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ERGONOMIC EVALUATION OF DESK-BOUND WORK OFFICES OF A COMMUNITY HEALTH CENTER AND EFFECT OF ERGONOMIC INTERVENTION ON THE HEALTH COMPLAINTS OF THE WORKERS

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ABSTRACT

Objective: *It has been known for many years that workplace environment of the individuals has a great impact on human health. The aim of this study was to determine the effect of ergonomic intervention on the health complaints of office workers.*

Material and Method: *In this interventional study, the health complaints of workers were determined via implementing surveys before and after the intervention. Moreover, ergonomic observations were made for the participants and the working environment. In the context of intervention, an overall ergonomic training was provided and risk factors at work were decreased.*

Results: *As the conclusion of the ergonomic intervention, an improvement was determined in the working posture and in equipment usage. As a result of this, the proportion of participants with at least one area of musculoskeletal complaints decreased from 81.2% to 62.5%, while the proportion of participants with any eye complaints decreased from 52.5% to 28.7%.*

Conclusion: *The results imply the intervention program is very useful and it is necessary to implement such programs for all of the risk groups by occupational safety and health units.*

Keywords: *Office ergonomics, musculoskeletal disorders, physical environment factors.*

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BİR TOPLUM SAĞLIĞI MERKEZİ MASA BAŞI ÇALIŞMA OFİSLERİNİN ERGONOMİK AÇIDAN DEĞERLENDİRİLMESİ VE ÇALIŞANLARIN SAĞLIK YAKINMALARINA ERGONOMİ GİRİŞİMİNİN ETKİSİ

ÖZET

Amaç: İşyeri ortamının insan sağlığı üzerinde büyük bir etkisi olduğu uzun yıllardan beri bilinmektedir. Bu çalışmadaki amaç, ergonomik müdahalenin ofis çalışanlarının sağlık şikayetleri üzerindeki etkisini belirlemekti.

Materyal ve Metot: Bu müdahaleli çalışmada, ergonomik müdahaleden önce ve sonra anket uygulanarak işçilerin sağlık şikayetleri belirlenmiştir. Ayrıca katılımcılar ve çalışma ortamı ergonomik açıdan değerlendirilmiştir. Müdahale kapsamında, genel bir ergonomik eğitim sağlanmış ve iş yerindeki risk faktörleri azaltılmıştır.

Bulgular: Ergonomik müdahale sonucunda, çalışma pozisyonunda ve ekipman kullanımında iyileşme olduğu tespit edilmiştir. Bunun sonucunda, en az bir kas-iskelet sistemi şikayeti olan katılımcı oranı %81,2'den %62,5'e düşerken, göz şikayeti olan katılımcı oranı %52,5'ten %28,7'ye düşmüştür.

Sonuç: Sonuçlar, müdahale programının çok faydalı olduğunu ve tüm risk grupları için bu tür programların iş sağlığı ve güvenliği birimlerince uygulanması gerektiğini göstermektedir.

Anahtar kelimeler: Ofis ergonomisi, kas-iskelet sistemi hastalıkları, fiziksel ortam faktörleri.

INTRODUCTION

It has been known for many years that workplace environment of the individuals has a great impact on human health. The objective of occupational health is to prepare a healthy and safe working environment for the employees by effectively controlling the factors that pose health risks in the workplace, and thus, to protect and develop the health of the employees. In the context of occupational health, ergonomics studies are of great importance, which provide the conformity between the individuals and their occupations, the equipment they use, and their workplaces.[1]

Today, the offices are the most common workplaces. A desk-bound individual working in an office can perform many functions without leaving the computer. In order for the individuals to be effective in their occupations, one of the most needed factors is a comfortable working environment. Therefore, the components such as the desk, chair, computer screen, keyboard, and mouse, which are the parts of the working environment, should be designed and placed to provide the most comfortable working environment to the individual. Many factors from the illumination of the room to the heat-humidity level can decrease the efficiency of the employees or can influence their concentration negatively. It is necessary to care about the principles of ergonomics in order for preparing the most comfortable environment for the employees and for minimizing risk of injury and harm.[2]

