Evaluation of ergonomic criteria with an AHP-based approach in the textile industry and ordering alternatives

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ABSTRACT – REZUMAT

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The textile sector, which has a wide application area worldwide and in Turkey, is one of the most critical sectors. Ergonomic risks, which are the most important risk factors of the sector, which contain many dangers in terms of work accidents and occupational diseases, affect the health and safety of the employee. In this area where human dependence continues, and labour-intensive production exists, it is aimed to make an ergonomic risk ranking of the sections of a textile factory within the borders of Yozgat province. Within the scope of this target, alternatives, criteria, and sub-criteria were determined after scientific literature, expert opinions, interviews with managers and employees, and a detailed examination of the textile factory, and the ranking of alternatives was made with the AHP method. Alternatives include sewing, ironing, quality control, packaging and shipping, slaughterhouse, and printing. The riskiest section has emerged as the sewing workshop. This study will not only increase the awareness of ergonomics and reduce occupational health and safety problems but also contribute to reducing workplace costs and losses.

Keywords: *textile industry, occupational health and safety, AHP method*

Evaluarea criteriilor ergonomice cu o abordare bazată pe AHP în industria textilă și alternative de comandă

Sectorul textil, care are o arie largă de aplicare la nivel mondial și în Turcia, este unul dintre cele mai critice sectoare. Riscurile ergonomice, reprezentând cei mai importanți factori de risc ai sectorului, care conțin multe pericole în ceea ce privește accidentele de muncă și bolile profesionale, afectează sănătatea și siguranța angajatului. În această zonă, în care dependența umană continuă și există producție cu forță de muncă intensivă, se urmărește realizarea unei ierarhizări ergonomice de risc a secțiilor unei fabrici textile de la granița cu provincia Yozgat. În sfera acestui obiectiv, alternative, criterii și subcriterii au fost determinate pe baza literaturii științifice, opiniilor experților, interviurilor cu managerii și angajații și a unei examinări detaliate a fabricii textile, iar ierarhizarea alternativelor a fost realizată cu metoda AHP. Alternativele includ: zona de asamblare, zona de finisare, zona de control a calității, zona de ambalare și expediere, depozitul și zona de imprimare. Zona cu cel mai mare risc a apărut ca fiind cea de asamblare. Acest studiu nu numai că va crește gradul de conștientizare asupra ergonomiei și va reduce problemele de sănătate și securitate în muncă, dar va contribui și la reducerea costurilor și pierderilor la locul de muncă.

Cuvinte-cheie*: industria textilă, sănătate și securitate în muncă, metoda AHP*

INTRODUCTION

The textile sector has a wide application area worldwide and in Turkey. The products produced in the sector are clothing, decoration products, and various accessories. They find a comprehensive production and usage area, including the defence industry. The textile sector, one of the most critical sectors of Turkey, started to proliferate with the implementation of the export-oriented development policy in 1980. The number of companies in the sector, which continue their activities with small and medium-sized enterprises is around 58.000 and continue their activities with approximately 1.100.000 employees. As of 2018, Turkey has become the seventh country in the world in the ready-to-wear sector, with an export rate of 3.2% [1]. OHS Law No. 6331 [2] states that risk is “the probability of loss, injury or other harmful result arising from danger”. The hazard class as “the potential for harm or damage that exists in the workplace or may come from outside, which may affect the employee or the workplace” is “in terms of OHS, the characteristics of the work done, the materials used or emerging at every stage of the work, work equipment, production methods and forms”. It is defined as the “hazard group determined for the workplace”, taking into account other issues related to the working environment and conditions. When identifying hazards, information about employees, work environment and workplace is collected. There are “hazards caused by physical, chemical, biological, psychosocial, ergonomic and similar sources of danger” in the working environment [3]. Although the sector is in the less dangerous class according to the hazard classification, it contains many dangers regarding occupational diseases and work accidents. Ergonomic risk factors are the leading risk factors that should be taken seriously. The risk factors in the workplace are numerous and affect the health and safety of the employee.

