**Public Health
and Safety**
International Journal **(PHASIJ)**

Ergonomic Environmental Relations with Occurrence of Work Accidents in Hisara Bali Garment Factory Garment Workers

Agnes Ayu Biomi[1], Komang Angga Prihastini[2], Ni Putu Diana Swandewi[3]
[1,2,3] Universitas Bali Internasional, Gg. Jeruk, Tonja, Kec. Denpasar Tim., Kota Denpasar, Bali
80234, telp/fax : (0361) 4747770
e-mail: [1]agnesayubiomi@iikmpbali.ac.id, [2]Anggaprihastini@iikmpbali.ac.id,
[3]diana.swandewi98@gmail.com

Abstract

Industrialization in Indonesia supports the use of technology, equipment, machines and various materials to produce good products or services in order to compete in the market. However, along with these progress and developments, it triggers various Occupational Safety and Health (K3) problems, such as increasing sources of danger, increasing potential hazards, risk of illness and accidents due to work. So this research was conducted to obtain the relationship between the ergonomics environment and the occurrence of work accidents in garment workers at Hisara Bali Garment Factory. The design of this research is descriptive qualitative research. The sample of this research is all garment workers at Hisara Bali Garment Factory, totaling 25 people because it uses total sampling. Data was collected by giving questionnaires and data analysis was done by Univariate analysis and Bivariate analysis using Chi-Square test. The results showed that there is a relationship between the ergonomics environment and the occurrence of work accidents, so it is necessary to improve the ergonomic environment in order to minimize the occurrence of work accidents at Hisara Bali Garment Factory.

Keywords—Ergonomics, Relation, Accidents, Environment

INTRODUCTION

Industrialization in Indonesia encourages the use of technology such as the use of equipment and machines in the production process. The high number of work accidents proves that the lack of protection for workers has the potential to endanger workers. Potential hazards and work risks can be generated starting from the work process, work environment, and equipment used. The results of research conducted by Isa Sukmawati in 2019 about the potential dangers of the convection home industry in Semarang City stated that the potential dangers in the sewing process were: cutting a finger, pricked by a needle, fell, sliced, electrocuted, stressed and many more. In addition, one of the causes of work accidents is the ergonomic factor [1]. Hisara Bali Garment Factory is a garment company that was established in 2002 which is located on Jalan Canggu Permai, Tibubeneng, North Kuta District, Badung Regency. Each unit section has various potential occupational health and safety hazards due to the large number of interactions between workers and equipment. Potential danger of being crushed by a roll of cloth, pattern making mistakes due to lack of focus on labor resulting in fatigue due to piling up work, potential danger of being cut by scissors, inhaling strong odors and fiber dust from cloth, potential danger of needle sticks and electric shock when turning on, using , and turning off the sewing machine, and the potential danger of ergonomic factors with a bent working position [2]. In the preliminary study by conducting interviews or observations, it was found that the number of work accidents in the last 3 months was recorded as many as 25 cases of work accidents based on work accident reports from Hisara Bali Garment Factory. In the garment industry there are several units of parts that are interrelated with each other which have a sequential workflow, namely: preparation of

materials (preparation); Pattern making (pattern maker); Cutting (cutting); sewing (sewing); Finishing and Checking (quality control); Packing.

Based on this preliminary study, this research was conducted to find out more about the relationship between ergonomics and the occurrence of work accidents in Hisara Garmen Factory Bali workers. Can the ergonomic environment cause work accidents where the ergonomic environmental variables discussed here are work attitudes that are less ergonomic because workers sit on chairs that do not use backrests for a long time so that the back of the body, especially the back, experience fatigue or experience musculoskeletal complaints. Data were obtained by means of observation, interviews, and filling out the Nordic Body Map (NBM) questionnaire with the aim of identifying the level of musculoskeletal disorders (MSDs) complaints and efforts to reduce the possible risk of MSDs complaints which can affect the level of worker productivity. From the identification carried out, it will provide results that can be used as a reference for taking appropriate handling actions against the ergonomic risks experienced by workers [3].