Chair is one of the most important office tools that provide a natural posture and comfort during working. The height and the back support of the chair should be adjustable for personal use. Moreover, there should be wheel castors (the most suitable one is 5-wheelcastor) for a simple moving, armrests for resting the arms, and a swivel chair seat with a sufficient size.[3,4] The desk, which is another office tool, should have a suitable height, a sufficient width, and it should be designed in a way not to restrict limit the movements of the chair. The ideal height of the desk should be between 65-70 cm, and if possible, it should be adjustable for personal use. The width of the desk should ideally be between 75-90 cm, and its length should be at least 90 cm. The chair, the individual, and the desk should be considered as a human-machine system. The monitor, another office tool, should be immediately across from the individual in an arm distance, the keyboard should be parallel to the body on the central line, and the mouse should be placed near the keyboard on the user hand side.[5]

In order for the individuals to work effectively, another element to consider is the physical environment factors. The ideal heat level in the offices for the winter months is between 20-23.5°C, while it is 23°C-26°C for the summer months. The ideal humidity level should be 30-60% and air circulation speed should be around 150 mm/sec. Moreover, the illumination level should be 300-500 lx if the work is only on the monitor, and it should be between 500-750 lx when it is also needed to read documents besides the computer works.[6]

In the developed countries, one of the most important work-related morbidity reasons influencing the desk-bounded employees is acute and chronic musculoskeletal disorders (MSD).[1] It is known that these disorders have a 38.1% percentage among all of the occupational diseases in Europe.[7] According to

the data of the Turkey Statistics Institute, the rate of the work-related MSDs in Turkey between 2007 and 2013 increased from 48.5% to 57.2% among all of the occupational diseases.[8] Generally, ergonomic inabilities and usage of the body in improper positions, and repetitive, forcing moves are causing these disorders, influencing the soft tissues such as muscles, tendons, ligaments, and discs. Work-related MSDs are localized in various regions such as neck, shoulder, elbow, back, wrist, and are present with a wide range of symptoms. These symptoms include pain, swelling, stiffness, numbness, tingling, weakness, impaired coordination, loss of function, color on the skin, and heat changes, and they can lead to limitations on the activities of employees.[9] Besides, eye complaints as a result of spending too much time in front of the monitor are the most frequent health problems observed on the employees working with computers. In order to cope with such problems, the employees should be supported and trained about ergonomic working.[10]

The effectiveness of well-planned ergonomic intervention in decreasing the work-related MSDs was demonstrated in various studies. Intervention programs focused on training the employees help the employees to use their bodies in the right position and lead to some other behavioral changes by creating an ergonomic consciousness were found effective. Moreover, in the context of these intervention programs, the workplaces turned into being appropriate for the employees with arrangements in the workplaces. Success of ergonomic intervention programs, which aim at maximizing the skills of the employees and increasing their efficiency by providing confidence and comfort for them, can only be reached by a sufficient training for both the employers and the employees and by behavioral changes in both groups based on this training.[5,11]

In this study, it was aimed to determine whether the Meram Community Health Center, in which desk-bound employees are working with computers, is in conformity with office ergonomics, to determine whether the workers have occupational health complaints, and lastly to determine the effect of ergonomic intervention on these health complaints.

MATERIAL AND METHOD

Study Design

The study is an intervention-style research conducted in the year 2017, in Meram Community Health Center in Konya province. In order for the research study to be conducted, approval was gained from the Necmettin Erbakan University, Faculty of Medicine, non-Pharmaceuticals and non-Medical Devices Research Ethics Committee (2017/832), and official permission was taken from the Konya Directorate of Public Health, and approval was gained from Konya Governorate.

Population and the Procedure of the Study

The population of the study was comprised of 87 desk-bound health personnel who used computers in Meram Community Health Center. In the study, it was aimed to reach the complete population, thus, sampling method was not used. The criteria to participate in the study were determined as follows; to be 18 years old or over, being a full-time employee, to be working with computers at least for one year, and using a computer in the workplace at least 3 hours in a day. The sample of the study was comprised of 80 Community Health Center employees, who met the participation criteria and who gave verbal approval. Two health employees did not accept to participate, while five of them could not meet the participation criteria eligibility. In total, 92% of the population could be reached.