Ergonomics is defined in different ways by Singleton [4] as the technology of work design, Tayyari and Smith [5] as a branch of science concerned with obtaining the most appropriate relations between employees and work environments, Attwood et al. [6] where people perform their tasks by using the equipment effectively, defines it as a systematic design process that manages safe and efficient operations operates systems, and applies their knowledge to improve environments. Lee [7] promoted compatibility between people and systems. Fernandez [8] defined workplace, machinery, equipment, tools, environment, product, and system design as optimizing the efficiency and effectiveness of work systems while ensuring the health, safety, and well-being of workers, taking into account the physical, physiological, biomechanical and psychological abilities of people. Koningsveld [9], in the definition of ergonomics approved by the International Ergonomics Association (IEA) and announced at the 2000 IEA Congress in San Diego, uses ergonomics as the scientific discipline concerned with understanding the interactions between humans and other elements of a system, and the theory for optimizing human well-being. They defined it as the profession that applies principles, data, and methods to design and overall system performance. The generally emphasized view of the definition of ergonomics; is mainly concerned with the working environment, job design, and the relationship between machine systems and people. Ergonomics aims to optimize the employee's health, safety, and productivity while ensuring the employee's comfort [10]. Employees' health and safety are essential for any organization's smooth and effective operation [11]. Improving worker health in the textile industry involves addressing musculoskeletal risk factors through ergonomic interventions [12]. Today's global approaches focus on integrating practices and models to improve occupational safety, health, and ergonomics, improve work quality, create a healthy workplace environment, and eliminate or minimize the risks associated with exposure to a bad work environment. Unacceptable working conditions, psychosocial, psychosomatic, cognitive environment, etc., when neglected, can inevitably cause concerns that lead to deficiencies in the production rhythm and the emergence of musculoskeletal disorders or disorders. All these cause economic and social losses [13]. Musculoskeletal Disorder (MSD), an occupational and public health problem in developed and developing countries, significantly impacts productivity and quality of life by losing working hours and creating an economic burden [14].

One way to improve worker health in the industry is to address work-related risk factors of the musculoskeletal system. This study aims to rank the departments of textile workers in a textile factory within the borders of Yozgat province regarding ergonomic risk. The criteria weights were determined with the Analytic Hierarchy Process (AHP), one of the Multi-Criteria Decision Making (MCDM) methods, and the ranking of the alternatives was made.

The study consists of five parts. The first part is the introduction and the second part is the literature review. The third section explains the method followed in this research. In the fourth section, the application is given. In contrast, the conclusions and suggested studies are included in the fifth and last sections.

