

MINISTRY OF EDUCATION AND TRAINING

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**CURRENT STATUS OF WORKING CONDITIONS AND
HEALTH OF FEMALE WORKERS AT TWO GARMENT
COMPANIES IN THAI BINH CITY AND THE
EFFECTIVENESS OF SOME INTERVENTION MEASURES**

Specialization: Public Health

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SUMMARY OF DOCTORAL DISSERTATION IN PUBLIC HEALTH

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1. **Dang Thi Van Quy, Nguyen Dang Vung, Ngo Thi Nhu (2024).** Current status of several labor environmental indicators affecting health at two garment companies in Thai Binh City. *Vietnamese Journal of Medicine*, No. 2, August 2023, Vol. 541, pp. 215–219.
2. **Dang Thi Van Quy, Nguyen Dang Vung, Ngo Thi Nhu (2024).** Knowledge of occupational safety and hygiene related to the health of female garment workers in Thai Binh City. *Vietnamese Journal of Medicine*, No. 2, August 2023, Vol. 541, pp. 301–305.
3. **Dang Thi Van Quy, Nguyen Dang Vung, Ngo Thi Nhu (2024).** Results of some intervention solutions to protect and enhance the health of female workers at two industrial garment companies in Thai Binh city, Thai Binh province, *Journal of Community Medicine*, volume 65, issue 6, 2024, pp 216-221.

INTRODUCTION

Currently, in our country, the textile and garment industry play an increasingly important role in the national economy. This sector not only meets the needs of individuals but also provides employment opportunities for many workers in society, contributing significantly to the national budget and facilitating economic development. According to the General Statistics Office, the number of female workers has increased alongside the rapid development of industrial zones. By 2022, female workers accounted for 46.8% of the national workforce and participated in all economic sectors [1], [2].

In recent years, Thai Binh has emerged as one of the provinces attracting substantial investment in the garment sector from both domestic and foreign textile corporations and private companies. Most workers come from residential areas in the outskirts of the city, with relatively low educational attainment and limited understanding of occupational safety and hygiene.

These factors pose limitations and potential risks that can adversely affect the health of workers. Notably, in the garment industry, which predominantly employs women, there are significant risks of illness, occupational diseases, and increased accidents [3]. Therefore, enhancing occupational safety and hygiene measures is essential and holds practical significance

According to estimates by the International Labor Organization, approximately 337 million occupational accidents occur worldwide each year, along with 160 million cases of occupational diseases. It is estimated that 2.3 million people die due to workplace accidents or occupational diseases [4]. An estimated 160 million new cases of occupational diseases due to exposure to risk factors at the workplace occur annually, with 30% to 40% leading to chronic illnesses and about 10% resulting in disabilities [5]. A study on the knowledge and practices of workers in several industrial garment companies in Hung Yen revealed that female workers correctly practiced wearing masks and self-care for health at rates of 99.3% and

70.8%, respectively [6].

The question arises: What is the current status of working conditions for workers in the garment industry in Thai Binh, and how can knowledge and practices related to occupational safety be improved? To address this issue, we conducted a study titled: “Current status of working conditions and health of female workers at two industrial garment companies in Thai Binh City and the effectiveness of some intervention measures,” with the following objectives:

1. To describe the current status of working conditions, health, and some factors related to the health of female workers at two industrial garment companies in Thai Binh City in 2021.
2. To evaluate the results of several intervention measures aimed at protecting and improving the health of female workers at the two industrial garment companies in Thai Binh City.

1. New Contributions of the Dissertation

- The research results provide a comprehensive overview of the current working conditions of workers at the two garment companies. Most indicators for temperature, humidity, wind speed, and concentrations of CO and CO₂ meet permissible standards. However, only 55.7% of the lighting conditions meet the standard.

- Regarding the health status of female workers at the two companies, the results indicate that common health issues include eye diseases (60.5% and 47.1%); gynecological conditions (41.2% and 45.3%); digestive disorders (26.0% and 12.7%); ear, nose, and throat issues (27.5% and 25.0%); musculoskeletal disorders (23.5% and 21.9%); and surgical conditions (21.1% and 23.5%). Additionally, 13.0% and 14.6% of workers experienced work-related injuries, with 11.3% and 14.5% resulting in reduced mobility as a sequela.

- After the interventions, the incidence of cardiovascular diseases

decreased with an effectiveness rate of 58.1%, skin diseases at 75.9%, musculoskeletal disorders at 35.0%, and ear, nose, and throat issues at 33.0%. The effectiveness of the intervention on knowledge of occupational safety and hygiene showed that 4 out of 5 assessed knowledge indicators for the intervened female workers achieved good levels, which were higher than those in the non-intervention group by 49.9% to 113.4%. The percentage of female workers with good general knowledge before the intervention was 28.2%, which increased to 75.1% after the intervention. The overall effectiveness of the intervention in improving general knowledge among female workers in the intervention group compared to the non-intervention group reached 166.3%.