Phases of the Study

Survey Implementation

Being developed according to the relevant literature, a 32-question survey was implemented with a face to face meeting method, which included information such as socio-demographic features of the participants, their computer using durations, giving breaks, and doing exercises. Before applying the survey to all of the participants, a pretest was conducted in a small group. Moreover, before the implementation, explanations were made to the participants about the objective of the study and content of the forms, and informed consents were obtained.

Evaluation of the Employees

After the survey, the employees were observed in their workplaces for five minutes while they used computer, and their posture and equipment placement status were recorded into the evaluation-follow up form. During the work, the participants were evaluated for wrist, elbow, neck, hip, and knee; if all of these regions were appropriate they gained 0 score, if not, they were given 1 for each, thus, their scores ranged from 0 to 5, ultimately calculating their Posture Defect Rate (PDR).[12,13] In order to determine the equipment placement status of the participants during the work, the eye-monitor distance, monitor position and keyboard position based on the center-line of the body, and position of the mouse according to the keyboard were examined. In case all of the equipment were in the right position, they gained 0, if the position was

not appropriate, they were given 1, thus, their scores ranged from 0 to 4, ultimately calculating Wrong Placement Rate (WPR).[12,13]

Evaluation of the Working Environment

Moreover, the offices were ergonomically evaluated, in which the conformity of the desk and the chair, the heat-humidity level of the working environment, illumination level, and air circulation speed were examined. Physical environment measurements were made in five different buildings in Community Health Center and affiliated units (Tuberculosis Dispensary, Youth Counseling and Living Center, Mother and Child Health and Family Planning Center, Cancer Early Diagnosis-Screening and Training Center) in 36 different offices, in which there were computer-using participants. The measurements of the working environment were conducted during the working hours separately for each office, heat and humidity measurement was conducted with Extech RH300 (FLIR Commercial Systems Inc., USA) brand portable heat and humidity measuring device, illumination level measurement was carried out with Extech EA31 (FLIR Commercial Systems Inc., USA) brand light intensity ranging device, and air circulation speed measurement was conducted placing the TSI 9515 (TSI Inc., USA) brand portable anemometer transiently at the center of the office. The values detected during the measurements were recorded into the evaluation-follow up form.

Ergonomic Intervention

In the context of the ergonomic intervention in the study, firstly, all of the participants working in the same office were applied the survey. Second, they were observed concerning posture and equipment placement. Third, the participants in the office were given a training about the right posture and equipment placement particular to each employee. Thus, it was aimed to correct the posture defects and wrong equipment placement detected in the first evaluation particular to each participant. Subsequently, an overall ergonomic training was given including office ergonomics, right sitting posture and equipment use, importance of breaks during the work hours, and work-related disorders. Moreover, during this training, the participants watched some videos about office exercises applicable to working environment, and training brochures with written-visual content were handed out to the participants in order to support the training. Ultimately, the offices were evaluated concerning conformity to ergonomics, and existing risk factors were attempted to be decreased, and desks and chairs detected to be inappropriate were reported to the Community Health Directorate, and they were replaced.

Post-Intervention Survey Application and Re-Evaluation

Three months after the ergonomic intervention, the same survey was applied to the employees again. Subsequently, the posture and equipment placement status of the participants while using their computers were observed and recorded one more time. Thus, it was evaluated whether there was any change in the health complaints, PDR, and WPR of the participants comparing their pre- intervention and post-intervention status.

Statistical Analysis

The analysis of the data obtained from the study was conducted in the computer environment in IBM SPSS version 23.0 program. Descriptive statistics were given by using median (Quartile 1- Quartile 3) and % distribution. In the statistical analysis, normality analysis of the data was conducted via Kolmogorov-Smirnov test. In comparing the categorical data McNemar chi-square test, and in the analysis of the continuous data Wilcoxon signed rank test were used. For the statistical significance $p<0.05$ value was accepted.

