

# The effect of ambient conditions on employees in textile and garment companies

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## ABSTRACT – REZUMAT

### The effect of ambient conditions on employees in textile and garment companies

*In this study, the effect of ambient conditions on employees was analyzed with the questionnaire applied to employees in selected textile and apparel companies and the results obtained were interpreted in terms of occupational health and safety. For the study, a total of 809 employees working in four companies including two textile companies and two garment companies were surveyed. 27.4% of the employees in the companies surveyed are women and 72.6% are men. In the survey conducted for the research, it was asked whether the environmental conditions in textile and apparel companies affect the employees negatively or not. According to the statistical analysis results made on the answers, it was concluded that high temperature, noise, moisture and bad ergonomics (positions that may cause discomfort in the musculoskeletal system) differ significantly, that is, they negatively affect the employees. The high temperature most negatively affected the employees in company D. Noise most negatively affected employees in company D. Moisture had the highest rate of affecting the employees in company A. The weak lighting rate is low for all companies. Bad ergonomics was seen at the highest rate in C and D companies, which are garment companies. Companies were informed about the negative conditions affecting employees and improvement studies were carried out.*

**Keywords:** ambient conditions, ergonomics, noise, occupational health, thermal comfort

### Influența condițiilor ambientale asupra angajaților din companiile textile și de îmbrăcăminte

*În acest studiu, a fost analizat efectul condițiilor ambientale asupra angajaților cu ajutorul chestionarului aplicat în firmele de textile și de îmbrăcăminte selectate, iar rezultatele obținute au fost interpretate în ceea ce privește sănătatea și securitatea în muncă. Pentru studiu, a fost chestionat un total de 809 de angajați care lucrează în patru companii, inclusiv două companii textile și două companii de îmbrăcăminte. 27,4% dintre angajații din companiile chestionate sunt femei și 72,6% sunt bărbați. Sondajul efectuat pentru studiu a abordat condițiile de mediu din companiile de textile și de îmbrăcăminte care afectează negativ angajații. Conform rezultatelor analizei statistice realizate pe răspunsuri, s-a ajuns la concluzia că temperatura ridicată, zgomotul, umiditatea și ergonomia necorespunzătoare (pozițiile care pot provoca disconfort la nivelul sistemului musculo-scheletal) diferă semnificativ, adică afectează negativ angajații. Temperatura ridicată a afectat în cea mai mare măsură angajații din compania D. Zgomotul a afectat cel mai mult angajații din compania D. Umiditatea a avut cea mai mare rată de afectare a angajaților din compania A. Rata slabă de iluminare a fost scăzută pentru toate companiile. Ergonomia necorespunzătoare a fost observată la cea mai mare rată în companiile C și D, care sunt companii de îmbrăcăminte. Companiile au fost informate despre condițiile negative care afectează angajații și au fost efectuate studii de îmbunătățire.*

**Cuvinte-cheie:** condiții ambientale, ergonomie, zgomot, sănătate ocupațională, confort termic

## INTRODUCTION

The increase in productivity of the people working in the textile and ready-made clothing sector will result in the regulation of working conditions according to the workforce, thus providing a safer working environment and this will directly affect product quality. Affecting the health of the employee; physical factors such as temperature, noise, and vibration, chemical factors such as acid-alkaline, pesticide, paint, and dust, ergonomic factors and psycho-social factors can be summarized as workplace environment factors. With the Occupational Health and Safety Law No. 6331, important regulations have been made with the support of the law so that the employees can work in better conditions in the production sector. The

purpose of Law No. 6331 on Occupational Health and Safety; is to regulate the duties, powers, responsibilities, rights and obligations of employers and employees to ensure occupational health and safety at workplaces and to improve existing health and safety conditions [1]. Within the scope of the law, six NACE codes have been introduced for workplace hazard classes, and within this framework, workplaces are classified as less dangerous, dangerous and very dangerous. For example, the manufacturing of textile products NACE code 13 is listed with other relevant textile areas under this code and the hazard group is given in table (13.10. Preparation and twisting of textile fibres (dangerous), 13.10.03 manufacture of natural cotton fibres (snoving, carding, etc.) (dangerous). 14 NACE code is the manufacture of

clothing and under this code, for example, 14.12.08 occupational uniforms (including formal and special uniforms and school uniforms, excluding industrial work clothes) were included and this group is in the less dangerous group [2]. In this context, the textile and apparel industry is in the dangerous and less dangerous group in terms of occupational health and safety.

