

## Evaluation of the risk of musculoskeletal disorders using Rapid Entire Body Assessment among hairdressers in Khorramabad, Iran, in 2014

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### Abstract

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**Background:** Work-related musculoskeletal disorders (WRMSDs) are considered a major factor in health problems, human injuries, and loss of work time. The aim of the present study was to assess the risk of musculoskeletal disorder (MSD) and evaluate the prevalence of MSD among female hairdressers.

**Materials and Methods:** In this descriptive analytical study, the risk of MSDs was evaluated in 172 female hairdressers using the Rapid Entire Body Assessment (REBA) method. Moreover, the prevalence of WRMSDs was investigated using a Nordic questionnaire. All obtained data was analyzed by means of SPSS software, and the logistic regression model.

**Results:** The results showed that 58.7% of the hairdressers experienced pain in their lower back, 52.3% in their neck, 41.3% in their knees, and 20.3% in their ankle. The results of this study showed a significant correlation between BMI and MSDs in the elbow, hip, and thigh. The results of REBA indicate that about 46% of the 1032 postures were classified as high risk and about 14.9% as very high risk. In addition, the results of this study showed a significant correlation between REBA score and MSDs in the neck, wrist, hip, and thigh.

**Conclusions:** With regard to the high prevalence of symptoms in the waist, neck, and wrist, it can be concluded that prolonged standing, uncomfortable working postures, strenuous movements, excessive shoulder flexion and shoulder abduction, trunk flexion and forceful exertion, and repetitive motion are considered important risk factors for MSDs.

**Keywords:** Risk, Body, Assessment, Musculoskeletal Disorders.

### Introduction

Work-related musculoskeletal disorders (WRMSDs) are one of the major occupational health problems in many countries and musculoskeletal disorders (MSDs) are common among hairdressers (1, 2).

Hairdressers are exposed to various hazards in the workplace such as awkward posture, load on the muscles, nerves, tendons, and joints, prolonged standing, and physical and chemical agents (3). Leino stated that hairdressers are exposed to chemical and ergonomic agents

and work-related disorders, although the risk of WRMSDs was the greatest among them (4). According to the results of a National Health Interview Survey In 2002 by Guo, of the top 15 major occupations, female hairdressers were the third most at risk for work-related lower back pain (5). Pain and discomfort in the neck, wrist/hand, and lower back region were

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commonly reported by Greek hairdressers. These were related to prolonged sitting, upper arms elevation, inappropriate body postures, and use of vibrating tools (6). According to another research, manual material handling, prolonged standing, awkward working postures, strenuous movements, excessive shoulder flexion and abduction, trunk flexion and forceful exertion, and repetitive motion are considered common risk factors for MSDs (7). In addition, working with upper arms above shoulder height is considered a major risk factor for neck and shoulder pain (8, 9). Moreover, most studies stated that the static activity of the muscles of the neck and shoulder and static loadings restrict blood flow to the muscles and tendons, and mechanical stress on the shoulder muscles or tendons could possibly be due to pathophysiological mechanisms (10).

Work is an important and integral segment of human life, but the development of technology has caused an increase in occupational diseases and WRMSDs are the most common among them (11, 12). In this regard, MSDs among hairdressers can be mentioned. A study assessing the risk factors of WMSDs for hairdressers stated that 91.7% of hairdressers reported shoulder pain as the most frequent problem followed by pain in the lower back (83.3%) and in the neck region (75%) (13).

Furthermore, other studies stated that inappropriate posture during work, repetitive movements, improper and long standing, use of inappropriate tools, working with the elbow above shoulder height, excessive shoulder flexion and shoulder abduction, and pronation and supination are considered important risk factors for WRMSDs among hairdressers (14, 15). These disorders can be prevented by the use of ergonomics such as risk assessment methods, job analysis methods, evaluation of work situations, and improvement of job situations (14, 15).

Therefore, the aim of this study was to assess the risk of MSD by using Rapid Entire Body Assessment (REBA) method and evaluate the

prevalence of MSD among female hairdressers by using a Nordic Questionnaire.