2. Layout of the dissertation

The dissertation comprises 135 pages. In addition to the introduction (2 pages), conclusion (2 pages), and recommendations (1 page), it includes four chapters: Chapter 1: Overview (35 pages); Chapter 2: Study Subjects and Methods (26 pages); Chapter 3: Research Results (36 pages); Chapter 4: Discussion (32 pages); The dissertation contains 42 tables, 6 charts, and 124 references (65 in Vietnamese and 59 in English).

CHAPTER 1. LITERATURE REVIEW

1.1. Some relevant concepts and definitions

1.2. Current status of working conditions at garment companies

1.2.1. Studies on working conditions and environment worldwide

The textile and garment industry are considered one of the key sectors in many countries around the world. Investment in infrastructure and the use of outdated machinery pose significant risks of environmental pollution and inadequate working conditions, particularly in developing countries. Today, even in the United States, which is one of the most advanced industrial nations globally, issues related to dust pollution and other environmental conditions in the workplace still persist [17].

Labor in the garment industry is not classified as heavy work. However, workers often have to perform tasks in constrained and unfavorable positions. The increasing use of dyes in the garment industry and other sectors leads to immune suppression and poses environmental risks [18]. Workers in the garment industry frequently encounter poor microclimatic conditions, especially high temperatures and humidity.

Issues related to safety and health conditions in the workplace vary between countries and organizations. The demands of working conditions often force workers to endure constrained and fatigued postures. Inadequate work and rest periods can disrupt the physiological and psychological activities of workers, leading to various pathological disorders and occupational stress. Noise is a characteristic of the garment industry; although the noise level is typically not high (70-90 dBA), workers are frequently exposed to it [20].

1.2.2. Some studies on working conditions and environment in Vietnam

The garment industry in Vietnam is currently experiencing robust growth and is viewed as a sector with significant development potential. Our textile products dominate many global garment markets due to our advantages in human resources, the participation of various economic sectors, and suitable technologies.

Like other sectors during the economic development period, the garment industry in our country must adjust labor organization and working conditions to meet increasingly high product quality standards. This creates pressure and psychological burdens on workers. Working in constrained positions, combined with the effects of noise, hot and humid working environments, and high dust concentrations, significantly impacts the health of workers. Moreover, companies expanding their production scale without increasing the area of their facilities can lead to inappropriate workplace arrangements. Additionally, they often do not install equipment to manage and reduce potential environmental pollution, posing further risks to workers' health [3].

1.3. Health of female workers in the garment industry

Female workers in the garment production sector are frequently affected by various health issues, primarily due to unsanitary working conditions and dust produced from raw materials.

Numerous studies by foreign authors indicate that workers in the garment industry often experience specific health problems compared to those in other sectors.

The working environment for female garment workers typically contains cotton dust, leading to a significantly high risk of allergies associated with cotton exposure.

1.4. Impact of working conditions on workers' health

Dust and unfavorable microclimatic conditions pose significant risks to workers in the garment industry in Asian countries.

Physical and chemical factors in the environment, such as dust and toxic fumes, cause a range of pathological disorders and occupational diseases. Among these, inorganic dust is particularly concerning, as it can lead to irreversible pulmonary fibrosis, severely impairing respiratory function.

Extended working hours can induce stress, both neurological and physical, due to excessive strain. Prolonged labor depletes energy reserves and increases the accumulation of intermediate products in muscle tissue, resulting in pain, fatigue, muscle stiffness, and even loss of mobility.

1.5. Some intervention measures for the health care of garment workers and their effectiveness

- Policy solutions
- Technological solutions and working conditions
- Occupational safety control solutions
- Health communication and education solutions
- Medical care solutions
- Implementation of personal protective equipment (PPE)

CHAPTER 2: RESEARCH SUBJECTS AND METHODOLOGY

2.1. Research subject, are and duration

2.1.1. Research subjects

* Working Conditions at Hung Nhan Garment Company Ltd. and Hualida Garment Company Ltd. in Thai Binh City: temperature, humidity, air movement speed, lighting, noise, and factory conditions, etc.

* Female workers at the two industrial garment companies.

2.1.2. Research area

+ Hung Nhan Garment Company Ltd., Nguyen Duc Canh Industrial Zone, Thai Binh City.

+ Hualida Garment Company Ltd., Phuc Khanh Industrial Zone, Phuc Khanh Ward, Thai Binh City.

2.1.3. Research duration:

- From May 2020 to April 2021: Finalize the outline and develop the research plan.
- May 2021: Prepare for the study, train investigators, etc.
- From June to July 2021: Conduct health examinations and interview study subjects.
- From October 2021 to October 2022: Organize intervention activities at Hung Nhan Garment Company Ltd. (intervention area).
- From November to December 2022: Conduct surveys to evaluate the effectiveness of the interventions.
- 2023: Process and analyze data, write, and complete the dissertation.