In the literature reviews, it was observed that the risk factors of muscle and skeleton and ergonomics were studied especially in garment factories [3–6]. In some studies, the role of hazard control measures in occupational health and safety was examined and risk analyzes were made [7–10]. There are also studies on noise and hearing loss in terms of occupational health, especially in weaving factories [11–12].

In this study, the effect of ambient conditions on employees was analyzed with the questionnaire applied to employees in selected textile and apparel companies and the results obtained were interpreted in terms of occupational health and safety. This field study was carried out to increase the awareness of the employees in two textile and two apparel enterprises that have been producing for many years and to ensure that these enterprises are improved in terms of occupational safety. Thus, the results obtained were shared with the business management, contributing to a positive step in terms of occupational health and safety.

## MATERIALS AND METHODS

### Study design

In this study, evaluations were done for statistical analysis of the results of the survey a total of 809 employees in four manufacturing companies in Malatya, Turkey. These companies are; A and B textile companies, and C and D garment companies. The number of people participating in the survey in Company A is 158, in Company B 169, in Company C 309 and Company D 173. The total number of employees participating in the survey is 809. Descriptive statistics on the employees participating in the survey: **Sex** (Female: 222 Persons; Male: 587 Persons); **Education** (Primary school: 164 Persons; Secondary school: 259 Persons; Highschool: 315 Persons; College: 71 Persons); **Position** (Managerial: 20 Persons; Preparation: 85 Persons; Production: 369 Persons; Finishing: 220 Persons; Others: 115); **Experience** (1 year: 202 Persons; 2–5 years: 203 Persons; 6–10 years: 210 Persons; 11–15 years: 116 Persons; 16 and above years: 78 Persons).

### Data collection

In this study, data were collected through a questionnaire. 100% of the employees answered the questionnaire. The first part of the questionnaire includes demographic aspects such as gender, age, education level of the employees, their department and their experience in the business. In the second part of the questionnaire, it was asked whether any factors were disturbing them in their work environment and

negatively affecting their productivity while working. To understand what the negative factors were, they were asked if there were high temperatures, noise, moisture, weak lighting and bad ergonomics in the work environment.

### Data analysis

The results of the study were analyzed using IBM SPSS Statistics 22. Demographic data and numbers and percentages of study characteristics are given. Percentages of the relationship between businesses and environmental conditions are shown with Crosstab, and the Chi-Square test was applied to see if this relationship is significant.

## RESULTS

### Background characteristics of workers

For the study, a total of 809 employees who worked in four companies including two textile companies and two garment companies were surveyed.

According to statistical analysis, 27.4% of the employees in the companies are women and 72.6% are men. 20.3% of the employees are primary school graduates, 32% secondary school, 38.9% high school and 8.8% university graduates. 2.5% of the employees work in the administrative staff, 10.5% in the preparation department, 45.6% in production, 27.2% in the finishing operations and 14.2% in other departments (machine maintenance, electricity maintenance, cafeteria, etc.). 25% of the employees have been employed less than a year, 25.1% have 1–5 years of experience, 26% have 6–10 years of experience, 14.3% have 11–15 years of experience, and 9.6% are and have 16 years or more of experience. The youngest employees surveyed in businesses is 18 years old and the oldest is 53 years old. The average age of the respondents is 33.26.

### Evaluation of the high-temperature factor of the environment according to the companies

In the survey, it was asked to employees if the ambient temperature in the enterprise was at an uncomfortable level. 52.5% of the employees in business A, which is a textile business, said it was uncomfortable. Again, 50.3% of the employees in business B, which is a textile business, said it was at an uncomfortable level. While only 26.2% of the employees in facility C, which is a garment business, feel uncomfortable with the heat, 63% of employees in business D, which is also a garment business, feel uncomfortable with the heat. Looking at the survey results in general, 44.3% of the workers in the textile and apparel industry saw high temperatures as a disturbing factor affecting their productivity. Crosstab values related to the temperature of companies are given in table 1. As seen in table 2, because the Chi-Square value of the high temperature in the companies is lower than 0.05, the temperature factor differs significantly according to the companies.