## Materials and Methods

This descriptive analysis study was performed in 2014. First, the list of all the hairdressers working in Khorramabad, Iran, was obtained through a trade association. The number of female hairdressers in Khorramabad was 300. From among them, 172 subjects were selected through census sampling method according to the following equation:

$$n = \frac{Nz^2pq}{d^2(N-1) + Z^2pq} = 172$$

In this equation,  $p = 0.5$ ,  $q = 0.5$ ,  $z = 2$ ,  $d = 0.05$ , and  $N = 300$ . All subjects possessed professional certificates. The MSDs of these 172 female hairdressers were evaluated. All tasks were observed by a trained occupational health and safety practitioner. In first step, the owner of each hairdressing salon was contacted to obtain permission to interview the hairdressers. In the second step, a meeting was held with the hairdressers to invite them to take part in the study and explain the objectives of the study. Data were collected using a Nordic Questionnaire for Musculoskeletal Symptoms of Pain or Discomfort.

The validity and reliability of the questionnaire have been determined in various studies (16-18). After the end of data collection, the prevalence of WRMDs for neck, shoulder, upper back, lower back, elbow/forearm, hand/wrist, and fingers were calculated. Then, ergonomic analyses of the work of the hairdressers were carried out. Next, the risk of MSDs was evaluated using the REBA method. The REBA is a posture-based analysis technique used for the evaluation of the risk of MSDs in various tasks, in particular for assessment of working postures in health care and other services in the work place (19, 20).

**Table 1: Rapid Entire Body Assessment (REBA) scores and indications**

Score	Risk level	Action level	Actions
1	None risk	0	Not necessary
2 to 3	Lower risk	1	Can be necessary
4 to 7	Medium risk	2	It is necessary
8 to 10	High risk	3	It is necessary to be done fast
11 to 15	Very high risk	4	It is urgent

This ergonomic method is a systematic tool which is used to evaluate whole body postural WRMSDs and risks associated with occupational tasks. In this method, a single page worksheet is used to evaluate required or selected body postures, forceful exertions, type of movement, muscle activity (static/dynamic), repetition, and coupling. The REBA worksheet is divided into 2 body segment sections labeled A and B. Section A covers the neck, trunk, and leg. Section B covers the arm and

wrist. Postures of hairdressers body regions are observed and postural scores increase with regarded to other items such as forceful exertions, type of movement, muscle activity (static/dynamic), repetition, and coupling. The scores are summed up to give one score for each posture (21). The obtained scores are compared in table 1. All data obtained was analyzed by means of SPSS software (version 16, SPSS Inc., Chicago, IL, USA) and logistic regression model.

**Table 2: Demographics of hairdressers (n = 172)**

Index	N	SD ± Mean	Min	Max
Age (year)	172	7.99 ± 32.36	18	68
Weight (kg)	172	1.08 ± 65.73	41.00	112.00
Height (m)	172	0.63 ± 1.63	1.39	1.78

**Results**

In the present study, 172 female hairdressers participated. They were on average aged 32.36 years. Table 2 shows the mean and standard

deviations of age, weight, and height. The prevalence of WRMDs for neck, shoulder, back, elbow/forearm, and hand/wrist is presented in table 3.

**Table 3: Prevalence of work-related musculoskeletal disorders (WRMSDs) for neck, shoulder, back, elbow/forearm, and hand/ wrist in the hairdressers (n = 172)**

Limb	Region	Musculoskeletal disorders	
		N	(%)
Neck	-	90	52.3
	right	32	18.6
Shoulder	left	18	10.5
	both	35	20.3
Elbow	right	12	7
	left	5	2.9
	both	7	4.1
Wrist and hand	right	49	28.5
	left	9	5.2
	both	26	15.1
Upper back	-	68	39.5
Lower back	-	101	58.7
Hip and thigh	-	31	18
Knee	-	71	41.3
Leg	-	35	20.3

