

# Ergonomic Evaluation of Working Postures and Analysis of Relationship between Physical Activities with Musculoskeletal Disorders among Men Barbers in Karaj (Iran)

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## A-R-T-I-C-L-E-I-N-F-O

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## A-B-S-T-R-A-C-T

**Background & Aims of the Study:** Work-related musculoskeletal disorders (WRMSDs) are considered as major occupational health problem in the developed and developing countries. The study was carried to the Ergonomic evaluation of working postures and analysis of the relation between physical activities with WRMSDs among men barbers in Karaj, Iran in 2016.

**Materials and Methods:** In this cross-sectional study, 80 participants were studied. Body postures were analyzed, using the Rapid Entire Body Assessment (REBA) method. In order to assess the prevalence of disorders and physical activities, standard Nordic questionnaire and Baecke physical activity questionnaire were used, respectively. Data were analyzed, using Shapiro-Wilk, Independent sample t-test, Mann-Whitney, Analysis of variance (ANOVA), Chi-Square statistical tests with SPSS-20.

**Results:** The average and standard deviation of barbers age were  $36.71 \pm 6.1$ . The highest of the prevalence of musculoskeletal disorders among barbers were related to shoulder and waist (95%). Considering to the findings, 71.3% of the participants were at moderate risk level. There was also a significant relation between physical activity and the knee, wrist, waist, elbow and buttocks/thigh ( $P_{\text{value}} < 0.05$ ).

**Conclusion:** The results showed most prevalence of disorders is related to the upper limbs. Also, barbers with higher levels of physical activity have lower levels of WRMSDs. Based on these facts, corrective actions such as chair and equipment re-design, work rest cycle, training and suitable physical practices is necessary.

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## Background

Pain and discomfort in different sections of the musculoskeletal system are one of the most important problems of occupational health in the workplace (1,2); so, the main cause of absences from workplace (more of 50 percent) is due to work-related musculoskeletal disorders (WRMSDs) (3). Considering to the

Bureau of labor Statistics that published by the United States in 2001, the reason of other than 30 percent of working days lost in this country is these disorders (4). In 1995, 83000000 working days lost in Britain due to musculoskeletal disorders in the upper limbs of workers was created (5). In general, respondents in the world are the reason for 40 percent of all costs associated with work (6). Today, in many countries the prevention of

musculoskeletal disorders has become a national priority, International Association of occupational health and safety, work-related diseases and disorders, according to national importance (in terms of prevalence, severity of prevention) is classified, where work-related musculoskeletal disorders after occupational respiratory diseases ranked second in the world (3). These problems are especially acute with increase the age (7). According to the report of Social Security Organization, in the years from 1991 and 1994, Musculoskeletal diseases responsible for the 14.4 percent of the country's total disability. These disorders, after the neurological disease (16.8 percent), mental illness (16.1 percent) and cancer (16 percent) were ranked fourth (3). A lot of physical and mechanical risk factors effective for this disorder, which one of the most important risk factors is an improper working posture (8). The other risk factors are excess force, repetitions, lifting and carrying, contact pressure and body vibrations (9). A group of people due to various tasks with the body position outside the normal situation is at most risk of physical disorders, are barbers. Musculoskeletal disorders are significantly increased in recent years in the barbers (10). The most common musculoskeletal disorders mentioned in barbers is an upper limb disorders, carpal tunnel syndrome, lower back and neck problems (11). The barber tasks involve time-consuming and multi-step process. Moreover to the traditional irrigation and shaving hair, barbers usually do a hair coloring, sort of hair, etc, in their workplace; therefore, these people are likely exposed to various types of potential hazards for health in their workplace. There is also insufficient attention to ergonomic principles which affect the increase of occupational injuries among these people (12). Poor and repetitive postures are reasons for the happening of musculoskeletal disorders in the organs of barbers, including: placement of the arms upper the shoulders height, inappropriate weight distribution on the feet, which causes

