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## Identification and Analysis of Ergonomic Rules in Laboratory Clothing with Diagnosis in Biological Accidents (Providing a New Sample of Laboratory Work Clothes)

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Received 12 October 2022; Revised 20 June 2023; Accepted 22 September 2023

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### Abstract

Human protection against possible risks in the environment, when it is related to the type of job of the consumer, attracts more attention. And on the other hand, it should be noted that in addition to protecting the body, the energy consumption conditions of the human body should be reduced through the design according to the type of work in order to achieve more efficiency. Despite the different jobs and the difficulty of work, work clothes are of great importance to protect the person from environmental hazards and to feel comfortable wearing them, and to be able to have the highest work efficiency with less energy consumption and minimal physical injuries. The collection of research, library and field information and the statistical population of this research is all the employees of the laboratory department of Arak University of Medical Sciences, including the selection of 30 people as a simple random sample for the survey. The analysis method of this research is qualitative and quantitative, from different sources. They are collected, reviewed and classified and then analyzed. In connection with the collection of information related to the literature of the subject and the background of the research from the library method and to reject or confirm the research questions, the research method is used. In this research, information about laboratory clothing with a protective approach in biological accidents is extracted from reliable sources. and then the design of the survey questionnaire and the design of new laboratory clothing samples will be discussed

**Keywords:** ergonomics, clothing design, staff ability and laboratory clothing ergonomics

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## **1. Introduction**

The traces of the clothing of the people of this land, how it has been from the beginning and how it has evolved, is a matter of research and precision. Through the collection of material signs, clothing establishes a communication and cultural system among the people of the society. Decoding these signs and receiving public and The concepts of the language of signs in any social group and society require understanding the social and cultural behaviors of the people of that group and society and knowing the religious, ideological and belief systems from which they got their symbolic values These values play an important and prominent role in maintaining the social and cultural identity of the people of the society and its continuity in the historical life of generations [1].

At the beginning of the formation of human societies and in early societies, clothing has a protective aspect and is used to protect the human body against natural and climatic factors, but later with the development of social and cultural activities in societies And the formation of religious and religious beliefs in the mentality of the people, clothes and the type of color, gender, shape and sewing style of the costumes found a cultural context and role and its social, cultural and symbolic function was highlighted [2].

Due to the spread of the new corona virus around the world, work environments are not immune from this disease. Several guidelines have been prepared and presented by international organizations regarding high-risk occupations and the need to comply with health standards in work environments. In fact, one of the factors that increases the productivity of employees is the discussion of occupational safety and health, which requires professional work. It is the foundation of organizations in this field .In the type of personal protective equipment (PPE) of laboratory workers, personal protective equipment is equipment designed to protect employees from occupational injuries or diseases caused by contact with biological, chemical, physical, electrical, radiological, etc. These equipments are different according to the type of expected injury and occupational contact. Personal protective equipment used to prevent infection, while protecting employees and preventing them from getting infected, prevents the transmission of infection to other patients and people [2,3].

## **2- Literature review**

The scientific system is related to the understanding of interactions between humans and system elements and uses theories, principles and methods for design in order to optimize human well-being and system

efficiency. And the limitations of people. Ergonomics is the knowledge of work. It removes the obstacles of quality, empowerment, equalization and safe efficiency of humans by matching products, tasks and environment with people [2].

Ergonomics is a science that studies humans and their interaction with products, productions, equipment, facilities, methods, and work and life environments, and despite the technical-engineering sciences (which mainly deals with techniques and techniques) on humans and Designing devices for people is emphasized [1,3]. Empowering employees basically means supporting employees, trusting their abilities, respecting their values, providing the necessary tools and resources, and creating the right conditions to benefit from their greater participation. By delegating enough authority, organizations can simplify the decision-making process for employees and allow them to perform more effectively and quickly. This process In addition to increasing self-confidence, it will also be effective in increasing the success rate of employees [4].