Table 4: Frequency distribution of risk in the each of the postures

Task	Low level risk (action level 1)		Moderate level risk (action level 2)		High level risk (action level 3)		Very High level risk (action level 4)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Trimming eyebrows	8	4.6	79	45.7	82	47.4	3	1.7
Trimming face	9	5.2	57	33.1	90	52.3	16	9.3
Makeup	7	4.1	74	43	83	48.3	8	4.4
Hair-cutting	18	10.5	44	25.6	77	44.8	33	19.2
Hairdressing	4	2.3	49	28.3	64	37	55	31.8
Hair-coloring	7	4.1	52	30.2	79	45.9	34	19.8

After the end of the initial survey and interview with hairdressers, ergonomic analyses of the work of the hairdressers in 6 important tasks were carried out according to services offered (such as trimming, makeup, hair-cutting, hair-coloring, and hair-perming). The risk of MSDs by using RULA is presented

in table 4 in the each of 6 tasks. In total, 1032 postures were evaluated. The risks of MSDs, using RULA, are presented in table 5 in the 1032 postures. According to table 5, most of the studied postures are classified as medium (34.4%) and high risk postures (46%).

Table 5: Percentage of risk of Rapid Entire Body Assessment (REBA) outputs (n = 1032 postures)

Risk level	Action Level	Number of task	Percentage of task
No risk	0	0	0
Low risk	1	53	5.1
Medium risk	2	355	34.4
High risk	3	475	46
Very high risk	4	149	14.9

The results of logistic back ward logistic regression analyses on risk factors of musculoskeletal disorder for the body regions such as wrists, forearms, elbows, shoulders, neck, trunk, back, legs, and knees are

presented in table 6. Table 7 shows the results of logistic back ward logistic regression analyses on the musculoskeletal disorder for different regions of the body and REBA scores in each task.

Table 6: Analysis of statistical value between musculoskeletal disorder (MSD) and age, weight, height, and BMI

Measured index	Statistical value	Musculoskeletal disorders in different regions of the body								
		Neck	Shoulder	Elbow	wrist and hand	Upper back	Lower back	Hip and thigh	Knee	Leg
Age (year)	P-value	0.01	0.025	0.358	0.095	0.388	0.117	0.036	0.02	0.882
	N	172	172	172	172	172	172	172	172	172
Weight (kg)	P-value	0.431	0.757	0.058	0.203	0.148	0.202	0.030	0.129	0.694
	N	172	172	172	172	172	172	172	172	172
Height (m)	P-value	0.698	0.763	0.087	0.196	0.130	0.138	0.034	0.145	0.644
	N	172	172	172	172	172	172	172	172	172
BMI	P-value	0.368	0.826	0.053	0.213	0.149	0.232	0.039	0.109	0.695
	N	172	172	172	172	172	172	172	172	172

Table 7: Analysis of statistical value between musculoskeletal disorder (MSD) in the regions of body and Rapid Entire Body Assessment (REBA) Scores in each task

Measured index	statistical value	Musculoskeletal disorders in different region of the body								
		Neck	Shoulder	Elbow	wrist and hand	Upper back	Lower back	Hip and thigh	Knee	Leg
REBA score (Trimming eyebrows)	OR	1.238	1.028	1.234	1.329	1.081	1.114	1.086	1.107	1.378
	P-value	0.021	0.820	0.265	0.025	0.542	0.379	0.651	0.433	0.001
	N	172	172	172	172	172	172	172	172	172
REBA score (Trimming face)	OR	0.910	0.927	0.792	0.811	0.939	0.963	0.963	0.956	1.288
	P-value	0.469	0.542	0.224	0.102	0.626	0.765	0.828	0.729	0.144
	N	172	172	172	172	172	172	172	172	172
REBA score (Make up)	OR	1.026	1.177	1.043	0.833	1.215	0.942	1.144	1.052	0.804
	P-value	1.837	0.019	0.832	0.152	0.007	0.628	0.446	0.698	0.259
	N	172	172	172	172	172	172	172	172	172
REBA score (Hair-cutting)	OR	1.299	1.090	1.443	1.208	1.217	1.099	0.806	1.084	1.073
	P-value	0.041	0.539	0.098	0.051	0.176	0.085	0.261	0.586	0.703
	N	172	172	172	172	172	172	172	172	172
REBA score (Hairdressing)	OR	1.040	1.012	0.825	0.988	1.070	0.979	1.357	1.152	1.078
	P-value	0.795	0.935	0.377	0.935	0.655	0.886	0.004	0.079	0.700
	N	172	172	172	172	172	172	172	172	172
REBA score (Hair-coloring)	OR	0.709	0.892	0.923	0.944	0.834	0.968	0.948	0.988	0.815
	P-value	0.009	0.403	0.690	0.676	0.207	0.811	0.790	0.935	0.258
	N	172	172	172	172	172	172	172	172	172