disturbances in this section of body, waist bent at task time, etc (13). The results of other similar studies also indicate the existence of work-related musculoskeletal disorders in different parts of the barber's body (9-12,14,15). Development of technology and mechanization of life, created reduction of physical activity for humans; it is worth mentioning that 70 percent of diseases caused by inactivity and reduce the mobility (16). Physical activity is any activity to boost or keeping physical fitness, overall health and wellness. According to the World Health Organization, physical activity refers to any movement with the movement of skeletal muscles and the energy consumption (17). Exercise helps maintain the physical fitness and a healthy weight, maintain healthy bone density, muscle strength and joint mobility, boost physiological well being, it also is effective in boosting the immune system.

#### **Aims of the study:**

According to the results of previous studies that showed physical activity reduces the risk of musculoskeletal disorders (18), and lack of studies in this regard among the barbers, the aim of the current study is ergonomic evaluation of working postures and analysis of relation between physical activities with WRMSDs among men barbers in Karaj, Alborz province of Iran, 2016.

#### **Materials & Methods**

In this temporary and descriptive- analytical study, working postures of 80 barbers in Karaj by random selection has been evaluated. To study the posture of barbers at work, a situation that has the factors such as the most time, frequency and poor conditions was selected. Assessment of physical postures during working hours was performed by direct observation of researcher, using checklist of the Rapid Entire Body Assessment (REBA ) method (19). Reason of using the REBA method is easy; the analysis a lot of types body postures with high sensitivity and reliability

(20). In this method, that provided by the McAtamney and Hignett, the first step is selecting a posture or activity that must be evaluated, then, using designed diagrams, posture encoded in different organs, and then organ score by force score and type of activities (Static or dynamic) combined. Finally, the overall risk of musculoskeletal injuries, the priority of corrective action level and the need of an ergonomic intervention is determined. So, in points 1, the level of risk is negligible and corrective action is not necessary, in rating 2-3, the level of risk is low and corrective action may be needed, in rating 4-7, the level of risk is medium and corrective action is necessary, in rating 8-10, the level of risk is high and corrective action should be taken in the near future and in rating 11-15, the level of risk is very high and immediate corrective action is necessary (21). To determine the prevalence of work-related musculoskeletal disorders among barbers, General Nordic Questionnaire was used (22). The first section of the questionnaire includes questions related to demographic information, the second section of the questionnaire includes questions that will determine musculoskeletal injuries in those sections of the neck, upper back, lower back, Shoulder, thigh and knee as a response to yes or no. This questionnaire is a standard questionnaire that used in order to determine musculoskeletal disorders and its validity and reliability have been confirmed (3). Also, in order to determine the levels of physical activity in barbers, Baecke physical activity questionnaire was used. This questionnaire is an international standard questionnaire to assess the level of physical activity that provide and translated by Iran University and Tehran University of Medical Sciences The Baecke questionnaire included 16 questions in Likert scoring method and assesses the person's activity in the three indices of the work, sports and leisure. The total average scores of all questions are in the range of 3 to 13. Level of

physical activity is determined in three levels, level one, the passive (non-athletes) score between 3 and 7.56, the second level, the average score between 7.57 to 9.56 and the third level, active people (athletes) score between 9.33 to 13 (23). Data were analyzed, using Shapiro-Wilk, Independent sample t-test, Mann-Whitney, Analysis of variance (ANOVA), Chi-Square statistical tests with SPSS-20.

## Results

The study was carried to among 80 barbers in the city of Karaj. The results of demographic information of barbers are shown in Table 1.

**Table 1) Demographic data of barbers**

Variable	Mean	Standard Deviation
Age (years)	36.71	6.1
Height (cm)	174.90	4.1
Weight (kg)	78.87	5.56
work experience (years)	11.62	4.69
Working hours per day	8.83	0.9
Body mass index (BMI)	25.81	2.04

The results of the frequency of REBA methods levels, levels of risk and the necessity for corrective actions are shown in Table 2.