HIGH TEMPERATURE OF THE ENVIRONMENT ACCORDING TO THE FACILITIES CROSTAB					
Studied companies			Temperature		Total
			Present	Absent	
Company	Company A	Count	83	75	158
		% within company	52.5%	47.5%	100.0%
		% within temperature	23.2%	16.6%	19.5%
		% of total	10.3%	9.3%	19.5%
	Company B	Count	85	84	169
		% within company	50.3%	49.7%	100.0%
		% within temperature	23.7%	18.6%	20.9%
		% of total	10.5%	10.4%	20.9%
	Company C	Count	81	228	309
		% within company	26.2%	73.8%	100.0%
		% within temperature	22.6%	50.6%	38.2%
		% of total	10.0%	28.2%	38.2%
	Company D	Count	109	64	173
		% within company	63.0%	37.0%	100.0%
		% within temperature	30.4%	14.2%	21.4%
		% of total	13.5%	7.9%	21.4%
Total	Count	358	451	809	
	% within company	44.3%	55.7%	100.0%	
	% within temperature	100.0%	100.0%	100.0%	
	% of total	44.3%	55.7%	100.0%	

Table 2

HIGH TEMPERATURE OF THE ENVIRONMENT ACCORDING TO COMPANIES CHI-SQUARE TESTS			
Indicator	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	72.313 <sup>a</sup>	3	0.000
Likelihood Ratio	74.380	3	0.000
Linear-by-Linear Association	0.073	1	0.786
N of Valid Cases	809		

Note: <sup>a</sup> 0 cells (0,0%) have an expected count less than 5; the minimum expected count is 69.92.

### Evaluation of the noise factor of the environment according to the companies

In the survey, it was asked to employees if the noise in the business was at an uncomfortable level. 42.4% of the employees in business A, which is a textile business, said it was uncomfortable. Again, 37.3% of the employees in business B, which is a textile business, said it was at an uncomfortable level. While 54% of employees in facility C, which is a garment company, are disturbed by noise, 72.3% of employees in company D, which is also a garment company, are disturbed by noise. Considering the survey results in general, 52.2% of the workers in the textile and apparel industry saw the noise as a disturbing factor in the environment and one that affected their efficiency. Crosstab values related to noise belonging

to companies are given in table 3. In table 4, since the Chi-Square value of the noise in the companies is lower than 0.05, the noise factor significantly differs according to the companies.

### Evaluation of the moisture rate factor of the environment according to the companies

In the survey, it was asked to employees if moisture in the business was at an uncomfortable level. 41.8% of the employees in business A, which is a textile business, said it was uncomfortable. 26.6% of the employees in B, which is also a textile business, said that the moisture was at an uncomfortable level. While 5.8% of the employees in facility C, which is a garment company, feel uncomfortable with the moisture rate, 8.1% of employees in Company D, which is a garment company, are uncomfortable with the moisture rate. Considering the survey results in general, 17.7% of the workers in the textile and apparel industry saw moisture as a disturbing factor in the environment and affecting their productivity. Crosstab values related to the moisture of companies are given in table 5.

In table 6, since the Chi-Square value of the moisture in the companies is lower than 0.05, the moisture rate factor differs significantly according to the companies.

### Evaluation of the weak lighting factor of the environment according to companies

In the survey, it was asked to employees if the lighting in the business was uncomfortably bad. 1.9% of

Table 3

CROSSTAB OF THE AMBIENT NOISE FACTOR ACCORDING TO THE COMPANIES					
Studied companies			Noise		Total
			Present	Absent	
Company	Company A	Count	67	91	158
		% within company	42.4%	57.6%	100.0%
		% within noise	15.9%	23.5%	19.5%
		% of total	8.3%	11.2%	19.5%
	Company B	Count	63	106	169
		% within company	37.3%	62.7%	100.0%
		% within noise	14.9%	27.4%	20.9%
		% of total	7.8%	13.1%	20.9%
	Company C	Count	167	142	309
		% within company	54.0%	46.0%	100.0%
		% within noise	39.6%	36.7%	38.2%
		% of total	20.6%	17.6%	38.2%
	Company D	Count	125	48	173
		% within company	72.3%	27.7%	100.0%
		% within noise	29.6%	12.4%	21.4%
		% of total	15.5%	5.9%	21.4%
Total	Count	422	387	809	
	% within company	52.2%	47.8%	100.0%	
	% within noise	100.0%	100.0%	100.0%	
	% of total	52.2%	47.8%	100.0%	