## Discussion

In the present study, 58.7% of the hairdressers experienced pain in their lower back, 52.3% in their neck, 41.3% in their knees, 20.3% in their ankle, 28.5% in their dominant right wrist and hand, 5.2% in their left wrist and hand, and 15.1% in both their wrists and hands. About 20.3% of hairdressers experienced pain in both their shoulders. The results of a similar survey conducted by Mussi revealed that most of the discomfort is experienced in the shoulders (49%), neck (47%), and back (39%) (22).

According to the research by Chuang, 94.4% of hairdressers stated that they felt the greatest discomfort in their shoulders, followed by the lower back and neck (23).

Kang evaluated the prevalence of work-related symptoms among hairdressers (24). The exposed group comprised 184 hair salon employees in 6 districts of Pusan city, and the non-exposed group comprised 119 individuals living in the same areas. They reported that the prevalence of musculoskeletal symptoms among Korean hairdressers was 59.9% in the neck, 76.6% in shoulders, 41.2% upper back, 72.2% lower back, 31.3% arm and elbow, 44.2% wrist, 35.0% finger, and 71.1% in legs (24).

According to the study by Hokm Abadi, the prevalence of disorders in different parts of the body was as follows: 8% in the wrist, 20% the neck, 36% shoulders, 46% back, and 84% in the legs (25). In a similar study by Miri, the prevalence of WRMSD in different regions of body was as follows: 21% in the neck, 31% shoulders, 6% wrist, 54% back, and 69% in the legs (26).

On the other hand, in the present study, the results of REBA indicate that a high percentage of hairdressers are at high to very high risk of MSDs. Only about 46% of the 1032 postures were classified as the action category/level 3 (high risk) and about 14.9% of the postures were classified as action level 4 (very high risk) which requires immediate corrective change in postures, but about 34.4% of the postures were classified as action level 2

(medium risk) by REBA. Results of a similar study conducted by Hokm Abadi showed that about 56% of the postures related to the right side of the body were classified as medium level and about 30% as high level, but about 76% of the postures related to the left side of the body were classified as medium level and about 16% as high level using REBA (25). Furthermore, the results of the study by Miri showed that about 42% of the postures related to the right side of the body were classified as medium level and about 38% as high level, but about 46% of the postures related to the left side of the body were classified as medium level and about 40% as high level using REBA (26). Nevertheless, in the research by Frvarsh, about 27.6% of the postures were classified as action level 2-3 (medium risk-high risk) using REBA (27).

The results of this study showed a significant correlation between BMI and MSDs in the elbow, hip, and thigh. The finding of this study revealed a significant correlation between age and MSDs in the knee, shoulder, and neck.

Moreover, the results of this study showed a significant correlation between REBA score and MSDs in the neck, wrist, hip, and thigh.

The study by Miri demonstrated a significant correlation between duration of work and MSDs in the leg (26). It also showed a significant correlation between REBA score and MSDs in the legs and wrist (26).

According to the research by Best, 70% of hairdressers suffered from MSDs (28). In addition, uncomfortable working posture and standing for a long period of time are the greatest causes of MRMSDs in hairdressers (28).

Uncomfortable working posture, standing for a long period of time, unsuitable tools and equipment such as unsuitable chairs, clipper, razors, blow-dryer, and scissors, and working with a shoulder or shoulders raised, bending forward or sideways, bending the head forward or sideways, and twisting the neck can led to high risk score in hairdressers.

## Conclusions

With regard to the results obtained in this study, it is concluded that the hairdressers are at high risk of MSDs. Furthermore, in order to reduce WRMSDs, risk level should be reduced through design and using of ergonomic and appropriate tools and equipment.

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**Conflict of interest:** Non declared

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