LITERATURE SEARCH

Taşkıran et al. [15] compared the findings of ergonomic job analysis in which 82 male and 143 female textile workers evaluated working conditions and functional hand capacities of workers. Metgud et al. [16] investigated the ergonomic risks affecting sewing machine operators in the sewing department of a textile factory. Kitis et al. [17] evaluated the construct validity and reliability of the arm, shoulder, and hand disability questionnaire in textile workers by correlating it with the Medical Outcomes Study Short Form-36 in industrial workers. Malik et al. [18] aimed to investigate the employees' problems, needs, etc., to ensure the employees' Occupational Health and Safety (OHS) in the textile industry. In their cross-sectional study, Öztürk and Esin [19] investigated the ergonomic risks of female sewing machine operators in a textile factory and the prevalence of musculoskeletal disorders (MSD) symptoms in their cross-sectional study. Sealetsa and Thatcher [20] aimed to identify the perceptions of workload and bodily discomfort and possible ergonomics deficiencies in sewing machine operators' workstations in Botswana's textile industry. Meenaxi and Sudha [11] aimed to provide information about musculoskeletal disorders, their causes, and preventive measures in their study. They stated that static and inappropriate postures, working time, furniture design, and not giving enough rest in the sitting or standing position of employees in the textile industry are associated with the emergence of musculoskeletal disorders. In their study, [21] evaluated the risk factors for upper extremity musculoskeletal system diseases of employees undertaking various tasks in a textile factory. Vandyck and Fianu [22] examined the ergonomic problems and work practices experienced by garment workers in Ghana. They examined noise, ventilation, light, wall and ceiling colour, temperature, height and depth of seats, posture and repetitive movements, and design of workplaces. Keawduangdee et al. [23] aimed to determine the prevalence of low back pain and associated risk factors for the Textile Fishing Net assembly worker population. Tompa et al. [24] worked in a clothing factory in Canada with approximately 300 employees. They presented an economic evaluation of the participatory ergonomics process. Comper and Padula [25] conducted their study in two production departments of a textile factory to determine the level of exposure to ergonomic risk factors. Langford et al. [26] summarized efforts to reduce and prevent musculoskeletal injuries in textile protectors through changes in culture, education, specific practices, and equipment (Historic Royal Palaces, HRP). Matebu and Dagnew [27] used 3D Static Strength Prediction Program software to analyze the manual material handling work posture of the operators and to identify the main areas that cause long-term injury to the operators. Thangaraj et al. [28] aimed to evaluate the general health status of female textile workers with particular reference to MSD disorder. Balasundaram et al. [29] aimed to reveal the ergonomic problems affecting the workers in the production department (Weaving Unit) of Ethiopia's Dire Dawa textile factory. On the other hand, Kaya and Özok [30] determined the ergonomic risk factors related to the physical ailments experienced by the employees in the production department of the textile factory in their study and presented sector-specific evaluations and recommendations. Nagaraj et al. [31] conducted a study to evaluate the musculoskeletal prevalence and associated ergonomic risk factors among standing sewing machine operators in the Sri Lankan textile industry. Aksüt et al. [32]determined the ergonomic risks of women working in a textile factory using the Analytic Network Process (ANP) method, which is one of the multi-criteria decision-making methods. Aksüt et al. [33] evaluated the textile factory regarding ergonomic risk. Okareh et al. [34] aimed to evaluate textile sewing machine operators' persistent pain, health, and safety hazards. Aksüt et al. [35] prepared staff scheduling to improve the health and safety of workers exposed to high ergonomic risks in a textile factory. Kazemi et al. [36] aimed to make a macro ergonomic risk assessment using the textile industry's Relative Stress Index (RSI).

The literature study showed that using multi-criteria decision-making methods for risk assessment was limited to a small number. Using multi-criteria decision analysis provides a link between working conditions, risk assessment, and workplace safety. Using this method in decision-making in workplace safety, identifying and correcting ergonomic risks will provide essential contributions in terms of OHS. Using the AHP method, one of the most popular decision-making methods, to identify the most challenging part for the workers in the textile factory will contribute to the literature. It will be an essential factor in the widespread use of the method in this area.

AHP METHOD

The criteria weights were determined by scientific literature, expert opinions, a detailed examination of the textile factory, and interviews with managers and employees by the AHP method. The ranking of the alternatives was made.

The study on the applications of MCDM methods in the literature revealed that one of the most common and popular methods in practice is the AHP (Analytical Hierarchy Process) method developed by the American mathematician Saaty [37]. AHP is a measurement theory. It decomposes a complex problem into a multilevel hierarchical structure of objectives, criteria, sub-criteria, and alternatives to help define the overall decision process [38]. In a traditional group decision-making method, experts must rank many alternatives according to their preferences [39]. Two features make the AHP method different from other decision-making approaches. First, it creates a comprehensive structure by combining intuitive, rational, and irrational values. The second is that the method can judge the consistency in the decision-making process [40]. The advantage of AHP is its ease of use, flexibility, and ability to measure the consistency of the decision maker's decision [41]. In addition, this method ensures that intangible and tangible factors are included that would otherwise be difficult to consider [42].

The application steps of the AHP method are given below [38, 43–47].

Step 1: The problem is clearly defined. A particular hierarchical order is followed by the main criteria starting from the purpose and the alternatives at the lowest level.

Step 2: According to the hierarchical structure created in Step 1, decision matrices are formed by comparing the alternatives for the criteria and among each criterion. The comparison matrices (nxn) are of square matrix size.

Step 3: To normalize each column, column sums are taken in the binary comparison matrix. The normalized matrix is formed by dividing the elements of the matrix by the corresponding column sum. The priority vector matrix is obtained by taking the row sums of the normalized matrix created for each criterion or alternative. The priority values created for each alternative or criterion in the priority matrix obtained by the weighted total matrix priority vector are obtained by multiplying the column elements of the binary comparison matrix belonging to that alternative or criterion.

Step 4: It is checked by calculating the consistency ratios for the comparison matrices. First of all, the Consistency Index CI value is found.