In 1400, Esdi Farsani et al., in an article titled "Ergonomic Study of Clothing Structure in Designing Iranian Business Clothes" with the main goal of increasing productivity with regard to human health, safety and well-being in the work environment, described the basic features using a qualitative method. And then by analyzing five samples of clothes in five jobs from industrial jobs as targeted study samples, between the physical needs of the worker's body and the design of clothes, they designed the final samples, the results of this research showed that work clothes in Iran regardless It is designed according to the type of job and its effect on productivity and the type of workers' needs. Asadi et al [5,6].

During a research titled ergonomic rules in the design of clothing for industrial jobs, which was a case study in the Barez rubber factory in Kerman and presenting a new example of work clothes, the work clothes of the employees of the Barez rubber factory were identified and analyzed with the help of observation, study and interview to meet the needs. , the problems and harmful factors of their environment were discussed and concluded that the resulting ergonomic principles and complete knowledge of the environment and the type of work can lead to the design and sewing of new work clothes that are compatible with the work environment so that the worker feels comfortable while working and protect his body. Murshidzadeh et al. [4] in an article entitled designing nurses' clothes based on the factors of color, form and material, considering the working environment of nurses who always deal with all kinds of pollution and diseases and there is a possibility of transferring them to nurses or patients, by using experimental, descriptive and analytical methods, they tried to design clothes that are suitable for their ergonomic situation and according to the department in which they are working and relative According to the type of patients related to the nurses, they determined the appropriate color of that department so that they can convey peace to the patient and make it easier for the patient to trust them and the way of treatment can be carried out easily. Furthermore, to prevent the transmission of disease and contamination, antibacterial fibers were used in the nurses' uniforms [7]. Nemat

published an article titled "Design Issues in the Field of Smart Functional Clothing" in 2016. tried to change the attitude towards functional clothing design from the level of technical attitude in the hands of textile specialists to a kind of user-oriented design process and including design criteria based on human, cultural and social aspects of the context and to answer the question that from the perspective of design studies, What design issues arise for smart functional clothing and can design issues He then defined the requirements of functional clothes (physiological, biomechanical, ergonomic and psychological), examining the design experiences and the results of the designs being developed, finally four general categories of the design process, Functional needs, user acceptance, materials and manufacturing technology have been introduced as output, which can be used as a checklist in the initial phases and for appropriate strategies for the design and development of other functional clothing [6,8].

Mojavarrostami et al. [9] in an article entitled "Importance and application of anthropometry in medical sciences and related industries" showed that the application of anthropometry in various fields such as forensic medicine, identity recognition, cosmetic surgery, industrial design , clothing design, ergonomics and architecture are specific and influential. They also showed that if there is a suitable database of anthropometric measurements, standard dimensions can be defined for each population, so that unidentified corpses can be easily identified. The correct ergonomic design of the workplace will increase the job satisfaction of employees and will significantly reduce skeletal-muscular discomforts and work-related injuries.

### 3- Research Methodology

In this research, the required information has been collected in two stages. In the first stage, by referring to library sources including books, magazines and authentic scientific articles, the materials related to the research literature have been collected. In the second stage of this research, information has been collected in the field using a questionnaire tool. In this research, after obtaining the information obtained through the ergonomics of clothes, through the questionnaire, we started to design the clothes and then to check the relationship between the ergonomic factors. The design, sensory-skin comfort and thermo-physiological comfort were made with the capabilities of the laboratory department staff

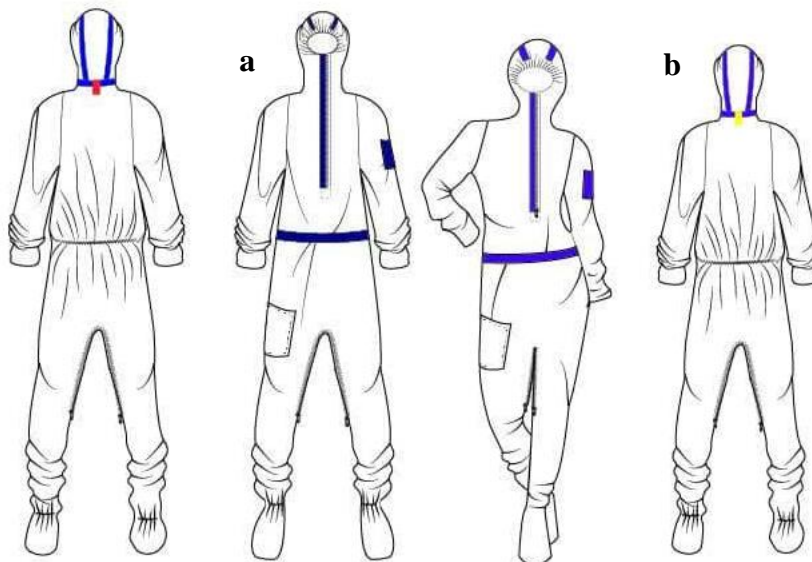
### **Designing and presenting new clothes and analyzing information**