2.2. Research methodology

2.2.1. Research design

+ Phase 1: Initial Investigation

Utilize a cross-sectional descriptive study design to assess the current working conditions, health status of female industrial garment workers, as well as their knowledge and practices regarding occupational safety and hygiene (OSH) and related factors.

+ Phase 2: Intervention and evaluation of effectiveness

Employ a community intervention study design with a control group to compare outcomes before and after the intervention.

2.2.2. Sample size and sampling method

2.2.2.1. Sample size

* The sample size is determined for the following environmental factors in the workplace: temperature, humidity, air circulation speed, lighting, and noise.

$$n = Z^2_{(1-\alpha/2)} \frac{SD^2}{d^2}$$

With the selected data, the calculated sample size is 30 samples per company. Thus, during the investigation, we identified the following factors: temperature, humidity, air circulation speed, lighting, and noise, with each parameter comprising 30 samples. In practice, we measured the microclimatic indicators, lighting, and noise with 30 samples at Hung Nhan Company and 31 samples at Hualida Company.

For the dust, CO, and CO₂ indicators, we intentionally measured at the locations where workers are present. We collected 10 samples at Hung Nhan Company and 12 samples at Hualida Company.

* Formula for calculating the sample size for examining and assessing knowledge and practices regarding occupational safety and hygiene (OSH)

$$n = Z^2(1 - \alpha/2) \frac{px(1 - p)}{d^2}$$

+ The calculated sample size is $n=783n = 783n=783$. In practice, 832 individuals were surveyed across the two companies: 408 individuals at Hung Nhan Garment Company Ltd. and 424 individuals at Hualida Garment Company Ltd.

* Sample size for the intervention study

$$n_1 = n_2 = \frac{\{z_{1-\alpha/2}\sqrt{2\bar{P}(1-\bar{P})} + z_{1-\beta}\sqrt{P_1(1-P_1) + P_2(1-P_2)}\}^2}{(P_1 - P_2)^2}$$

The sample sizes are $n_1=n_2=395$ individuals. In practice, the investigation at Hung Nhan Garment Company Ltd. (intervention group) included 406 individuals, while the survey at Hualida Garment Company Ltd. (control group) included 410 individuals.

2.2.3. Variables and indicators in the study

* Variables for Objective 1

- + Environmental indicators
- + General information about study subjects
- + Job-related information
- + Knowledge and practices regarding occupational safety and hygiene
- + Health information
- + Health examination results
- * Variables for Objective 2
- + Results of intervention activities

2.2.4. Community intervention measures, implementation, and evaluation

- Measure 1: Training on occupational safety and hygiene and disease prevention related to the profession.
- Measure 2: Guidance on minimizing the burden of working postures and promoting health care for female garment workers.

The intervention period was conducted from Oct 2021 to Oct 2022.

2.2.5. Data processing method

- The survey data were processed using Epi Data and SPSS 20.0 software on computers at the Department of Community Health at Thai Binh University of Medicine and Pharmacy.
- A comparative analysis was used to evaluate the effectiveness of the intervention regarding knowledge and practices for ensuring occupational safety and hygiene.

2.2.6. Research ethics

The project was approved by the Council of Thai Binh University of Medicine and Pharmacy according to Decision No. 1065/QĐ-YDTB dated July 3, 2019.

The study received consent from the female workers participating in the research and the management of Hung Nhan Garment Company Ltd. and Hualida Garment Company Ltd. The purpose of the study was communicated to the management of both companies regarding the content of the implementation plan for each location.

The research results were shared with Hung Nhan Garment Company Ltd. and Hualida Garment Company Ltd.

CHAPTER 3. RESEARCH RESULTS

3.1. Current state of working conditions, health, and health-related factors of female workers at two export garment companies in TB city

3.1.1. Current state of working conditions through measured and evaluated indicators in the workshops

Table 3.1. Results of temperature measurements in the workplace at the two companies

Location	Temperature ($^{\circ}\text{C}$)			
	Sample Size	Min - Max	Means	SD
Hung Nhan	30	22.1 - 32.1	23.6	1.7
Hualida	31	28.4 - 32.0	30.2	1.1
QCVN 26:2016	18 $^{\circ}\text{C}$ - 32 $^{\circ}\text{C}$			
Percentage of samples meeting standards (%): 98.4				

The results in Table 3.1 indicate that the average temperature in the working environment at the two garment companies ranges from 23.6 ± 1.7 $^{\circ}\text{C}$ to 30.2 ± 1.1 $^{\circ}\text{C}$. The average temperature in the working environment at these two garment companies meets the permissible standard at a rate of 98.4%.