CI: Consistency Index

$CI = (\lambda\ max - n)/(n-1)$

$CR = CI/RI$

The Consistency Ratio can be calculated using the CI and the Random Table values expressed in table 1.

Table 1

RI VALUES FOR DIFFERENT VALUES OF n

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59

CR: Consistency Indicator
RI: Randomness Indicator
CR values less than 0.1 are considered consistent.

Step 5: As a result of the AHP method, the alternative with the highest importance weight is selected as the best alternative.

APPLICATION

The flow chart for the solution of the problem is given in figure 1.

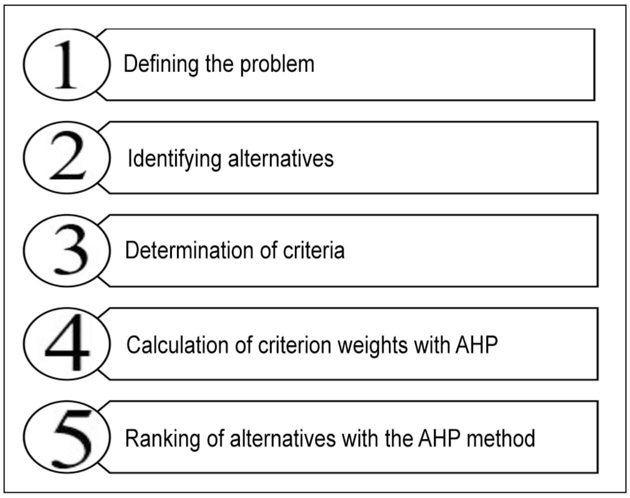

Fig. 1. Flow chart of the problem

Problem definition

Musculoskeletal diseases significantly impact the quality of life and productivity due to the loss of working hours, which creates a significant economic burden as essential public health and occupational health problem in both developed and developing countries [14]. Despite the developing technology, the textile sector is a labour-intensive industry. With the increasingly competitive environment, situations such as unsuitable working postures, continuous and repetitive jobs, and time pressure in the sector cause musculoskeletal problems. In this context, ergonomics is essential in preventing work-related physical discomfort [30]. It is essential to detect and eliminate ergonomic problems, thus ensuring employees' occupational health and safety. For this reason, in our study, the problem of determining the ergonomic risk ranking of a factory operating in the province of Yozgat, which is one of the most important working areas of Turkey, with 338 employees, consisting of 4 buildings, working on combed cotton production and marketing the produced products abroad, has been discussed. The problem is solved based on AHP, a Multi-Criteria Decision-Making approach.

Identification of alternatives

This study discusses the problem of determining the working areas regarding ergonomic risk factors in a textile factory in Yozgat province, which exports the products they produce. As a result of the information obtained from the textile factory managers and the detailed examination of the factory, the research was carried out by dividing the factory into six alternative sections. The alternatives are shown in figure 2, starting from the slaughterhouse and ending in the sewing room.

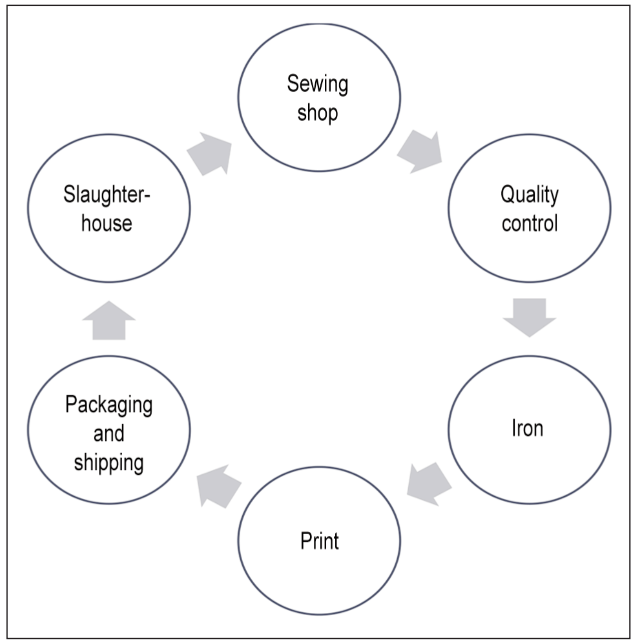

Fig. 2. Textile factory sections

The criteria and sub-criteria were determined after scientific literature, expert opinions, interviews with managers and employees, and a detailed examination of the textile factory [9, 10, 48–65]. The study consists of 6 criteria and 36 sub-criteria. The criteria and sub-criteria are listed below.