RESULTS

Descriptive Characteristics

21.3% of the 80 participants were male, while 78.7% of them were female. The age mean (±SD) was calculated as 40.5±8.8, it was determined that 58.8% of them were 40 and over according to the age classification. Other socio-demographic features of the employees are shown on Table 1.

Table 1. Socio-demographic features of Meram Community Health Center employees.

		n	%
Gender	Male	17	21.3
	Female	63	78.7
Age	20-29	12	15.0
	30-39	21	26.2
	40 and over	47	58.8
Marital status	Married	74	92.5
	Single	6	7.5
Educational status	High School	4	5.0
	College or University	76	95.0
Total		80	100

Table 2. The status of Meram Community Health Center employees giving breaks and performing exercises before and after the intervention.

	Intervention	Before n (%)	After n (%)	p[a]
Giving breaks	Hourly breaks	44 (55.0)	61 (76.3)	<0.001
	Giving breaks in every 2-3 hours or giving no breaks	36 (45.0)	19 (23.7)	
Regular exercise	Doing regular exercise	27 (33.8)	29 (36.3)	0.620
	Doing irregular or no exercise	53 (66.2)	51 (63.7)	
Office exercise	Doing office exercise	11 (13.8)	37 (46.3)	<0.001
	Not doing office exercise	69 (86.2)	43 (53.7)	
Total		80 (100)	80 (100)	

[a]McNemar chi-square test

Table 3. The comparison of the musculoskeletal and eye complaint status of Meram Community Health Center employees before and after the intervention.

		Before intervention n (%)	After intervention n (%)	p[a]
Musculoskeletal complaint at least in one region	Yes	65 (81.2)	50 (62.5)	<0.001
	No	15 (18.8)	30 (37.5)	
Complaint in the hand-arm region	Yes	33 (41.3)	28 (35.0)	0.063
	No	47 (58.7)	52 (65.0)	
Complaint in the leg-foot region	Yes	31 (38.8)	15 (18.8)	<0.001
	No	49 (61.2)	65 (81.2)	
Complaint in the neck region	Yes	41 (51.2)	21 (26.3)	<0.001
	No	39 (48.8)	59 (73.7)	
Complaint in the shoulder region	Yes	40 (50.0)	24 (30.0)	<0.001
	No	40 (50.0)	56 (70.0)	
Complaint in the back region	Yes	51 (63.7)	22 (27.5)	<0.001
	No	29 (36.3)	58 (72.5)	
Complaint in the lumbar region	Yes	28 (35.0)	23 (28.7)	0.180
	No	52 (65.0)	57 (71.3)	
Eye complaint	Yes	42 (52.5)	23 (28.7)	<0.001
	No	38 (47.5)	57 (71.3)	
Total		80 (100)	80 (100)	

[a]McNemar chi-square test

Table 4. The comparison of the PDR (Posture Defect Rate), WPR (Wrong Placement Rate) median scores of Meram Community Health Center employees calculated before and after the intervention.

			Before intervention	After intervention	p[a]
PDR score	Median	(1.Quartile-3.Quartile)	2 (2-3)	1 (0-1)	<0.001
WPR score	Median	(1.Quartile-3.Quartile)	2 (1-2)	0 (0-1)	<0.001

[a]Wilcoxon signed rank test

47.5% of the participants were either midwives or nurses, 16.2% of them were medical assistants, 11.3% were doctors, 10.0% were secretaries, 3.7% were dietitians and 1.3% were psychologists. The mean (±SD) of the total years passed in front of the computers was calculated as 8.1±6.2 years, and the mean (±SD) of daily computer using durations was detected as 5.1±1.7 hours.

Evaluation of Giving Breaks and Doing Exercises

Before the intervention, 55.0% of the participants were giving hourly breaks, 33.8% of them had regular exercises in their daily lives and 13.8% of them were performing office exercises during work hours. As per post-intervention period, it was detected that 76.3% of the participants were giving hourly breaks, 36.3% of them had regular exercises in their daily lives and 46.3% of them were performing office exercises during work hours. The proportion of the participants giving hourly breaks and performing office exercises after the intervention was significantly higher compared to the pre-intervention status (p<0.001). However, there was no significant difference between the proportion of the participants having regular exercises before and after the intervention (p=0.620). The changes in the status of the employees giving breaks and performing exercises before and after the intervention are shown on Table 2.

