survey; without glove (Figure 2) using knitted glove (Figure 3) which is used to provide protection to wrist against friction or abrasion as well as to protect from

dirt, and using fingerless anti-vibration glove (Figure 4) where this glove can reduce the vibration exposure to the worker; provide protection to the hand, and the exposed fingers will not interfere with sensation or gripping. Finally, the workers are required to fill up the satisfaction survey. For satisfaction survey, it includes rubric assessment as shown in Table 2.

Table 2 Rubric assessment

	Level	1	2	3	4	5
Level of Comfort	Rubic	Slightly comfort	~	Moderately comfort	~	Discomfort
Dexterity	Rubic	Very easy to pick child part	~	Moderately easy to pick child part	~	Difficult to pick child part
Feel of Vibration	Rubic	Not feel any vibration	~	Feel the vibration	~	Feel strong vibration
Grip Force	Rubic	Low grip strength	~	Moderate grip strength	~	High grip strength
Ventilation	Rubic	Free of sweat	~	Lack of sweating	~	Intense sweating
Worker Judgment of Suitability	Rubic	Good	~	Moderate	~	Poor



Figure 2 Without glove



Figure 3 Knitted glove



Figure 4 Fingerless anti-vibration glove

3.0 RESULTS AND DISCUSSION

3.1 Satisfaction Without Glove

Most of the workers are prefer not to wear the knitted glove. They are more probably felt better when performing their job without using glove. The satisfaction result of the worker without glove is shown in Figure 5.

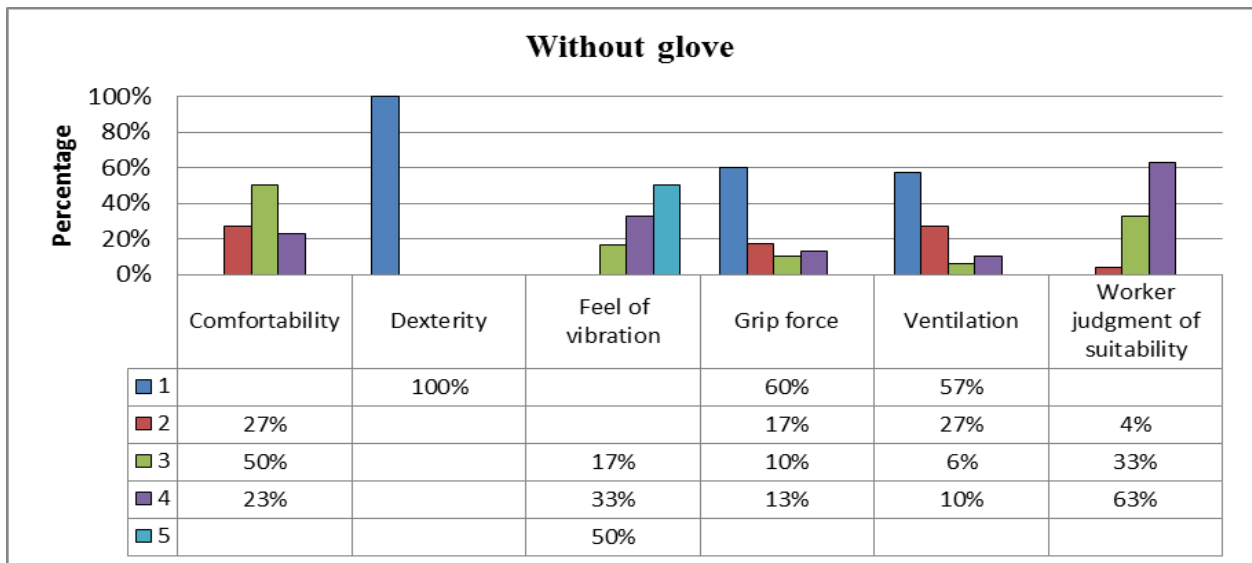


Figure 5 Result of satisfaction survey for without glove

Based on the assessment, in term of comfort ability, there are still none of the workers are feel comfortable without using any glove. It might be due to the vibration that exposed directly to their palm make them felt uncomfortable. Other than that, some of the workers reported that extra force needed to grip the tool. For ventilation factor, even without the glove, there are some workers that are sweating, but not under the range of intense

sweating. Overall, for worker's judgment, most of the workers feel moderate.

3.2 Satisfaction Of Knitted Glove

The worker's satisfaction assessment were carried out among thirty workers. The satisfaction result of the worker when using the knitted glove is shown in Figure 6.