RESEARCH METHODS

This research is included in research in the field of occupational health and safety. The scope of this research is the relationship between environmental ergonomics and the occurrence of work accidents in garment workers at Hisara Bali Garment Factory. The target population in this study were all garment workers, both men and women who worked in all work units at Hisara Bali Garment Factory. The reachable population in the study was 25 workers. The sample of this research is all garment workers, both men and women who work in all work units at Hisara Bali Garment Factory. The sampling technique used in this study is total sampling, which is a sampling technique where the number of samples is equal to the number of population. The sample size in this study was 25 people who were divided into several unit sections, namely 2 people in the material preparation section, 2 people in the pattern making section, 3 people in the cutting section, 10 people in the sewing section, 4 people in the finishing and quality control sections. , 3 people in the packing section, and 1 person in the warehouse section.

The independent variable in this study is the ergonomic environment obtained from the results of filling out the Nordic Body Map (NBM) questionnaire. The results of the questionnaire indicate which part of the body is the most frequently complained or felt by workers. while the dependent variable in this study is work accidents, where work accident data were obtained from interviews and company reports for the last 3 months. The instrument used is a questionnaire in the form of a list of questions that have been tested for validity and reliability, a list of interviews, and a camera as a documentation tool.

The stages of this research began with interviews and filling out the Nordic Body Map (NBM) questionnaire. After the data is obtained, it is then matched with the risk level classification table for musculoskeletal disorders (MSDs) to find out the low, medium, high and very high risk levels for workers. Then, after grouping the risk data, a relationship is sought with the occurrence of work accidents, whether the risk of ergonomics due to MSDs affects the occurrence of work accidents at Hisara Bali Garment Factory obtained through interview data and company reports. In this study, to prove that the two variables have a relationship, the chi square test (X2) was carried out. The results of the chi square test can determine whether or not there is a statistically significant relationship or influence using SPSS 17.0 software [4].

RESULTS AND DISCUSSION

Table 1. Classification of MSDs Risk Levels Based on Individual Total Scores

Likert Scale	Individual Score Total	Risk Level	Corrective Action
1	28-49	Low	No corrective action is required
2	50-70	Average	Action may be required in the future
3	71-91	High	Urgent action is required
4	92-112	Very high	Comprehensive action is needed as soon as possible

Table 1 is a classification table for musculoskeletal disorder risk levels experienced by workers from the Nordic Body Map (NBM) questionnaire data used to determine low, medium, high and very high risk levels before and after work.

Table 2. Classification of Skeletal Muscle Risk Levels (MSDs) based on individual total scores before work

Respondent	Work unit	Individual Score Total	Risk Level MSDs
/1	Material Preparation	48	Low
2	Material Preparation	28	Low
3	Pattern Making	39	Low
4	Pattern Making	50	Low
5	Cutting	48	Low
6	Cutting	60	Low
7	Cutting	41	Low
8	Tailoring	56	Currently
9	Tailoring	55	Currently
10	Tailoring	59	Currently
11	Tailoring	43	Low
12	Tailoring	62	Currently
13	Tailoring	62	Currently
14	Tailoring	59	Currently
15	Tailoring	61	Currently
16	Tailoring	40	Low
17	Tailoring	46	Low
18	Finishing & QC	64	Currently
19	Finishing & QC	42	Low
20	Finishing & QC	44	Low
21	Finishing & QC	48	Low
22	Packing	38	Low
23	Packing	44	Low
24	Packing	47	Low
25	Warehouse	39	Low

From the results of table 2 above, the results show that 6 workers with a moderate risk level (remedial action is needed in the future) and 19 workers with a low risk level (no corrective action is needed).