Health Complaints

Health complaints of the participants in the last one month were questioned in the ergonomic intervention for 7 different regions of the body. Six of these regions were musculoskeletal regions. While there were musculoskeletal complaints at least in one region of 81.2% of the participants before the intervention, it was determined that this proportion decreased to 62.5% after the intervention. As a result of the intervention program including ergonomic training and office arrangement, there was a significant decrease in the proportion of participants with musculoskeletal complaints in at least one region (p<0.001). In addition, there were significant decreases in the rates of participants with complaints in the neck, shoulder, back and leg-foot regions. The changes in the proportion of the participants, who had musculoskeletal complaints before and after for each region, are given on Table 3.

That the rates of the participants who had complaints in the eyes, which was another region that the health complaints were questioned, such as pain, burning, or lacrimation before and after the intervention, were 52.5% and 28.7% respectively. With the conclusion of the ergonomic training program, in which the importance of eye-monitor distance and giving appropriate breaks during the working hours was expressed, it was determined that there was a significant decrease in the proprotion of the participants with eye complaints. (Table 3, p<0.001).

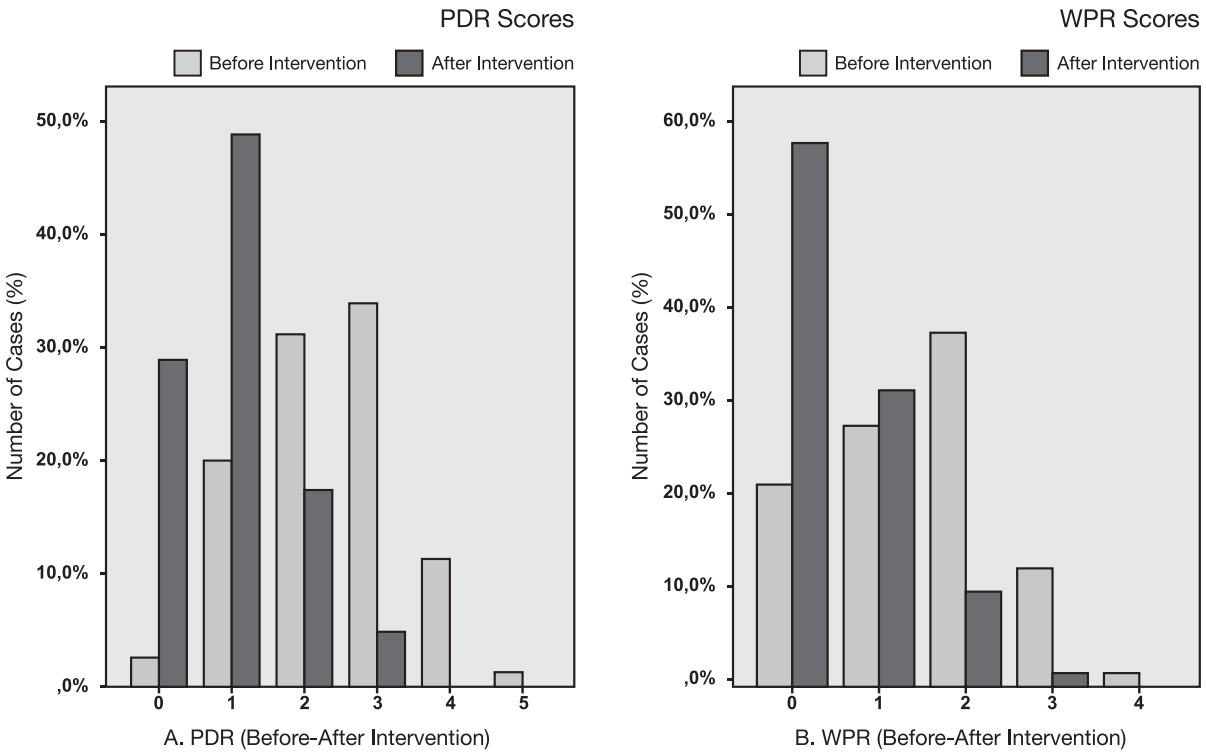

Figure. The distribution of the PDR (Posture Defect Rate), WPR (Wrong Placement Rate) scores of Meram Community Health Center employees calculated before and after the intervention.