employees at business A, a textile business, said they were uncomfortably weak. Again, 3.6% of employees at B, which is a textile business, said that the lighting was uncomfortably weak. While 4.2% of employees in facility C, which is a garment company, feel uncomfortable with the weakness of the lighting, 2.3% of employees in company D, which is also a garment company, feel uncomfortable with the weak lighting. Looking at the survey results in general, 3.2% of the workers in the textile and apparel industry saw weak lighting as a disturbing factor in the environment and affecting their efficiency. Crosstab values related to weak lighting belonging to companies are given in table 7. In table 8, it is seen that the weak lighting factor does not differ significantly according to the companies, since the Chi-Square value of weak lighting in the companies is higher than 0.05.

#### Evaluation of bad ergonomomy factor according to businesses

In the survey, it was asked to employees if ergonomomy in the business was uncomfortably bad. 0.6% (only one person) of employees at firm A, a textile business, said it was uncomfortably bad. 0.6% of the employees in B, which is also a textile company, said that their working ergonomomy was bad. While 4.5% of employees in business C, which is a garment business, feel uncomfortable with ergonomomy, 4% of employees in business D, which is also a garment business, are uncomfortable with bad ergonomomy.

Table 4

Chi-SQUARE TESTS OF THE NOISE FACTOR OF THE ENVIRONMENT ACCORDING TO THE COMPANIES			
Indicator	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	49.459 <sup>a</sup>	3	0.000
Likelihood Ratio	50.736	3	0.000
Linear-by-Linear Association	38.613	1	0.000
N of Valid Cases	809		

Note: <sup>a</sup> 0 cells (0,0%) have an expected count less than 5; the minimum expected count is 75.58.

Looking at the survey results in general, 2.8% of those working in the textile and apparel industry saw their working ergonomomy as a disturbingly bad factor in the environment and affecting their productivity. Crosstab values related to bad ergonomomy belonging to companies are given in table 9. In table 10, the bad ergonomomy in the companies is significantly different from the bad ergonomomy factor, as the Chi-Square value is lower than 0.05.

#### DISCUSSION

The A and B enterprises, where the field studies were conducted, are the textile enterprises, and the C and D are apparel enterprises and they are the factories that have been producing for years. The purpose of this study is to improve the perspectives of the

CROSSTAB MOISTURE FACTOR OF THE ENVIRONMENT ACCORDING TO THE COMPANIES					
Studied companies			Moisture		Total
			Present	Absent	
Company	Company A	Count	66	92	158
		% within company	41.8%	58.2%	100.0%
		% within moisture	46.2%	13.8%	19.5%
		% of total	8.2%	11.4%	19.5%
	Company B	Count	45	124	169
		% within company	26.6%	73.4%	100.0%
		% within moisture	31.5%	18.6%	20.9%
		% of total	5.6%	15.3%	20.9%
	Company C	Count	18	291	309
		% within company	5.8%	94.2%	100.0%
		% within moisture	12.6%	43.7%	38.2%
		% of total	2.2%	36.0%	38.2%
	Company D	Count	14	159	173
		% within company	8.1%	91.9%	100.0%
		% within moisture	9.8%	23.9%	21.4%
		% of total	1.7%	19.7%	21.4%
Total	Count	143	666	809	
	% within company	17.7%	82.3%	100.0%	
	% within moisture	100.0%	100.0%	100.0%	
	% of total	17.7%	82.3%	100.0%	

Table 6

CHI-SQUARE TESTS FOR THE MOISTURE FACTOR OF THE ENVIRONMENT ACCORDING TO THE COMPANIES			
Indicator	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	113.090 <sup>a</sup>	3	0,000
Likelihood Ratio	109.587	3	0.000
Linear-by-Linear Association	93.519	1	0.000
N of Valid Cases	809		

Note: <sup>a</sup> 0 cells (0,0%) have an expected count less than 5; the minimum expected count is 27.93.

employees and business management of these four enterprises in terms of the concept of occupational health and safety. Noise, temperature, humidity and lighting, which are physical risk factors, revealed the current situation of A, B, C and D businesses as environmental risks together with bad ergonomics. In the survey conducted for the study, it was asked whether the ambient conditions in the textile and apparel companies affect the employees negatively or not. According to the results of the statistical analysis made on the answers, it was analyzed that high temperature, noise, moisture and bad ergonomics differ significantly, that is, they affect the employees negatively, and weak lighting does not affect the employees as they do not differ significantly. It has been

evaluated that the humidity value due to the working environment is high and inconvenient in A and B textile enterprises, the ergonomics is poor in C and D apparel enterprises due to repetitive movements and inappropriate postures, and the lighting is generally weak in all four enterprises.