Table 3.2. Results of air humidity measurements in the working environment at the two companies

Location	Relative humidity (%)			
	Sample Size	Min - Max	Means	SD
Hung Nhan	30	50.0 - 67.5	62.9	2.6
Hualida	31	68.0 - 83.0	74.7	3.3
QCVN 26:2016	40-80			
Percentage of samples meeting standards (%): 98.4				

Table 3.2 shows that the relative humidity in the working environment of both garment companies meets the quality standards (TCCP) at a rate of 98.4%. The average relative humidity ranges from $62.9 \pm 2.6\%$ to $74.7 \pm 3.3\%$.

Table 3.3. Results of illumination measurements in the working environment at the two companies

Location	Illumination (Lux)			
	Sample Size	Min - Max	Means	SD
Hung Nhan	30	507 - 688	566.5	42.9
Hualida	31	150 - 2.050	981.1	457.6
QCVN 22:2016	500-750			
Percentage of samples meeting standards (%): 55.7				

Table 3.3 indicates that the illumination in the working environment at Hung Nhan company falls within permissible limits. However, Hualida company has some areas that do not meet the standards, with an overall compliance rate of 55.7%.

Table 3.4. Results of noise level measurements in the working environment at the two companies

Location	Noise Level (dBA)			
	Sample Size	Min – Max	Means	SD
Hung Nhan	30	52.1 - 66.9	56.8	2.1
Hualida	31	58.3 - 77.8	71.0	4.3
QCVN 24:2016	85dBA			
Percentage of samples meeting standards (%): 100.0				

The results of the noise level survey in the working environment of the workers at both companies indicate that 100% of the samples surveyed meet the permissible standards.

Table 3.5. Results of respiratory dust measurements in the working environment at the two companies

Location	Respiratory dust (mg/m ³)			
	Sample Size	Min - Max	Means	SD
Hung Nhan	10	0.04 - 0.23	0.08	0.05
Hualida	12	0.06 - 0.70	0.16	0.20
QCVN 02:2019	1.0			
Percentage of samples meeting standards (%): 100.0				

Table 3.5 shows that the results of the survey on respiratory dust concentrations in the working environment at both companies meet the permissible standards.

Table 3.6. Results of carbon monoxide (CO) concentration measurements at the two companies

Location	CO gas (mg/m ³)			
	Sample Size	Min - Max	Means	SD
Hung Nhan	10	2.20 - 3.40	2.77	0.42
Hualida	12	0.50 - 0.50	0.50	0
QCVN 03:2019	20			
Samples meeting standards (%)	100			

Table 3.6 shows that the concentration of CO in the working environment at both companies meets the permissible standards (100%).

Table 3.7. Results of CO₂ measurement in the work environment at two companies

Location	CO ₂ gas (mg/m ³)			
	Sample Size	Min - Max	Means	SD
Hung Nhan	10	5.19 - 620	501.03	221.88
Hualida	12	889 - 1.387	1.213.33	149.44
QCVN 03:2019	9.000			
Samples meeting standards (%)	100			

The results in Table 3.7 indicate that the CO₂ concentration in the working environment of both surveyed companies also meets the permissible standard (100%).

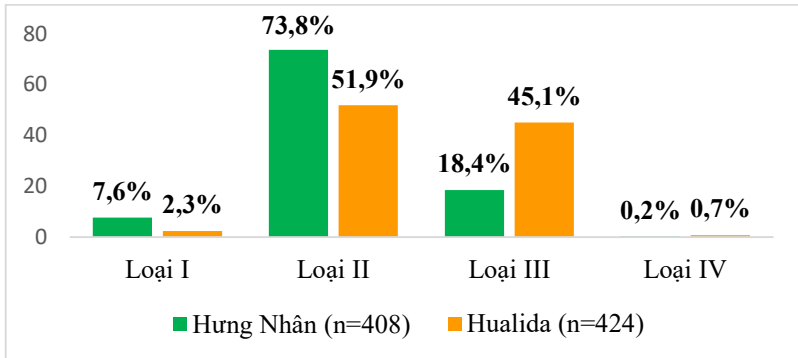


Figure 3.1. Classification of health status among female workers

The results from the health classification of female workers at the two study locations indicate that the majority fall into the good and fair health categories (Types I and II). Specifically, at Hung Nhan Company, the percentages are 7.8% for Type I and 73.5% for Type II, while at Hualida Company, the percentages are 2.4% for Type I and 74.3% for Type II. At Hung Nhan Company, 18.1% of female workers were classified as having average health (Type III), and at Hualida Company, this figure was 20.0%. The percentages of workers classified as weak and very weak (Types IV and V) were both less than 5% at both companies.