Physical Factors: Inappropriate posture, material use, repetitive movements, static posture, force, compression, excessive force, prolonged standing work, and long sitting work.

Cognitive Factors: Decision making, mental workload, work stress, education, human-computer interaction.

Organizational Factors: Study design, job rotation, monotonous work.

Environmental Factors: Noise, Thermal Comfort, sensory risk, dust, vibration, chemicals.

Personal Factors: Body Mass Index, age, smoking, gender, left-handedness, diabetes, pregnancy, fatigue.

Psychosocial Factors: High professional expectations, job stress, job dissatisfaction, inadequate management, social support, compensation, and pay.

Finding criterion weights with the AHP method

Creation of decision hierarchy

Excel program was used in AHP calculations. The hierarchical structure is given in figure 3.

Analysis of pairwise comparison matrices of criteria

First of all, the main criteria were compared. Then, the sub-criteria were compared based on the main criteria. The consistency index and priority values

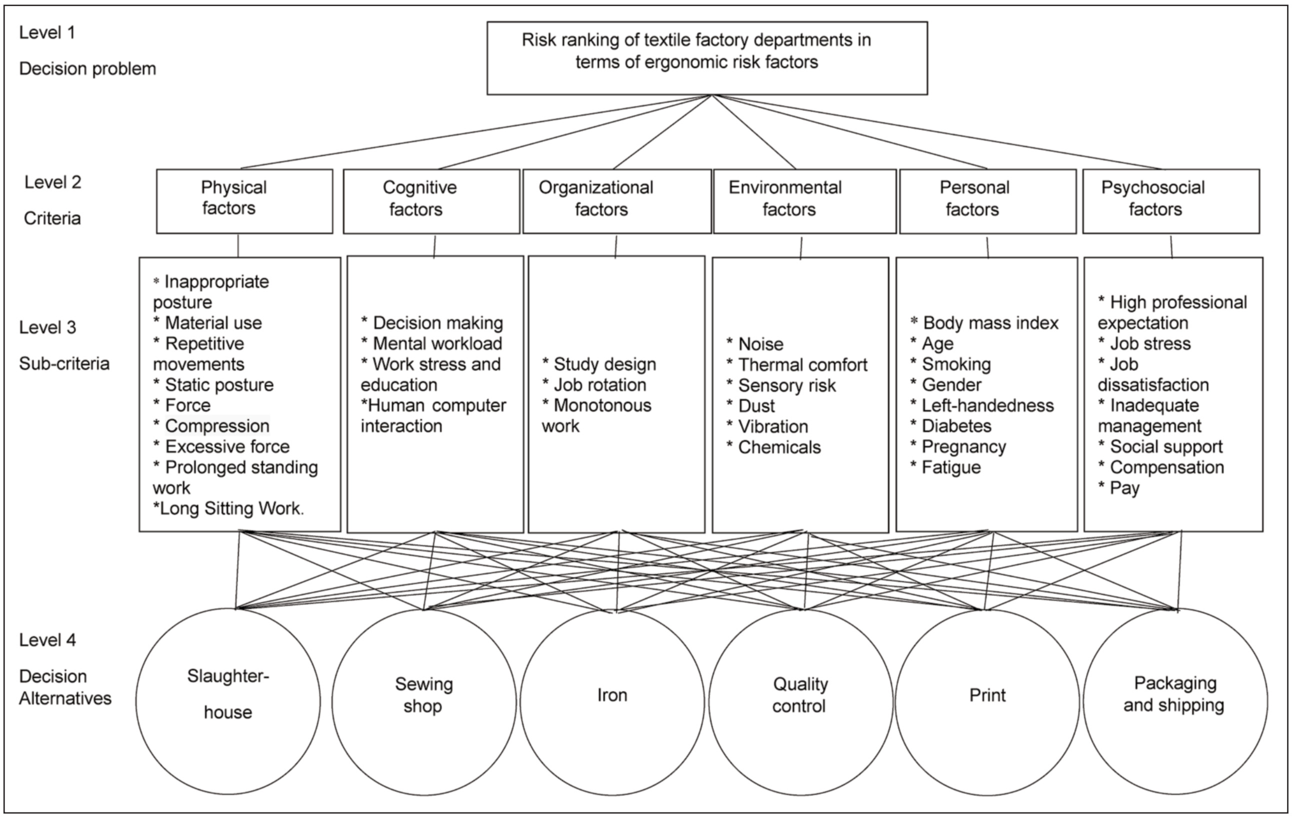

Fig. 3. Determination of the mostrisky area in terms of ergonomic risk factors in the textile factory

were calculated using the Excel program. The importance levels of the criteria are presented in table 2.
According to table 2, all consistency indices were less than 10% (0.1). According to the AHP method, the consistency index is less than 0.1, which indicates a consistent comparison. In the study, "physical factors" were the primary essential criteria with a degree of importance of 0.40895. Other criteria in order of importance are environmental, organizational, cognitive, personal, and psychosocial risk factors, respectively. From a physical point of view, the most crucial sub-criterion was "working standing for a long time", with a degree of importance of 0.23012148. The most crucial sub-criterion from the cognitive point of view was "mental workload", with a degree of importance of 0.495991508. The most crucial sub-criterion of organizational factors is that with the significance value of 0.665070243, "monotonic work" has taken place. The most crucial sub-criterion of the leading environmental criterion was "noise", with a value of 0.383258719. While the most critical sub-criterion from an individual point of view was "fatigue", with a significance level of 0.241605284, the most crucial factor in psychosocial terms was found to be waged with a significance level of 0.312314.

Ranking of alternatives with the AHP method

The creation of the hierarchical structure is given in figure 3. The items are compared with each other to determine the weights. The data in the problem are evaluated using the importance scale developed by Saaty [43], known as the "1–9" scale in table 3. Consecutive jurisdictions are to be used when compromise is required.