In this research, out of the 30 samples of laboratory employees who answered the questions of the questionnaire, the majority are male (about 60 percent), and out of these 30, 21 are married (72.6 percent), and the majority have work experience of 5 up to 10 years (40 percent) and 4 people out of a sample of 30 people have at least 15 years of work experience, which means that the majority do not have much work

experience, that is, about 64 percent have work experience of up to 10 years. Regarding the ergonomics of clothing, men and women mostly agree on long sleeve design, having pockets, having a detachable cover, having moisture balance and heat balance.

Therefore, according to the descriptive patterns of the ergonomics of the work clothes in the following formats, the new clothes of laboratory science workers were designed and presented.

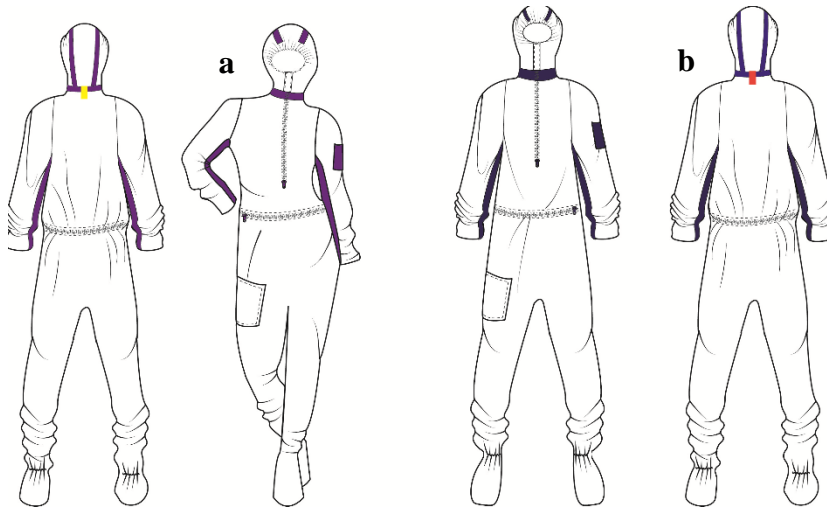
In figure 1, on the left side of the image the dress is designed for women and on the other side for men, the model is completely similar with the difference in its color scheme. There is a zipper sewn in the crotch area, and also a zipper is sewn in the front upper body part up to the waist for easier wearing. Of course, this model should be cut in a larger size, which can be changed with the drawstring that is sewn in the waist. There is also a pocket on the left hand. To use the machine, which will help to do the work easily. In the back of the neck, using a sewn band, medical stethoscopes can be passed through it if necessary.



**Fig 1. Men's (a) and women's (b) clothing sets, design number one (researcher's own reference)**

In figure (2), as seen on the right side of the image, the clothes are designed for women (a) and on the other side for men (b), the model is completely similar with the difference in its color scheme. A separate zipper has been sewn in the waist area so that it can be easily converted into a blouse and pants. Also, for easier wearing, a zipper has been sewn in the front of the upper body from the center line to the waist. It will

help and also a pocket is designed on the thigh to use necessary equipment while doing work, on the back of the neck with the help of a sewn band, medical stethoscopes can be passed through it if necessary.