According to the graphics created to compare the ambient conditions of the companies within themselves:

- The high temperature most negatively affected the employees in the D company (figure 1). The ambient temperature of the textile companies is higher than the ambient temperature of the garment companies. Despite this, the disturbance of the temperature at a higher rate in Company D, which is a garment company, indicates that the temperature is a problem that needs to be solved in D company.
- Noise most negatively affected employees in Company D (figure 2). As can be seen from the

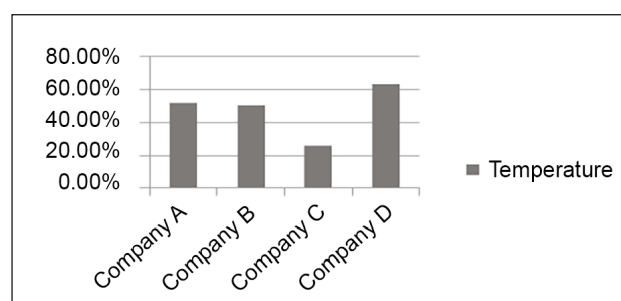


Fig. 1. Companies and temperature

CROSSTAB OF THE AMBIENT WEAK LIGHTING FACTOR ACCORDING TO THE COMPANIES					
Studied companies		Weak lighting		Total	
		Present	Absent		
Company	Company A	Count	3	155	158
		% within company	1.9%	98.1%	100.0%
		% within weak lighting	11.5%	19.8%	19.5%
		% of total	0.4%	19.2%	19.5%
	Company B	Count	6	163	169
		% within company	3.6%	96.4%	100.0%
		% within weak lighting	23.1%	20.8%	20.9%
		% of total	0.7%	20.1%	20.9%
	Company C	Count	13	296	309
		% within company	4.2%	95.8%	100.0%
		% within weak lighting	50.0%	37.8%	38.2%
		% of total	1.6%	36.6%	38.2%
	Company D	Count	4	169	173
		% within company	2.3%	97.7%	100.0%
		% within weak lighting	15.4%	21.6%	21.4%
		% of total	0.5%	20.9%	21.4%
Total	Count	26	783	809	
	% within company	3.2%	96.8%	100.0%	
	% within weak lighting	100.0%	100.0%	100.0%	
	% of total	3.2%	96.8%	100.0%	

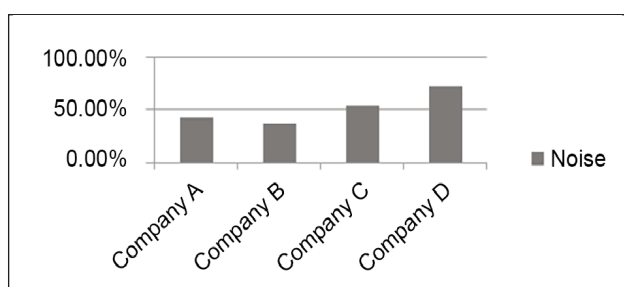


Fig. 2. Companies and noise

graph, the noise mostly affects the workers in the apparel companies negatively. The source of this noise is hundreds of sewing machines working at the same time.

- Moisture had the highest rate of affecting the employees in the A company (figure 3). Yarn, dyeing and finishing departments are the parts of the

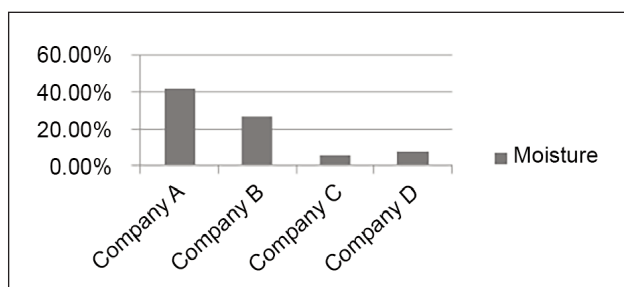


Fig. 3. Companies and moisture

Table 8

CHI-SQUARE TESTS OF THE WEAK LIGHTING FACTOR OF THE ENVIRONMENT ACCORDING TO THE COMPANIES			
Indicator	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.372 <sup>a</sup>	3	0.499
Likelihood Ratio	2.481	3	0.479
Linear-by-Linear Association	0.155	1	0.694
N of Valid Cases	809		