Table 3.8 Health issues among female workers at two garment companies

Health issues	Hung Nhan (n=408)		Hualida (n=424)	
	SL	(%)	SL	(%)
Dental disorders	64	15.7	67	15.8
Eye diseases	247	60.5	200	47.1
ENT Issues	112	27.5	106	25.0
Musculoskeletal disorders	96	23.5	93	21.9
Urinary tract issues	57	14.0	64	15.1
Surgical conditions	86	21.1	100	23.5
Gynecological conditions	168	41.2	192	45.3

The table indicates that female workers at Hung Nhan Company have the highest prevalence of eye diseases (60.5%), followed by gynecological conditions (41.2%), and ENT issues (27.5%). Other conditions such as digestive disorders, musculoskeletal disorders, and surgical conditions show prevalence rates of 26.0%, 23.5%, and 21.1%, respectively. At Hualida Company, the rates for eye diseases are 47.1%, gynecological conditions are 45.3%, and musculoskeletal disorders, surgical conditions, and ENT issues are 21.9%, 23.5%, and 25%, respectively.

Table 3.9. Relationship between noise levels and headache symptoms after work shifts among female workers

Noise Perception	Headache Symptoms		OR (95% CI)
	Yes	No	
Noise (Low or High)	115	167	3.09 (2.24 - 4.27)
No noise	100	450	

The results from the table indicate that headache symptoms occurring at the end of work shifts among female workers are strongly associated with noise levels during the work shift. Female workers working in noisy environments have a 3.09 times higher risk of experiencing headache symptoms compared to those working in environments without noise, with an odds ratio (OR) of 3.09 and a 95% confidence interval (CI) of (2.24 - 4.27).

Table 3.10. Relationship between insufficient lighting and blurry vision symptoms after work shifts among female workers

Lighting perception of workers	Blurry vision		OR (95% CI)
	Yes	No	
Insufficient Lighting	26	35	2.03 (1.19 - 3.47)
Adequate Lighting	206	565	

Female workers working in environments with insufficient lighting have a 2.03 times higher risk of experiencing blurry vision symptoms compared to those working in adequately lit environments, with an odds ratio (OR) of 2.03; (95% CI): (1.19 - 3.47).

Table 3.11. Impact of dust on itching and allergic reactions after work shifts among female workers

Worker Perception of Dust	Itching/Allergy		OR (95% CI)
	Yes	No	
Dust	24	388	1.93
No dust	13	407	(0.98 - 3.96)

The analysis in the table indicates that there is no strong association between working in a dusty environment and the symptoms of itching and allergic reactions at the end of work shifts among female workers, with an odds ratio (OR) of 1.93; (95%CI): (0.98 – 3.96).

Table 3.12. Impact of noise on tinnitus symptoms after work shifts among female workers

Worker Perception of Noise	Tinnitus		OR (95% CI)
	Yes	No	
Noise	25	355	1.70
No noise	18	434	(0.91 - 3.21)

The results in the table show a weak association between working in a noisy environment and the occurrence of tinnitus symptoms at the end of work shifts among female workers, with an odds ratio (OR) of 1.70; (95%CI): (0.91 – 3.21).

Table 3.14: Knowledge of female workers regarding PPE before and after intervention

Protective Equipment	Intervention Group				Control Group				IE (%)
	BI (n=408)		AI (n=406)		BI (n=424)		AI (n=410)		
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	
Helmet	206	50.5	264	65.0	149	35.1	107	26.1	3.1
Effectiveness Change Index (%)	28.7				25.6				
Mask	359	88.0	403	99.3	403	95.0	391	95.4	12.4
Effectiveness Change Index (%)	12.8				0.4				
Earplugs	182	44.6	217	53.4	28	6.6	27	6.6	19.7
Effectiveness Change Index (%)	19.7				0				
Clothing	397	97.3	281	68.7	132	31.1	102	24.9	9.5
Effectiveness Change Index (%)	29.4				19.9				
Glasses	96	23.5	28	6.9	9	2.1	6	1.5	42.0
Effectiveness Change Index (%)	70.6				28.6				

BI: Before Intervention; AI: After Intervention; IE = Intervention effectiveness

The results from the table indicate that the effectiveness of the intervention regarding female workers' knowledge of using protective glasses in the workplace showed a change of 42.0%. This was followed by the effectiveness of using earplugs and masks, which showed changes of 19.7% and 12.4%, respectively.

Table 3.15. Practices of female workers in preventing related diseases before and after intervention.