Table 3. Classification of Skeletal Muscle Risk Levels (MSDs) Based on Individual Total Scores After Work

Respondent	Work unit	Individual Score Total	Risk Level MSDs
1	Material Preparation	55	Currently
2	Material Preparation	66	Currently
3	Pattern Making	43	Low
4	Pattern Making	50	Low
5	Cutting	53	Currently
6	Cutting	63	Currently
7	Cutting	67	Currently
8	Tailoring	102	Very high
9	Tailoring	98	Very high
10	Tailoring	100	Very high
11	Tailoring	94	High
12	Tailoring	104	Very high
13	Tailoring	101	Very high
14	Tailoring	106	Very high
15	Tailoring	95	High
16	Tailoring	100	Very high
17	Tailoring	107	Very high
18	Finishing & QC	66	Currently
19	Finishing & QC	64	Currently
20	Finishing & QC	70	High
21	Finishing & QC	59	Currently
22	Packing	69	Currently
23	Packing	62	Currently
24	Packing	60	Currently
25	Warehouse	40	Low

From the results of table 3 above, the results show that 8 workers with a very high risk level (required comprehensive action as soon as possible), 3 workers with a high level of risk (immediate action required), 11 workers with a moderate risk level (remedial action required) in the future) and 3 workers with a low level of risk (no corrective action is needed yet).

Table 4. Work accident incident data at Hisara Bali Garment Factory

No	Jenis Insiden	Unit Kerja	Jumlah
1	Cut scissors and cutter	Cutting	2
2	Being hit by a sharp object (scissors / cutter)	Cutting	1
3	Needle pricked	Tailoring	8

4	Scissors cut	Tailoring	3
5	Electric shock on sewing machine	Tailoring	2
6	Needle pricked	Quality Control	5
7	Scissors cut	Quality Control	4
	Total		25

Based on the data obtained from the Hisara Bali Garment Factory work accident report and reinforced by the results of interviews with all garment workers in all units, the results of work accident incident data recorded in the last 3 months are in table 4. Then this data will be looked for in relation to the level of risk skeletal muscles before and after work using the chi square test.

Table 5. Results of Analysis of Ergonomic Environmental Relations Before Working with Work Accidents at Hisara Bali Garment Factory

Environment Ergonomics After Work	Accident				Total		P Value
	N	%	N	%	N	%	
Low	11	44	6	24	17	68	0.002
Currently	0	0	8	32	8	32	

Source: Data processed, 2021

Based on Table 5, it shows that 11 people or 44% of respondents with an ergonomic environment before working in the low category experienced minor work accidents or 44% where work accident data is based on company accident data for 3 months. Pearson chi-square significance value of 0.002 <0.05, it can be concluded that there is a relationship between pre-work ergonomic environment and work accidents.

Table 6. Results of Analysis of Ergonomic Environmental Relations After Working with Work Accidents at Hisara Bali Garment Factory

Environment Ergonomics After Work	Accident				Total		P Value
	Light		Currently				
	N	%	N	%	N	%	
Low	3	12	0	0	3	12	
Currently	8	32	3	12	11	44	0.001
High	0	0	3	12	3	12	
Very high	0	0	8	32	8	32	

Based on Table 6, it shows the relationship between ergonomics environment after work and work accidents that have a mild accident category of 3 people and 12%. While the medium category is 8 people or 32%. Pearson chi-square significance value of 0.001 <0.05, it can be concluded that there is a relationship between ergonomic environment after work and work accidents.

Discussion

Ergonomic risk classification that causes skeletal muscle complaints with high and very high risk is most commonly found in workers in the sewing unit. This is supported by the results of observations of non-ergonomic work methods, namely inappropriate seats or chairs for workers with a monotonous work attitude, it is necessary to provide seats or chairs that are more ergonomic which contain backrests so that workers can stretch their muscles by reclining for a while. in between sewing.

From this data, it can be seen that there were 25 cases of work accidents among garment workers at Hisara Bali Garment Factory, from the last 3 months, the dominant work accidents were needle sticks in the sewing unit which occurred 8 times in the last 3 months. In addition, work accidents also often occur in cutting and quality control work units such as being cut and hit by sharp objects such as scissors and cutters. Based on the results of the analysis using chi-square, a significant Pearson chi-square value was obtained of 0.001 <0.05, which means that there is a significant relationship between ergonomics and the occurrence of work accidents in garment workers at Hisara Bali Garment Factory. Respondents with an ergonomic environment in the very high category were 8 people or 32%.