Working Posture and Equipment Placement Status

The PDR median score of the employees was 2 (2-3) before the intervention, and 1 (0-1) after the intervention. As per the WPR median score, it was detected as 2 (1-2) before the intervention, and 0 (0-1) after the intervention. The distribution of the PDR and WPR scores before and after the intervention were illusrated on Figure A and B. When the results were examined, it was detected that the PDR and WPR median scores of the participants were significantly lower after the intervention compared to the pre-intervention values (Table 4, $p<0.001$).

Working Environment

The desks and chairs of 80 participants were evaluated according to the conformity to ergonomics. All of the heights and widths of all the desks were in conformity with ergonomics, however, the lengths of the desks were determined to be inappropriate. As per the chairs, 77 of them were detected to be in conformity with ergonomics, while 3 of them were not (Table 5).

The heat level varied between 24.3°C and 31.0°C, the sensible humidity level ranged between 20.6% and 36.0%, the illumination level was between 56 lx and 971 lx, and the speed of air circulation ranged between 10 mm/sec and 170 mm/sec in the offices included in the study. While it was determined that the heat level was higher than the normal level in 88.9% of the offices; it was detected that the humidity level in 47.2% of the offices, the illumination level in 50.0% of the offices, and the air circulation speed level in 86.1% offices were lower than the normal level (Table 6).

Table 5. Conformity to ergonomic status of the desks and chairs used by Meram Community Health Center employees.

		Appropriate n (%)	Not appropriate n (%)	Total n (%)
Desk	Desk height	80 (100)	0	80 (100)
	Desk width	80 (100)	0	80 (100)
	Desk length	77 (96.2)	3 (3.8)	80 (100)
	Desk	77 (96.2)	3 (3.8)	80 (100)
Chair	Height adjustment	77 (96.2)	3 (3.8)	80 (100)
	Armrests	78 (97.5)	2 (2.5)	80 (100)
	Swivel chair seat	78 (97.5)	2 (2.5)	80 (100)
	Number of wheel	78 (97.5)	2 (2.5)	80 (100)
	castor	77 (96.2)	3 (3.8)	80 (100)
	Chair			

Table 6. Conformity to ergonomic status of heat, sensible humidity, illumination, and air circulation speed levels of the offices in the Meram Community Health Center.

	Appropriate n (%)	Not appropriate n (%)	Total n (%)
Heat level	4 (11.1)	32 (88.9)	36 (100)
Sensible humidity level	19 (52.8)	17 (47.2)	36 (100)
Illumination level	18 (50.0)	18 (50.0)	36 (100)
Air circulation speed level	5 (13.9)	31 (86.1)	36 (100)

DISCUSSION

Today, human beings spend most of their time in the workplace with an intense work beat. A big portion of daily work is comprised of desk-bound work and computer usage. This case increases the risk of work-related health problems.[14] Similarly, the employees of the Community Health Center spend most of their work hours with desk-bound computer works, and they encounter many health problems in case the ergonomic principles are disregarded.

In a study conducted by Özdinçler *et al.* in a university in Istanbul, it was determined that the participants, who were comprised of academics and administrative staff, spent 5.2 hours a day in average using computer on a desk.[15] In another study conducted on 79 participants in a Turkish province, who were civil servants in a state institution, it was reported that the employees spent 6.2 hours a day in average using computer.[16] In this study, similarly, it was detected that the employees used computers 5.1 hours a day in average. It is reported in the literature that using computers more than 4 hours a day caused MSDs.[12,17] Besides, female gender and advanced age are indicated to be among the risk factors for MSDs.[18-20] Besides the fact that most of the employees participated in the study used computers more than 4 hours a day, 78.7% of them were female, and 58.8% of them were over 40, which indicates that the Meram Community Health Center employees are in the risk group concerning work-related MSDs. This demonstrates the necessity of providing ergonomic training for the employees and arrangement of the working environment according to the ergonomic principles.