**Table 2) Frequency of risk level and the need for corrective action in the barbers**

Risk levels	Frequency (Percent)	The necessity of corrective actions and time
Negligible	0 (0)	Not necessary
Low	23 (28.7)	May be necessary
Moderate	57 (71.3)	Necessary
High	0 (0)	Necessary (sooner)
Very High	0 (0)	Necessary (Critical)

The results showed that the highest prevalence of WRMSDs exists in the shoulder and waist areas (95 percent) and parts of legs, neck, wrists/hands, elbows, knees, back, hips/buttock and ankle has the prevalence of 92.5, 87.5, 81.2, 72.5, 47.5, 46.3, 42.5, 33.8 percent, respectively. Also, the results of the frequency distribution of the intensity of the discomfort and pain of musculoskeletal disorders for every organ of the barbers body is shown in diagram 1.

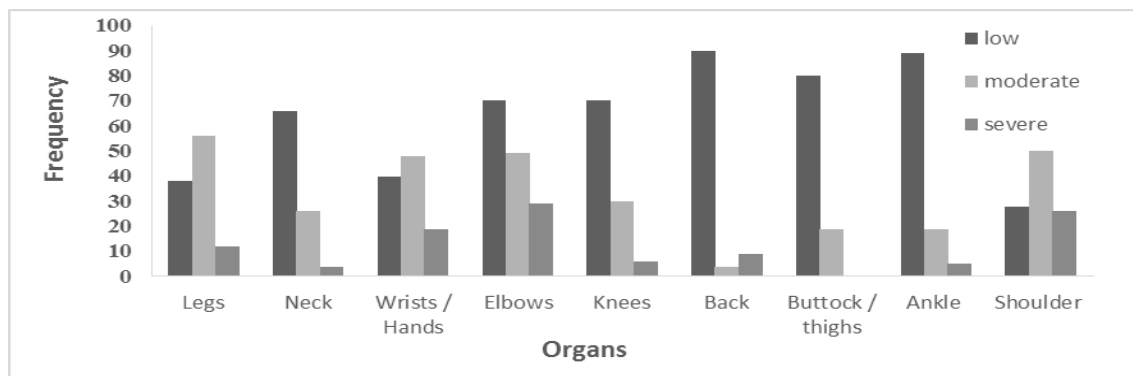


Diagram 1) Frequency of pain and discomfort intensity in the organs of the barbers body

Table 3) Distribution of musculoskeletal disorders and the severity of pain and discomfort in the organ of barber's body based on the amount of physical activity

organ	Prevalence (percent)			Severity (percent)								
	Low physical activity	Moderate physical activity	High physical activity	Low physical activity			Moderate physical activity			High physical activity		
				Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
Neck	87.7	90.5	84.6	82.1	12.8	5.1	26.3	63.2	10.5	81.8	18.2	0
shoulder	97.8	90.5	92.3	13.6	45.5	40.9	26.3	64.4	5.3	66.7	33.3	0
elbow	77.8	61.9	69.2	62.9	37.1	0	61.5	30.8	7.7	100	0	0
wrist / hand	88.9	66.7	84.6	32.5	50	17.5	42.9	42.9	14.2	72.7	27.3	0
Back	51.1	33.3	46.2	95.7	4.3	0	71.4	0	28.6	100	0	0
waist	100	90.5	84.6	8.9	57.8	33.3	36.8	42.1	21.1	63.6	27.3	9.1
buttocks / thigh	44.4	42.9	30.8	85	15	0	55.6	44.4	0	100	0	0
knee	60	28.6	38.5	70.4	29.6	0	37.5	50	12.5	100	0	0
leg	91.1	100	92.3	31.7	53.7	14.6	28.6	57.1	14.3	50	50	0
Ankle	35.6	33.3	23.1	87.5	12.5	0	71.4	14.3	14.3	100	0	0

Table 4) The relationship between the prevalence of musculoskeletal disorders with a score of physical activity and REBA method for each organ of the barber's body