Occupational Safety and Health (OSH)	Intervention Group				Control Group				IE (%)
	BI (n=408)		AI (n=406)		BI (n=424)		AI (n=410)		
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	
Hygiene after work shift	226	55.4	342	84.2	150	35.4	201	49.0	8.6
Effectiveness Change Index (%)	52.0				38.4				
Use of PPE	269	65.9	402	99.0	215	50.7	208	50.7	50.2
Effectiveness Change Index (%)	50.2				0				
Balance Work and Rest	107	26.2	175	43.1	65	15.3	104	25.4	-1.5
Effectiveness Change Index (%)	64.5				66.0				
Adequate Nutrition	43	10.5	79	19.5	44	10.4	62	15.1	40.5
Effectiveness Change Index (%)	85.7				45.2				
Regular Health Monitoring	147	36.0	194	47.8	114	26.9	96	23.4	19.8
Effectiveness Change Index (%)	32.8				13.0				

BI: Before Intervention; AI: After Intervention; IE = Intervention effectiveness

The table above shows the practices of female workers regarding disease prevention before and after the intervention. Compliance with the use of personal protective equipment (PPE) and adequate nutrition demonstrated the highest intervention effectiveness at 50.2% and 40.5%, respectively. The remaining factors showed insignificant changes in intervention effectiveness.

Table 3.16. Practices regarding the use of personal protective equipment among female workers before and after the intervention

Occupational Safety and Health (OSH)	Intervention Group				Control Group				IE (%)
	BI (n=408)		AI (n=406)		BI (n=424)		AI (n=410)		
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	
Helmets	65	15.9	159	39.2	41	9.7	78	19.0	50.6
Effectiveness Change Index (%)	146.5				95.9				
Masks	211	51.9	406	100	208	49.1	300	73.2	43.6
Effectiveness Change Index (%)	92.7				49.1				
Protective Clothing	47	11.5	103	25.4	52	12.3	75	18.3	72.1
Effectiveness Change Index (%)	120.9				48.8				
Uniforms	56	13.7	102	25.1	7	1.7	8	1.9	71.4
Effectiveness Change Index (%)	83.2				11.8				

BI: Before Intervention; AI: After Intervention; IE = Intervention effectiveness

The table shows the changes in adherence to the use of personal protective equipment among the study subjects before and after the intervention. There is not a significant difference between the intervention group and the control group, with the effectiveness index for using protective clothing at 72.1%, uniforms at 71.4%, and masks at 38.2%.

CHAPTER 4. DISCUSSIONS

4.1. Current state of working conditions, health, and health-related factors of female workers at two industrial garment companies

4.1.1. Current state of working conditions

1) Microclimatic factors in the working environment

Microclimatic factors include temperature, humidity, and air movement speed. These factors must be maintained within certain limits that are suitable for human physiology. Microclimate affects the body's thermoregulation process and can lead to health issues for female workers when physiological functions are disrupted. The air temperature in production workshops depends on the ventilation system; temperature has a significant impact on female workers. The research results obtained regarding the working environment at the two companies, presented in Table 3.1, indicate that the average temperature in the sewing workshop positions of Hung Nhan Garment Company is lower compared to those in the sewing workshop of Hualida Garment Company. This difference is attributed to the distinct design of the workshop buildings at the two companies. The workshops of Hung Nhan Garment Company are constructed as separate rows of buildings with ventilation openings, while the workshops of Hualida Garment Company are designed within a large, wide building to accommodate 20-25 production lines (each line consisting of 12-20 sewing tables).

According to the results in Table 3.2, the humidity levels in the sewing workshops at the two research sites are within the standards set by the Vietnamese National Standards for Occupational Safety and Health (VSCP), ranging from 50% to 83%. Only one sample did not meet the standard (83%) and exceeded the VSCP, located in the middle of Line 11 in Workshop 2 of Hualida Garment Company; this position is directly below the steam cooling system for the workshop. Our research findings show a higher variability compared to the study by Vu Xuan Trung, which reported humidity levels in workshops ranging from 59.3% to 67.3% [68]. However, our results are consistent with the findings of Bui Hoai Nam at two garment companies in Hung Yen in 2017, which indicated humidity levels in the sewing workshops ranging from 76.0% to 79.9% [3].

2) Lighting in the work environment

In the total of 61 light measurements taken at the two companies, we obtained results with a minimum-maximum range of 507 to 2050 Lux. The light levels at Hung Nhan Garment Company are within the standards set by the Vietnamese National Standards for Occupational Safety and Health (VSCP), while Hualida Garment Company has some areas that are underlit, but also some areas with excessively high light levels. The percentage of samples meeting the overall standard at the two companies is 55.7%. Our results are lower compared to the study by Bui Hoai Nam, which reported that 41.3% of samples did not meet the standard, with low light levels falling below the VSCP standard by 80 to 140 Lux. In comparison, Hoang Thi Thuy Ha's research indicated that the lighting levels not meeting sanitary standards were 57.22%, and Pham Thi Ngoc's study in Nghe An found that 95.0% of light samples did not meet the VSCP standard. These results indicating non-compliance are higher than our measurements. The difference may depend on the timing of each study. Our research was conducted during the summer when sunlight is more abundant, resulting in higher illumination levels.