When the literature is examined, it is observed that the frequency of musculoskeletal complaints of the computer-using individuals vary in a between 10-86%.[21-23] In a study conducted on 600 office employees in Hong Kong, it was determined that the frequency of computer-based musculoskeletal complaints was over 56.0%.[24] In a study on 333 office employees in Turkey conducted by Baran, Doğan, and Akdur, it was reported that the frequency of musculoskeletal complaints of the participants was 80.8%.[25] In this study, it was detected that in 81.2% of the participants there was musculoskeletal complaint at least in one region. This result, which is close to the highest rates detected in the literature, can be attributed to the fact that the participants of the research have most of the work-related MSDs risk factors.

During the research study, it is possible to protect oneself from MSDs via implementing the right body mechanics and providing comfortable and ergonomic working environments.[5] The effectiveness of well-planned ergonomic intervention in decreasing such problems was demonstrated in some research studies. Creating an ergonomic consciousness in the employees, training-based intervention programs provide behavioral changes in individuals, using the body in the right positions, and as a result of these, a decrease in musculoskeletal complaints.[11] In a study conducted on 109 office employees in Finland, it was demonstrated that there was a decrease in work-related musculoskeletal complaints of the participants after ergonomic intervention.[26] In another study conducted on 81 participants, who used computers at least 3 hours a day, it was determined that the ergonomic intervention was effective in decreasing the severity, duration, and frequency of the musculoskeletal complaints.[10] In this study, similarly, it was determined that there was a significant decrease in the participant proportion of the musculoskeletal complaints at least in one region. Moreover, as a result of the ergonomic intervention, it was detected that there were significant decreases in the participant proportion of neck, shoulder, back, and foot-leg region complaints. Positive results found both in the literature and in our research indicate that implementation of ergonomic intervention programs should not be limited to research studies. Regular implementations of such kind of programs by the Occupational Safety and Health (OSH) units to all risk groups, would be helpful in decreasing the prevalence of work-related musculoskeletal complaints.

Besides musculoskeletal problems, individuals, who are working long hours on the computer, can have complaints such as pain in eyes, burning, dryness, feeling of weight, eyestrain, blurred vision, and double vision.[27] In a study conducted on 83 individuals in Turkey, it was determined that eye complaints of the participants were over 50.0%.[28] In this study, similarly, it was detected that 52.5% of the participants had eye complaints such as pain, burning, and lacrimation. It is possible to decrease such kind of eye complaints by getting the employees adopt ergonomic habits such as giving proper breaks while using the computer, and adjusting the eye-monitor in an arm distance. The proportion of employees with eye complaint was significantly decreased as a result of the ergonomic intervention of our research study, which is a finding that supports this case.

In a study conducted on 219 participants, who were using computer more than 4 hours in a day, Robertson *et al.*, examined the effects of ergonomic training on the participants.[29] As the result of the study, an increase was determined in ergonomic consciousness and positive behavioral changes. Rizzo *et al.* examined

the effectiveness of two different training methods in changing the ergonomic consciousness of the participants, who were working with computers.[30] As a result, an enhancement was determined in ergonomic consciousness of the participants in both of the methods. In this study, concerning both the ergonomic consciousness and habits, whether the participants were giving breaks and doing office exercises was questioned both before the training and 3 months after the training. As a conclusion, it was detected that there was a significant increase in the proportion of the participants, who regularly gave breaks and did office exercises. The findings, which demonstrated that ergonomic consciousness and positive behavioral changes of the participants increased after the training, are in parallel with the findings of the literature, and they are significant regarding their potential to decrease the health complaints of the employees.