Pairwise comparisons are made in line with the opinions of experts. The comparison matrix of the criteria is given in table 4.
Table 5 shows the weights of the criteria.
To make a consistent comparison, the AHP method requires all consistency indexes to be less than 10% (0.1), according to the evaluations. Consistency values were less than 0.1, as shown in table 6 in the study. This result shows that a consistent comparison has been made.
Table 7 shows the weight matrix of alternatives by criteria. The most important criterion was determined by giving the Weight of the Criteria result in table 5. Table 8 shows the ranking result of the Alternatives.
In ordering the alternatives in terms of ergonomic risk, the riskiest place was the sewing department. In contrast, the others were the ironing, quality control, packaging, shipping, slaughterhouse, and printing departments.

CONCLUSION

In the study, a multi-criteria model was presented to rank the factory sections in terms of risk by determining the ergonomic risk factors for the protection of the safety and health of the employees with the MCDM method. A mathematical model consisting of six main criteria, 37 sub-criteria, and six alternatives was prepared. To evaluate our model, we applied our approach based on a popular MCDM, AHP. As a result of the application, the importance levels of the

Table 2

IMPORTANCE OF CRITERIA		
Criteria		**Degrees of importance**
Main criteria	Physically	0.40895
	Cognitive	0.114981
	Organizational	0.13822
	Environmental	0.221541
	Personal	0.063716
	Psychosocial	0.052593
	Consistency index	0.064783
Physical main criteria sub-criteria	Inappropriate posture	0.131819561
	Material use	0.038350695
	Repetitive movements	0.164330234
	Static posture	0.10189844
	Force	0.060670722
	Compression	0.042926561
	Excessive force	0.057147239
	Prolonged standing work	0.23012148
	Long-sitting work	0.172735068
	Consistency index	0.093540971
Cognitive main criteria sub-criteria	Mental workload	0.495991508
	Decision making	0.071016484
	Human computer interaction	0.154607892
	Work stress and education	0.278384116
	Consistency index	0.070866
Organizational main criteria sub-criteria	Study design	0.103847382
	Job rotation	0.231082375
	Monotonous work	0.665070243
	Consistency index	0.074956387
Environmental main criteria sub-criteria	Noise	0.383258719
	Thermal comfort	0.162709708
	Sensory risk	0.093630388
	Dust	0.250065228
	Vibration	0.06670644
	Chemicals	0.043629517
	Consistency index	0.098621
Personal main criteria sub-criteria	Body mass index	0.095418683
	Age	0.071162316
	Smoking	0.145926778
	Gender	0.088177488
	Left-handedness	0.035854625
	Diabetes	0.121555277
	Pregnancy	0.200299548
	Fatigue	0.241605284
	Consistency index	0.097466
Psychosocial main criteria sub-criteria	High professional expectation	0.089461
	Job stress	0.253684
	Job dissatisfaction	0.15296
	Inadequate management	0.043951
	Social support	0.079287
	Compensation	0.068342
	Pay	0.312314
	Consistency index	0.062501