3) Noise levels in the work environment

Noise is one of the most dangerous factors and a common cause of occupational deafness today. While noise levels in the garment industry are not as high and hazardous as in many other industries, they are still classified among those with high intensity that can adversely affect the health of female workers. The negative effects of noise levels in the garment industry can lead to psychological disturbances, fatigue, and an increased incidence of various illnesses among workers. The environmental monitoring results in Table 3.5 indicate that most areas within the garment workshops of the two companies studied have measured noise levels that comply with the standards set by the Vietnamese National Standards for Occupational Safety and Health (VSCP), with values ranging from 52.1 to 77.8 dBA.

4) Dust in the work environment

Dust in the work environment is a primary factor for many pathological disorders and occupational diseases, notably inorganic dust that can cause irreversible pulmonary fibrosis, leading to respiratory disability. Some types of organic dust, such as animal hair, cotton, jute, and pollen, can trigger allergic

reactions and bronchial constriction. It has been observed that symptoms like shortness of breath due to exposure to various types of dust, particularly cotton and jute, are commonly referred to as “cotton dust pneumoconiosis” (Bysinose), which is prevalent in many countries worldwide. In Vietnam, this disease is also included in the list of occupational diseases covered by insurance. The dust generated by current garment industry technologies is a mixed dust with a high organic content.

5) CO and CO₂ gas in the work environment

Carbon monoxide (CO) is a colorless, odorless, and tasteless gas that does not irritate the respiratory mucosa, is flammable, and highly toxic. There are many sources of CO, with human exposure primarily occurring from ambient air and occupational exposure. CO inhibits respiratory enzymes, hindering cellular respiration. Symptoms of CO poisoning often begin with dizziness, headache, nausea, and shortness of breath. Our study on the concentration of CO in the garment workshops showed values ranging from 0.5 to 3.4, with all measurements falling within the acceptable standards.

4.1.2. Health status of female workers in the garment industry

The assessment and classification of health through health examinations for female workers in the two research locations primarily indicated health classifications II and III, accounting for 92.2% and 97.0%, respectively. In contrast, the proportion of health classification IV was less than 1%. The classification into health category IV was attributed to factors such as short stature and low body weight. Our study's findings show a higher prevalence of health categories II and III compared to Bui Hoai Nam's research, which reported approximately 80% for both categories, with classifications IV and V comprising less than 10% [6]. However, in comparison with Nguyen Ngoc's results, female garment workers with health classification II constituted 56.9%, classification I was at 27.2%, classification III at 13.2%, and classification IV at 2.6% [40]. Hoang Thi Giang and colleagues reported that 29.9% of female workers had health classification I, 56.9% had classification II, 11.8% had classification III, and classifications IV and V represented 1.4% [101].

Relationship between health of female workers and harmful factors.

The survey revealed that symptoms such as headaches and tinnitus occurring at the end of the work shift among the study subjects were associated

with a noisy work environment. Additionally, symptoms of blurred vision were linked to inadequate lighting conditions, while itching and allergic reactions were connected to dusty environments.

During the production process, noise exposure contributes to auditory fatigue, tinnitus, headaches, insomnia, dizziness, and lightheadedness. Women are generally more sensitive to noise than men. Working in poorly lit conditions for extended periods is one of the primary causes of diminished visual acuity. The most dangerous effect of dust exposure is its potential to lead to dust-related pulmonary diseases [69]. Similarly, research by Hoang Thi Thuy Ha indicated a correlation between dust pollution and the incidence of bronchial diseases, demonstrating that female workers exposed to dust levels exceeding permissible limits had a 1.5-fold higher incidence of bronchial and pulmonary diseases (13.67%) compared to those working in environments with dust levels within acceptable limits, who exhibited a lower incidence rate (9.56%) [17].

Symptoms such as joint pain, back pain, shoulder discomfort, and hand numbness among female workers are associated with high work intensity. Additionally, neck pain following work shifts is linked to the nature of the tasks that require frequent bending of the head. Foot numbness is related to inappropriate sitting postures during work.

Improper working positions in relation to machinery or methods can lead to functional abnormalities, increasing the likelihood of pathological disorders and accelerating cellular fatigue. This issue is commonly observed in facilities adopting either outdated or newly introduced technologies without considering the anatomical stature and physiological functions of Vietnamese individuals. For instance, in textile factories, female workers often have to stand on chairs to reach the shuttle, as the height of the machinery is excessively elevated, etc.

4.2. Evaluation of the results and effectiveness of occupational safety and health interventions

4.2.1. Assessment of knowledge and practices in occupational safety and health

In our intervention study, we conducted a communication and training program on Occupational Safety and Health (OSH) for 406 workers at Hung

Nhan Garment Company. Female workers received information about ensuring OSH and participated in brief activities between work shifts aimed at mitigating post-work symptoms. The research findings indicate that both the intervention and comparison groups received OSH training. Female workers reported that training was delivered through posters and distributed materials, alongside two informational sessions focused on OSH to enhance safety practices in the workplace.