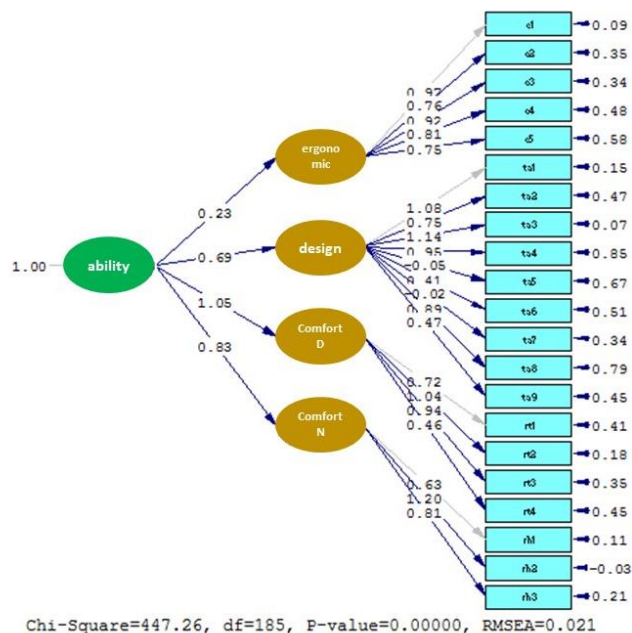
**Fig 2. women's (a) and Men's (b) clothing sets, design number two (researcher's own reference)**

Therefore, after applying the proposed designs, the following analytical results were extracted. Regarding the descriptive statistics of the indicators examined in this research, which are two indicators of employee capability (response variable) and the ergonomics of the laboratory staff's coat as a predictor variable (independent variable), it can be said that the average of the employee capability index according to the questionnaire The survey is 2.01, while the average ergonomic index of the dressing gown is 1.45 Also, the dispersion of the scores of the respondents to the questions in both indicators is below 0.7, which indicates the same opinions of each of the respondents to the questions. Also, according to Table 1, the descriptive statistics of their skewness and elongation have a normal distribution, and also To be more sure about the normality of the components (indices), the Kolmogorov Smirnov test was used, then the research hypothesis was investigated using confirmatory factor analysis.

**Table 1. Descriptive findings of the variables**

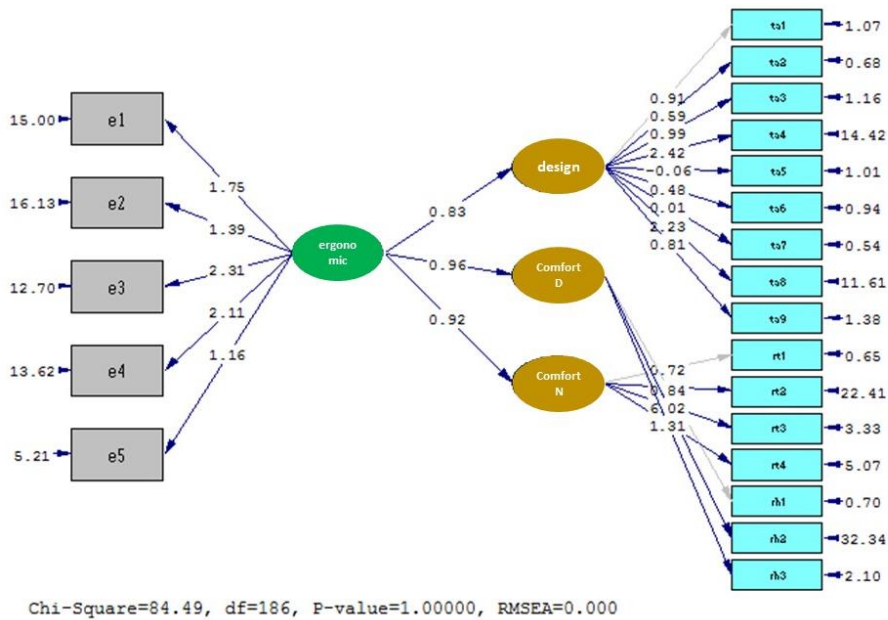
Variables					Indicators
Skin comfort	Thermophysiological comfort	cloth design	Ability of employees	Robe ergonomics	Average
2/56	3/16	3/05	2/01	1/45	The standard deviation
0/58	0/48	0/66	0/67	0/85	crookedness
0/50	0/43	0/41	0/48	0/48	Elongation
0/46	0/42	0/35	0/44	0/49	minimum
1	1	1	1	1	my maximum
5	5	5	5	5	