Organ	Prevalence (percent)	Variable	P. value
Neck	87.5	Physical activity Score	<b>0.305</b>
		REBAs Score	<b>0.254</b>
Shoulder	95	Physical activity Score	<b>0.917</b>
		REBAs Score	<b>0.05</b>
Elbow	72.5	Physical activity Score	<b>0.026</b>
		REBAs Score	<b>0.035</b>
Wrist / Hand	81.2	Physical activity Score	<b>0.025</b>
		REBAs Score	<b>0.272</b>
Back	46.3	Physical activity Score	<b>0.213</b>
		REBAs Score	<b>0.834</b>
Waist	95	Physical activity Score	<b>0.029</b>
		REBAs Score	<b>0.702</b>
buttocks / Thigh	42.5	Physical activity Score	<b>0.030</b>
		REBAs Score	<b>0.800</b>
Knee	47.5	Physical activity Score	<b>0.031</b>
		REBAs Score	<b>0.933</b>
Leg	92.5	Physical activity Score	<b>0.261</b>
		REBAs Score	<b>0.958</b>
Ankle	33.8	Physical activity Score	<b>0.140</b>
		REBAs Score	<b>0.119</b>

The results of measurements of physical activity showed that 56.25% of people with low physical activity, 27.5% moderate and 16.25% of barbers had high physical activity. Also, the prevalence of musculoskeletal disorders and the pain and discomfort severity among barbers according to the level of physical activity for each organ are presented in Table 3.

The results of the relationship between the prevalence of musculoskeletal disorders for every organ of the barber's body with the score of physical activity and REBA method are shown in table 4.

## Discussion

The results showed that all barbers have a symptom of work-related musculoskeletal disorders in various sections of their body. These results have also been mentioned in the research of Froresh et al (12,24). A study that was carried out by Margaret Best and colleagues in Australia on barbers showed that the majority (approximately 70 percent) of barbers suffer from musculoskeletal disorders (25). The results of the prevalence of musculoskeletal disorders in barbers by Nordic questionnaire showed that the highest prevalence of WRMSDs exists in the shoulder and waist areas (95 percent) and parts of legs, neck, wrists/hands, elbows, knees, back, buttock/thighs and ankle has the prevalence of 92.5%, 87.5%, 81.2%, 72.5%, 47.5%, 46.3%, 42.5%, 33.8% respectively. In the study of Hokmabadi and colleagues, there are also the most discomfort is in the area of the legs, back, shoulders, neck and wrist/hand (9), and in Froresh and colleagues study the highest prevalence of musculoskeletal disorders are reported in elbow, wrist/hands, neck, shoulders and back, respectively (12). A study of Hisao lin fang and colleagues between barbers showed that there is the highest prevalence of musculoskeletal disorders in the part of shoulders and waist (10). There is also a significant correlation between the results of

this study with the results of the Gisele Mussi and colleagues' research in the neck and shoulder (26). However, the results showed that the upper limbs of the barbers are in exposure to lots of ergonomic risk factors, so, the cause of this disorder can long-term work at heights above the shoulders height, lack of standard seats and standard equipment, etc.

The results of the study of the relationship between demographic variables of barbers (Table 1) and musculoskeletal disorders in different sections of the body are similar to Froresh and Hokmabadi studies (9,12), with the average of age was no significant relationship in other sections, and the only difference in meaningful relation were found in wrist ( $p=0.028$ ) and neck ( $p=0.019$ ). A significant relationship was observed between weight and impaired neck ( $p=0.035$ ) and there was no significant relationship in other sections of body, similar to Froresh et al. research (12). There was a significant relationship between height and disorder in the neck ( $p=0.009$ ), and in other areas there was not a significant relationship, the reasons of this issue could be the lack of adjustable seat and bent over the neck of tall barbers. There was not a significant relationship between work experience and musculoskeletal disorders, similar to Hokmabadi and Miri researches (9,14). The only significant relationship was observed between work experience and musculoskeletal disorders in the knee ( $p=0.026$ ) and wrist ( $p=0.049$ ) similar to Froresh et al. research (12). In the section of Knee, one important reason for this difference can be attributed to higher work experience of barbers in this research. Also, there was not a significant relationship between average hours worked per day and musculoskeletal disorders, so, it was not matched with the results of the Hokmabadi et al research (9). There was a significant relationship between BMI and musculoskeletal disorders in Knee ( $p=0.023$ ) and Waist ( $p=0.011$ ).