Table 3

AHP PAIRWISE COMPARISONS SCALE		
Importance degree	**Definition**	**Explanation**
1	Equal importance	The two activities contribute equally to the goal.
3	Moderately more important than the other	Experience and judgment moderately favour one activity over another.
5	Strong importance	Experience and judgment strongly favour one activity over another.
7	Very strong importance	An activity is conveniently preferred and seen with ease in exercising a strong dominance.
9	Extreme importance	The evidence for favouring one activity over another is very credible.
2, 4, 6, 8	Average values	Value falling between two consecutive jurisdictions to be used when compromise is required.

Table 4

COMPARISON MATRIX OF CRITERIA						
Criteria	**Physically**	**Cognitive**	**Organizational**	**Environmental**	**Personal**	**Psychosocial**
Physically	1	5	4	3	5	4
Cognitive	1/5	1	1/2	1/2	3	3
Organizational	1/4	2	1	1/3	3	3
Environmental	1/3	2	3	1	4	4
Personal	1/5	1/3	1/3	1/4	1	2
Psychosocial	1/4	1/3	1/3	1/4	1/2	1
Total	2.23	10.67	9.17	5.33	16.50	17.00

Table 5

CRITERION WEIGHTS	
Criterion	**Weight**
Physically	0.408949875
Cognitive	0.114981077
Organizational	0.138219996
Environmental	0.221540803
Personal	0.063715666
Psychosocial	0.052592582

Table 8

RANKING OF ALTERNATIVES	
Alternatives	**Conclusion**
Slaughterhouse	0.119179581
Sewing Shop	0.252835646
Iron	0.2173188
Quality Control	0.176029416
Print	0.075884794
Package and Shipment	0.158751763

Table 6

CONSISTENCY INDEX OF ALTERNATIVES WITH CRITERIA						
Alternatives	**Physically**	**Cognitive**	**Organizational**	**Environmental**	**Personal**	**Psychosocial**
Slaughterhouse	0.090629	0.314519	0.058289	0.084951	0.156459	0.17317463
Sewing Shop	0.316382	0.103446	0.263188	0.238586	0.235179	0.13952079
Iron	0.23203	0.097009	0.240861	0.295746	0.103542	0.11156026
Quality Control	0.165247	0.220513	0.079791	0.17019	0.314304	0.27262518
Print	0.050279	0.101375	0.101859	0.093992	0.065222	0.08763681
Package and Shipment	0.145433	0.163138	0.256012	0.116535	0.125295	0.21548232
Consistency Index	0.04921	0.054047	0.07327	0.026629	0.073913	0.043866

Table 7

WEIGHT MATRIX OF ALTERNATIVES BY CRITERIA						
Alternatives	**Physically**	**Cognitive**	**Organizational**	**Environmental**	**Personal**	**Psychosocial**
Slaughterhouse	0.090629	0.314519	0.058289	0.084951	0.156459	0.17317463
Sewing Shop	0.316382	0.103446	0.263188	0.238586	0.235179	0.13952079
Iron	0.23203	0.097009	0.240861	0.295746	0.103542	0.11156026
Quality Control	0.165247	0.220513	0.079791	0.17019	0.314304	0.27262518
Print	0.050279	0.101375	0.101859	0.093992	0.065222	0.08763681
Package and Shipment	0.145433	0.163138	0.256012	0.116535	0.125295	0.21548232

criteria were listed as physical, environmental, organizational, cognitive, personal, and psychosocial factors. The order of the alternatives is given in figure 4. Alternatives include sewing, ironing, quality control, packaging and shipping, slaughterhouse, and printing.