Based on the results of the study, it showed that there was a significant relationship between the level of ergonomics risk and MSDs complaints. Respondents who had a high ergonomics risk level had 6 times more risk of experiencing MSDs complaints than respondents who had a moderate ergonomics risk level. The Nordic Body Map is intended to find out in more detail which parts of the body experience disturbances or pain while working. Although this questionnaire is subjective [6], this questionnaire has been standardized and is valid enough to use. According to bridger (1995) and NIOSH (1997) the factors that influence the level of ergonomic risk are posture, duration, frequency, and load.

Therefore, it is important to improve ergonomics considering that the working environment in the garment industry usually pays little attention to ergonomics and occupational health and safety aspects. This can affect the performance and productivity of workers especially with work facilities that are inadequate and not well organized which can ultimately cause discomfort at work and affect product quality in the garment industry.

CONCLUSION

Based on the results of the research above, it can be concluded that ergonomic environmental factors have a significant relationship with the occurrence of work accidents in garment workers at Hisara Bali Garment Factory. Suggestions to Hisara Bali Garment Factory to improve the quality of its human resources and improve ergonomic environmental conditions and reduce the risk of work accidents. So it is important to give suggestions or input regarding ergonomic improvements that can be done to reduce the high and very high level of ergonomic risk so as to reduce the incidence of work accidents. Further research can also be carried out by raising work accident cases related to human, environmental and machine factors with OSH behavior in the garment industry.

SUGGESTION

Based on the data and analysis presented in your research, it is clear that there is a significant relationship between ergonomics and the occurrence of work accidents in garment workers at Hisara Bali Garment Factory. To further explore this topic and provide valuable insights for improving workplace safety and ergonomics in the garment industry, here are some research suggestions:

1. Conduct a longitudinal study to track the relationship between ergonomics and work accidents over an extended period. This will help in understanding how changes in ergonomics practices affect accident rates and worker health over time.

2. Compare the effectiveness of different ergonomic interventions or measures in reducing work accidents. This could involve implementing specific changes in one section of the factory while keeping another section as a control group.

3. Investigate the impact of ergonomics training programs for workers. Evaluate if educating workers about ergonomics and proper workplace practices reduces the occurrence of work accidents.

THANK-YOU NOTE

REFERENCES

Lee, W. T., Lim, S. S., Kim, J., Yun, S., Yoon, J. H., & Won, J. U. (2020). Work Schedule Irregularity And The Risk Of Work-Related Injury Among Korean Manual Workers. International Journal Of Environmental Research And Public Health, 17(20), 7617.

Sen, A., Sanjog, J., & Karmakar, S. (2020). A Comprehensive Review Of Work-Related Musculoskeletal Disorders In The Mining Sector And Scope For Ergonomics Design Interventions. IISE Transactions On Occupational Ergonomics And Human Factors, 8(3), 113-131.

Lemos, J., Gaspar, P. D., & Lima, T. M. (2022). Environmental Risk Assessment And Management In Industry 4.0: A Review Of Technologies And Trends. Machines, 10(8), 702.

Notoatmodjo S. 2002. *Metodologi Penelitian Kesehatan*, Rineka Cipta, Jakarta.

Tarwaka. 2012. *Dasar-Dasar Keselamatan Kerja Serta Pencegahan Kecelakaan Di* Tempat *Kerja*.Surakarta: Harapan Press.

Tarwaka. 2014. *Keselamatan Dan Kesehatan Kerja: Manajemen Dan Implementasi K3 Di Tempat* Kerja. Surakarta: Harapan Press.

Wowo Sunaryo Kuswana. (2014). *Ergonomi Dan K3 Kesehatan Keselamatan Kerja. Bandung.*