The results of posture assessment showed that 28.7% of barbers are in low-risk levels and 71.3% of them are in a medium risk level, similar to Hokmabadi et al. and Froesh et al. researches (9,12) in the medium risk level. In addition, there was a significant relationship between the risk levels of REBA method and musculoskeletal disorders in the elbow ( $p=0.035$ ) and shoulders ( $p=0.05$ ), similar to Hokmabadi et al research (9) in the part of shoulders. As regards that the most of barbers were in the moderate risk level, taking corrective measures is essential. In the absence of timely and suitable corrective action, increase the prevalence and severity of this work-related disorders during the time (due to accumulative property of musculoskeletal disorders) among barbers is expected.

One advantage of this study is considering the important factor as physical activity and its role in the development of musculoskeletal disorders of barbers that has not been studied in this community. In a study of physical activity, the results showed that the majority of participants (56.25 percent) had a low physical activity; they had the most prevalent of musculoskeletal disorder and severity of pain and discomfort in their limbs. The results show that increased physical activity effectively reduced the musculoskeletal disorder in the waist, buttock/thighs and ankles. Prevalence of disorders in other organs (except the legs) among those who had higher physical activity was less (Table 3). The results showed that pain intensity in who with more physical activity, is low, these barbers did not have much pain severity in any of their organs (except the back). The results of the data analysis indicate that there was a significant relationship between physical activity and the WRMSDs in knee, wrist, waist, elbow and buttocks/thigh ( $P$ -value $<0.05$ ). The results of the Arokoski and colleagues research also represents a significant relationship between physical activity and musculoskeletal disorders in the barbers (People who have more physically active have

less musculoskeletal disorders) (27). Also, the study that was conducted by Cristina et al between dental practitioners, indicated that dentists who have regular exercisers have a more fitness and the prevalence of musculoskeletal disorders was lower as compared to those who did not exercise (28).

The more prevalence of musculoskeletal disorders shows that barbers are in contact with high volumes of ergonomic risk factors. Moreover to poor posture during the work, work at height higher than the shoulders, lack of standard seats and standard equipment and other factors also play a role in the creating of musculoskeletal disorders such as pressure or repetitive force when shaving (squeezing the fingers when shaving) and exposure to vibration (for example, when using a hair dryer and shaver hands are exposed to vibration). Margaret Best, in her study, reported that the cause of these disorders, among barbers, is the long-term standing during the work and improper posture (25). Deschamps and colleagues have reported in their study that prevalence of musculoskeletal disorders in the barbers is due to many factors such as poor working conditions, long working hours, inadequate education and lack of medical examinations (29). These risk factors can be reduced with standard equipment design, planning time for short breaks at work and provide the necessary training for barbers about how to use the equipment and maintain the proper posture in the working times. Also, the results of this research showed that increasing the physical activity can be an effective step in decreasing the prevalence of musculoskeletal disorders among barbers.

## Conclusion

This research indicates a more prevalence of WRMSDs in the upper limbs of barbers. These conditions can be lead to physical fatigue, burnout and job absenteeism. Also, barbers with higher levels of physical activity have

lower levels of WRMSDs. Based on these results, controlling measures such as chair and equipment re-design, use of adjustable chair, design the training programs for keeping the proper posture during the work and changing of standing to sitting works are necessary. According to the results, increasing the physical activity can be an effective step in decreasing the prevalence of musculoskeletal disorders among barbers.

## Footnotes

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