Physical ergonomic risks have the highest criterion weight in the sewing shop, which is the riskiest section. Working by sitting all the time is a danger that needs to be prioritized. In this section, the features of chairs and tables are significant, and they should be adjustable and suitable for health and safety. In the ironing section, environmental ergonomic risks are the most crucial factor. With the effect of heat and steam coming out of the iron, negative aspects of thermal comfort are experienced in working conditions. This situation may adversely affect the health and working efficiency of the employees. To eliminate this negativity, an air conditioning system can be installed to keep the humidity and air in the environment stable. Since ironing is heavy, requires more workforce, and causes fatigue, women workers are not employed here. In the quality control section, features originating from personal factors came to the fore. Since it is a job that requires constant standing and attention, people have difficulties in this section, pregnant women, and smoking. Continuous standing work is carried out in the package and shipping departments. While men work in the shipping department, women work in the packaging department. There are ergonomic risks associated with improper posture during packaging and the use of force during loading. In this section, risks arising from organizational reasons have emerged as a priority.

Since standing work is carried out continuously in the packaging and shipping departments with quality control, ergonomic mats can be used to reduce the load on the feet and legs, and chairs can be placed at specific intervals. Cutting by machine in the slaughterhouse avoids many ergonomic risks. However, human-computer interaction is present in this section, and the risks associated with cognitive factors are higher. In the printing section, water-based paints that pass the test are used. There are two different printing machines with 17 and 14 heads. A small amount of existing digital printing machines can also be used. The complete digitalization of the printing department will effectively reduce the risks. The low number of employees in this department, the fact that women are more sensitive to chemicals, and job rotation reduce the risk level.

In the future, new studies can be conducted using different MCDM methods on ergonomic risks in textiles. MCDM is reaching the best possible result according to the established rules. Problems encountered in real life often involve conflicting criteria that cannot be expressed on the same scale. Therefore, finding a solution that meets all the selection criteria is problematic. Generally, a conciliatory solution is sought for such problems in light of established rules [66]. MCDM methods examine decision-making problems with all dimensions and process every aspect of the problem in terms of the decision maker's preferences to reach the best compromise solution. In cases with many criteria for the best compromise solution, the decision maker

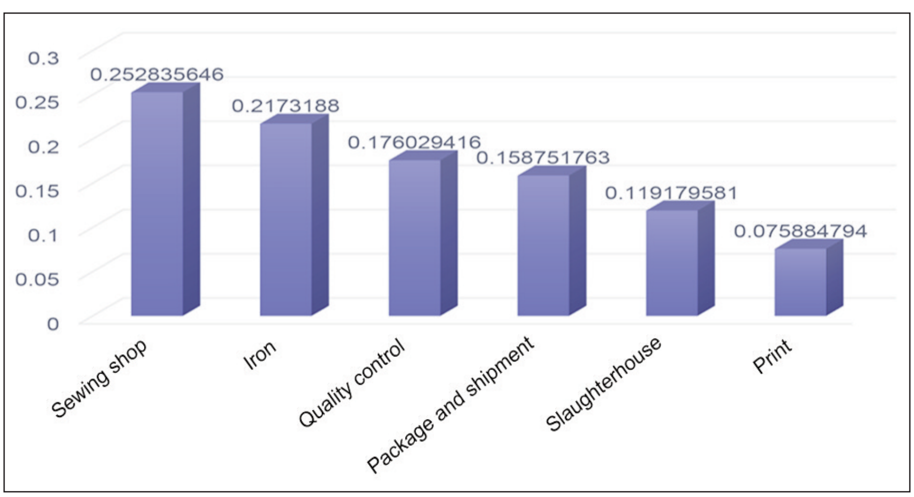

Fig. 4. Ranking of alternatives

can group, rank, or choose from among the alternatives by combining and balancing the conflicting criteria [67]. Considering the advantages and disadvantages of the methods in different conditions according to their applicability, the results obtained from using different methods can be evaluated comparatively. The relationship between accidents in textile factories and ergonomic factors can be investigated.

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