Note: <sup>a</sup> 0 cells (0,0%) have an expected count less than 5; the minimum expected count is 5.08.

companies with the highest moisture. Employees of company A work intensively in these departments. Compared to company B, the rate of being disturbed by moisture is very high in company A. For this reason, improvement studies should be carried out regarding moisture in company A.

- Weak lighting rate is low for all businesses (figure 4). As it did not differ significantly in statistical analysis, it was analyzed that it did not affect the employees negatively.
- Bad ergonomics was seen at the highest rate in C and D companies, which are garment businesses (figure 5). Ergonomics is very important for the employees of apparel businesses since most of the workers in apparel businesses work long hours.

Table 9

CROSSTAB FACTOR OF BAD ERGONOMY OF THE ENVIRONMENT ACCORDING TO THE COMPANIES					
Studied companies			Bad ergonomiy		Total
			Present	Absent	
Company	Company A	Count	1	157	158
		% within company	0.6%	99.4%	100.0%
		% within bad ergonomiy	4.3%	20.0%	19.5%
		% of total	0.1%	19.4%	19.5%
	Company B	Count	1	168	169
		% within company	0.6%	99.4%	100.0%
		% within bad ergonomiy	4.3%	21.4%	20.9%
		% of total	0.1%	20.8%	20.9%
	Company C	Count	14	295	309
		% within company	4.5%	95.5%	100.0%
		% within bad ergonomiy	60.9%	37.5%	38.2%
		% of total	1.7%	36.5%	38.2%
	Company D	Count	7	166	173
		% within company	4.0%	96.0%	100.0%
		% within bad ergonomiy	30.4%	21.1%	21.4%
		% of total	0.9%	20.5%	21.4%
Total	Count	23	786	809	
	% within company	2.8%	97.2%	100.0%	
	% within bad ergonomiy	100.0%	100.0%	100.0%	
	% of total	2.8%	97.2%	100.0%	

Table 10

CHI-SQUARE TESTS OF THE BAD ERGONOMY FACTOR OF THE ENVIRONMENT ACCORDING TO THE COMPANIES			
Indicator	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.988 <sup>a</sup>	3	0.019
Likelihood Ratio	12.129	3	0.007
Linear-by-Linear Association	7.016	1	0.008
N of Valid Cases	809		

Note: <sup>a</sup> 3 cells (37,5%) have an expected count of less than 5; the minimum expected count is 4.49.

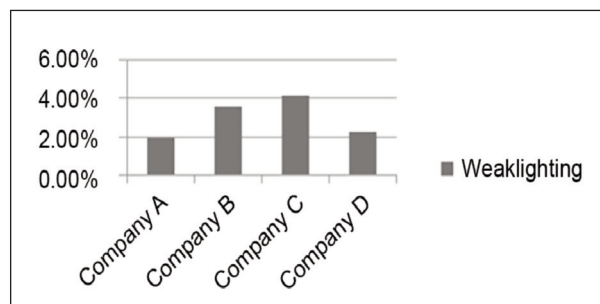


Fig. 4. Companies and weak lighting

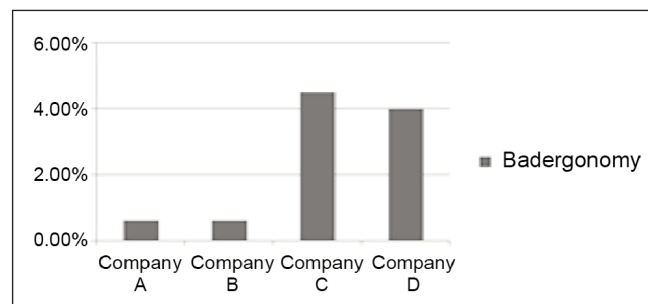


Fig. 5. Companies and bad ergonomiy

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