In various research studies on computer users, it was reported that the ergonomic intervention program was also effective in correcting the posture defects and wrong equipment placement. In a study conducted by Lewis *et al.* on 170 participants working with computers in the USA, corrections were determined in neck posture and improper mouse placement.[13] In another study conducted on 81 computer users in Istanbul, ergonomic intervention was implemented to the participants and it was determined that there were decreases in posture defects and wrong equipment placement.[10] In this study, posture defects and equipment placement status of the participants were evaluated before and after the ergonomic intervention, and it was determined that there were enhancements after the intervention in working posture and equipment right usage. The research participant group was comprised of different occupational groups such as doctor, midwife, technician, and dietitian; it was determined that 95.0% of the participants were college or university graduates. It can be considered that higher educational status of the participant group enabled obtaining more positive results after the ergonomic training.

The desks and chairs in the working environment should be ergonomically appropriate, which is accepted as a prerequisite for the employees to work in the right position. In a study examining the conformity of the banks in Turkey province to ergonomics, it was determined that 80.0% of the desks and 95.0% of the chairs that the participants used were in conformity with ergonomics.[31] In this study, 96.2% of the desks, which were examined regarding the height, width, and length features, accorded with ergonomics. Today, with an increasing ergonomic consciousness, it is known that conformity proportion is increased in office equipment such as desk and chair. In our study, it was determined that almost all of the desks and chairs in the Meram Community Health Center were in conformity with ergonomics. Moreover, as a result of an evaluation, 3 desks and 3 chairs, which were detected to be inappropriate, were replaced by the authorities.

One of the most important requirement for the employees to be protected from health problems and to be effective in their occupation is providing the physical environment factors in an appropriate level in the working environment. The leading ones among these factors is the heat and humidity level. These components, which make up thermal comfort, affect the health, morale and productivity of the employee.[32]

In a study conducted by Ramos *et al.*, in which the physical environment factors of a new hospital building in Chicago were examined, it was determined that the heat and humidity levels of most of the rooms were appropriate.[33] In our study, it was detected that the heat levels in the majority of the offices were higher than the normal level, while the humidity levels were lower than the ideal.

One of the components of thermal comfort is the air circulation speed. In a study, in which the comfort status of the patients hospitalized in a hospital in Scotland was examined, it was reported that in all of the hospital rooms the air conditioning was not sufficient.[34] Similar to this study, in our study, in almost all of the offices the air circulation speed was lower than the level it should be.

Another factor is the lighting and it was demonstrated in various studies that with a sufficient illumination level, sight problems and neck pain decreased.[35] In a study conducted by Akbari *et al.*, in two automobile production plants in Iran, there the levels illumination were insufficient in most of the stations.[36] In this study, half of the offices that the participant used had insufficient level of illumination.

As the conclusion of the measurements conducted in our study, the physical environment factors were at inappropriate levels. This situation can be evaluated as a preparatory factor of high-level musculoskeletal complaints of the participants. The old and decrepit buildings being used as Community Health Center should be replaced with the new buildings with modern illumination, air conditioning, heating, and cooling systems. Thus, the working environment of the employees will be much more in conformity with ergonomics, their complaints will be decreased, and their labor productivity will increase.

Strengths and Limitations

That the study was conducted in only one center and the follow-up period was short can be accepted as limiting factors. Since the follow-up period was short, the evaluations did not coincide with the same season. The first evaluation was employed in the spring and the next in the summer. It can be thought that the season contributed to the decrease in the complaints of the participants. In addition, since the participants were aware that they were observed during the evaluations, through the Hawthorne effect, they might have paid attention to their work postures and use of equipment. Further studies in this field should be conducted on wider participant groups with longer follow-up periods, and the obtained results should be shared with the employees, employers and managers, thus, general consciousness should be increased concerning ergonomics.

CONCLUSION

As the conclusion, in our study, it was determined that musculoskeletal and eye complaints were intensely observed in the desk-bound individuals working with computers, and it was demonstrated that after the implementation of ergonomic intervention, these complaints decreased. Moreover, the offices of the buildings, where the research was conducted, were ergonomically insufficient.

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