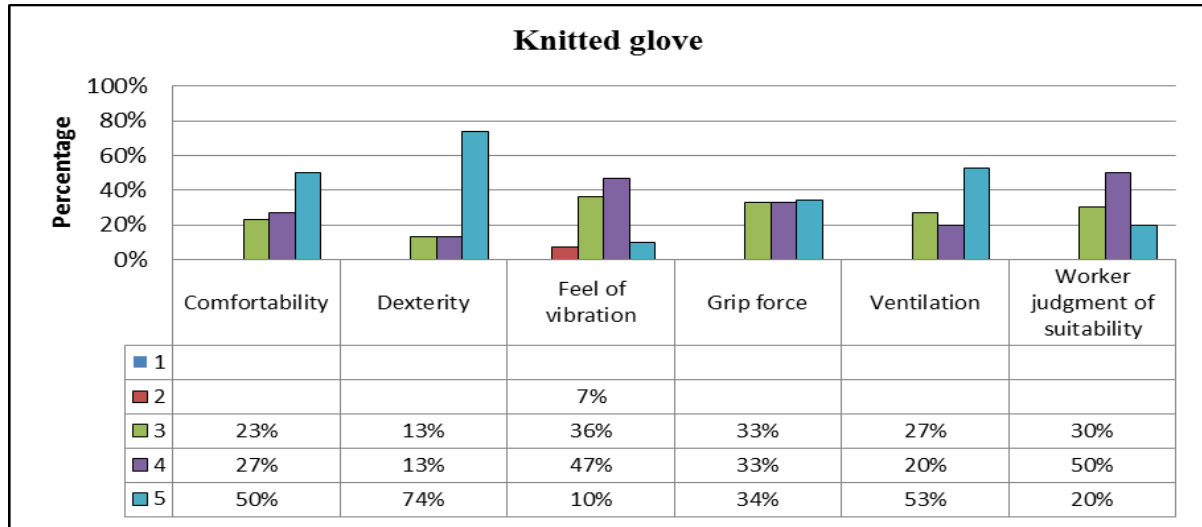


Figure 6 Result of satisfaction survey for knitted glove

According to the figure, none of the workers are comfort when using the knitted glove while performing their job. It is due to lack of dexterity where the workers are mostly difficult to pick the small child part when using the glove. Other than that, they can feel the vibration from the tools since the material of the glove is thin. In term of gripping, it was reported that it required more force because it can be slippery. For the ventilation, all the worker's palms are sweating while using this glove. Finally for the worker's judgment, they are basically stated that the knitted glove is not suitable for them.

3.3 Satisfaction Of Fingerless Anti-Vibration Glove

For the purpose of reducing the vibration exposure to the workers, researcher proposed to use a fingerless anti-vibration glove. The fingerless glove often padded in the palm area. It really suit with assembly

worker who are using torque driver. This glove can reduce the vibration exposure to the worker; provide protection to the hand, and the exposed fingers will not interfere with sensation or gripping.

Based on the observation, all the workers are comfortable with the glove. Some of the workers comment that this fingerless anti-vibration glove is much better compared to the previous glove. This glove gives better grip to the tool while the previous glove sometimes can be slippery. In addition, after direct interview with five workers that are using the anti-vibration glove, all of them declared that they are not feeling pain anymore. On the other hand, rubric assessment has been done in order to get the job satisfaction level of the workers after implementing the fingerless anti-vibration glove. The result was summarized in Figure 7.

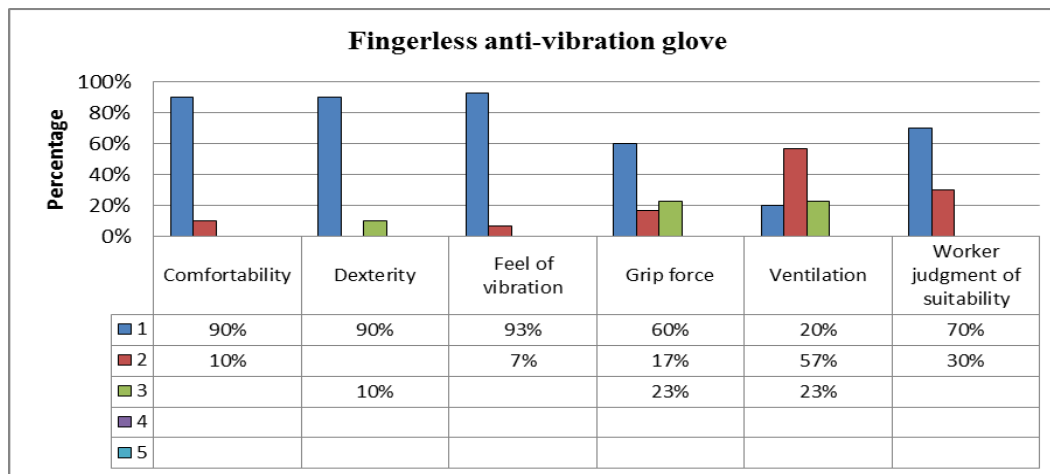


Figure 7 Result of satisfaction survey for fingerless anti-vibration glove

The result from the figure showed that the fingerless anti-vibration glove is the most suitable glove for the workers. 90% of the workers felt comfortable with the glove. It is because, most of them felt very easy to pick the child part, not feel any vibration from the tool, and low grip strength is required to handle the tool. Unfortunately, only six workers are free from sweat and the rest are having palm sweating when using the glove. This cannot be avoided since the weather in the assembly area is warm. Overall, most of the workers are stated that this glove is good and suitable for them.

It clearly showed that the use of fingerless anti-vibration glove is the most comfortable among the workers. The main advantage is that the fingers and thumb remain uncovered resulting in unconstructed movements. In term of dexterity, all the workers agree that they feel very easy to pick the child part when not using any glove. While when the workers are using fingerless anti-vibration glove, only some of them (10% of the workers) feel moderately easy to pick child part. For knitted glove, none of the workers feel easy to pick child part. Most of them felt very difficult to pick the child part.

4.0 CONCLUSION

The results show that:

1. Workers are not comfortable working without glove due to vibration exposure.
2. Using knitted glove cause the worker difficult to pick the small child part when using the glove. Other than that, they can feel the vibration from the tools since the material of the glove is thin. It also required more force because it can be slippery.
3. Using fingerless anti-vibration glove has increase the percentage of comfortability level and dexterity level among the workers as well as reduce the vibration exposure to the workers.

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