Regarding the significant indicators of the model, the mean square root of the error is equal to 0.089 and the chi-square degree of freedom is equal to 1.22, and regarding the fit indicators such as goodness of fit, normalized and non-normalized fit, they all confirm They are structural models. The main hypothesis under investigation is the correlation between ergonomics, design, sensory-skin comfort and thermophysiological comfort of laboratory clothes on the ability of the employees of the complex.



**Fig 3. Standard coefficients of the proposed model of the causal relationship between research variables**

According to the diagram (1) and The results obtained from the analytical model can be said that all the factors of ergonomics, design, sensory-skin comfort and thermo-physiological comfort of laboratory clothes are significant on the ability of the employees of the complex and their significance level is less than 5% based on the Student's t-test. On the other hand Assumptions of the influence of design factors, sensory-skin comfort and thermophysiological comfort of laboratory clothes on the ergonomics of laboratory clothes, after examining their structural equations, it was found that the thermophysiological comfort of laboratory clothes was not significant on the ergonomics of laboratory clothes, and the design factors and sensory-skin comfort due to the lower significance level They are significant from 5 percent.



**Fig 4. Standard coefficients of the proposed model of the causal relationship between ergonomics, design and sensory-skin comfort factors**



## **Conclusion**

Laboratory clothing is one of the important factors in creating safety and job satisfaction of a person in the workplace. As a result, by considering ergonomics in clothing design, the level of satisfaction can be increased and the productivity of employees in the laboratory environment can be increased. Using the science of ergonomics helps that the clothes, in addition to creating comfort, make the person safe from possible environmental risks to a great extent, which will lead to an increase in work efficiency. Different parameters are needed to produce a suit suitable for the laboratory. Among the most important of these parameters is the clothing pattern for cutting, which has an undeniable effect on the quality of the clothing Lays. In such a way that a pattern with suitable cuts, if it takes into account all the biomechanical angles of the body, can ultimately lead to the production of clothes in which, in addition to feeling comfortable, when doing things like bending and straightening, etc. have enough freedom of action. which defines the relationship between ergonomics and clothing. Therefore, following the principles of ergonomics in clothing design will increase employee satisfaction and increase job productivity. Regarding the fabric quality and Raw materials, there is some limitation between the choosing right materials, in iran there is special law for the medical clothes which should be followed but in this research our suggestion was one of the fabrics which were be availabe and confirmed by the iranian mediacial ministry. In the iran design business, the principles of ergonomics have not been observed and it can be said that the clothes are almost similar in a work environment. The design of work clothes should be based on the conditions of the work environment, the type of activity and also considering the needs of the employees.

If the structural factors of clothes such as pockets, pleats, pockets, etc. are observed in the pattern, then the clothes can be more practical in addition to comfort. In this resaerch tried to used silver pattern rules to have a standard patterns. The clothes used by the employees must be selected according to the conditions of the working environment and all the effective factors in the way a person works, such as the temperature of the working environment, the type of activity, the parts of the body that are used the most during work, etc., when designing Clothing should be considered. In general, it can be said that employees in any working conditions and special environment should have clothes that are coordinated and specific to those working conditions. Therefore, in relation to the sample under study as it was done in the findings of the research and also according to the designs related to the needs assessments made based on the needs based on the type of activity and working environment. Every type of activity requires a type of clothing that can be redesigned in terms of pattern or structure, and the use of ready-made work clothes for different activities lowers work efficiency and can be increased by designing related to the type of work. It ensured the energy of the employees along with the health of his body.

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## **Acknowledgements**

These and the Reference headings are in bold but have no numbers. Text below continues as normal.

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## **Appendix A. An example appendix**

Authors including an appendix section should do so after References section. Multiple appendices should all have headings in the style used above. They will automatically be ordered A, B, C etc.

### *A.1. Example of a sub-heading within an appendix*

There is also the option to include a subheading within the Appendix if you wish.