The results of the knowledge assessment on Occupational Safety and Health (OSH) for both groups indicated that female workers demonstrated the highest awareness of using personal protective equipment, particularly regarding face masks, with rates of 88.0% and 95% prior to the intervention, and 99.3% and 95.4% post-intervention. Following this, knowledge of safety helmets and protective clothing was noted. Furthermore, the intervention group exhibited a significant improvement in their understanding of hazardous factors in the workplace, whereas the control group showed no change in their knowledge. This highlights the effectiveness of the intervention in enhancing awareness of OSH among female workers.

Before the intervention, the awareness of female workers regarding occupational diseases linked to environmental conditions ranged from 40% to 80%. After the intervention, this awareness increased to over 90% to 99.0%. Conversely, the control group had a low awareness of these diseases, below 40%, and did not show any change in knowledge post-intervention.

The knowledge of the intervention group regarding OSH factors was found to be more than double that of the control group. After the intervention, this knowledge further increased, while the control group exhibited minimal or no change in their OSH knowledge.

Ensuring proper practices in Occupational Safety and Health (OSH) is a critical factor in disease prevention among female workers. The study results indicate that wearing face masks during work is the most commonly practiced safety measure, both before and after the intervention. Notably, earplugs and safety goggles were not utilized by the workers. When asked about the reasons, workers reported that the noise levels were not excessively high and were within an acceptable range, leading them to feel that wearing earplugs was unnecessary. Additionally, they expressed that wearing safety

goggles interfered with their work tasks. As a result, these two items were largely absent in the safety practices of female garment workers.

CONCLUSION

1. Current state of working conditions, health, and health-related factors for female workers at two garment companies in Thai Binh city

1.1. Working conditions

The working conditions at the two companies met 98.4% of the allowable standards for temperature, humidity, and air velocity. However, only 55.7% of the lighting levels met the permissible standards. The levels of CO and CO₂ were compliant, with 100% of the samples meeting the acceptable limits.

1.2. Health status and influencing factors

The health status of female workers showed that 73.8% and 51.9% were classified as health category II, while 18.4% and 45.1% fell into category III. The reported health issues among female workers included: eye diseases (60.5% and 47.1%), gynecological conditions (41.2% and 45.3%), digestive disorders (26.0% and 12.7%), ENT (ear, nose, throat) issues (27.5% and 25.0%), musculoskeletal disorders (23.5% and 21.9%), and surgical conditions at 21.1% and 23.5%.

Several factors were associated with symptoms of fatigue experienced after work shifts among female garment workers: headaches were linked to noise exposure; blurred vision was related to inadequate lighting; joint pain, shoulder discomfort, and hand numbness were associated with high work intensity; and neck pain was connected to frequent bending postures during work.

2. Evaluation of the effectiveness of intervention solutions to enhance the health of female workers at two industrial garment companies

After the intervention, the incidence rates for various health conditions showed significant reductions: cardiovascular diseases decreased by 58.1%, skin diseases by 75.9%, musculoskeletal disorders by 35.0%, and ENT (ear, nose, throat) issues by 33.0%.

The effectiveness of the intervention on knowledge regarding Occupational Safety and Health (OSH) was evident, with 4 out of 5 assessed

indicators showing that the intervention group of female workers achieved a "good" level or higher, exceeding the non-intervention group by 49.9% to 113.4%. The proportion of female workers with overall good knowledge before the intervention was 28.2%, which increased to 75.1% after the intervention. The overall effectiveness of the intervention in improving good knowledge among female workers in both the intervention and non-intervention groups reached 166.3%.

The effectiveness of the intervention regarding the correct implementation of occupational disease prevention measures and ensuring safety and hygiene practices in the intervention group was higher than that in the non-intervention group, by 47.1% and 56.4%, respectively. The proportion of female workers demonstrating overall good practices before the intervention was 9.8%, which increased by 25.1% after the intervention. The overall effectiveness of the intervention in improving good practices among female workers in both the intervention and non-intervention groups reached 156.1%

RECOMMENDATIONS

Strengthen outreach and assessment of occupational safety and health practices among female workers through extracurricular programs. Implement extracurricular programs that utilize various educational materials and communication methods to provide regular training for female workers on OSH practices annually.

Transfer female workers classified as health categories IV and V to less demanding roles and increase the duration of short breaks during work shifts. Organize occupational health screenings to facilitate early detection of diseases and ensure timely healthcare for female workers.

Female workers should promptly report any potential hazards, accidents, or unsafe conditions in the workplace to ensure timely interventions. They should actively and seriously participate in the annual Occupational Safety and Health (OSH) training organized by the company to be fully equipped with knowledge and comply with OSH regulations.