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MEASUREMENT OF CHAIR DIMENSIONS USED BY NURSES AND COMPARING WITH ANSI / HFES100 STANDARD

Azar Mehrabi Matin[1], Zeinab Nazari[1], Mohammad Hossein Ebrahimi[2], Mohsen Poursadeghiyan[3], Hamed Yarmohammadi*[1], Mehdi Raei[4]

[1]Student Research Committee, Department of Occupational Health, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran

[2]M.D, Occupational and Environmental Health Research Center, Shahroud University of Medical Sciences, Shahroud, Iran.

[3]PhD, Department of Ergonomics, School of Rehabilitation, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran.

[4]M.Sc, Department of Biostatistics, School of Medicine, Qom University of Medical Sciences, Qom, Iran.

Email: yarmohammadi68@yahoo.com

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Abstract

Introduction: Appropriate designing of chairs and matching them with anthropometric characteristics not only promote the quality of services and prevent musculoskeletal disorders but also improve people health. The present study done aimed to determine the dimensions of the chairs used by nurses and compare it with the standard of ANSI / HFES100.

Methods: The study, a descriptive - analytical one, was performed cross-sectional. 238 seats used in the hospital using the checklist, which contains 6 parameters, were evaluated in comparison with ANSI / HFS100 standard. In addition, the Nordic Questionnaire was distributed among 111 nurses to determine the prevalence of musculoskeletal disorders. At the end, the obtained data were analyzed using SPSS16 statistical software.

Results: The results showed that 01/92% of the horizontal displacement in the rear seat, 100% of vertical displacement, and 100% of vertical and horizontal displacement in armrests of the chair were non-standard. Furthermore, 22/57% did not set a suitable base height. Also, 11/44% of chair legs were not moved easily on the surface. In addition, depth, width, backrest width, height and rear length mean were 42, 1/44, 07/38 , 85/49 and 4/29 respectively.

Results and Discussion: Due to the fact that in our evaluation, the chairs used in the hospital were not on the standard level, it is recommended to purchase appropriate ergonomic chairs to enhance level of satisfaction, health and working efficiency of the nurses.

Keywords: chairs, hospital, ANSI / HFS100.

Introduction

Ergonomics is defined as obeying principles that prevent diseases, and accidents, increase productivity, and create working fitness to the workers (1). Designing worksite in such a way that is convenient and helps to more productivity of work force is the basic philosophy of ergonomics. It is desirable the work station to be designed in such a way that is both physically and mentally appropriate and fit to the staff (2). While the comfort, physical health, welfare and productivity as a result of matching between the equipment and users is significantly increased (3), needed accessories and fittings are designed according to scientific measurement of body or anthropometry. Therefore, consumed materials must be so designed that have physical conformity to a large number of people. Ergonomics improves more productivity of products and the staff. Most of discomforts such as backache, the prevalence of pain in shoulders and neck, and other parts of the body can arise from not following ergonomic issues while making products like tables and chairs. Usually, the used chairs are not fitted to the standard posture or they are not matched with human engineering principles, due to the fact that their dimensions are not coordinated to the physical aspects of the users (4). The main target of chair designers should include manufacturing based on different dimensions and sizes. Chair manufacturers try to make chairs which are adjustable in several important aspects. Since the products can be used by different people; as a result, designers should consider working requirements to along with the anatomical and anthropometric details of users. During the recent years, different companies design and provide office and educational chairs, and they generally claim that the chairs are made on the basis of ergonomic principles. However, so far, the truth of this claim has less been considered. Not applying anthropometric data for product designing can cause to waste various resources including financial, human, and time ones (5). One of the effective pillars in the health and therapeutic centers, to achieve organizational strategies is nursing profession; the task which maintains, promotes and rehabilitates patient health. Therefore, nurses' satisfaction and health can work directly and indirectly to achieve higher goals for the organization. In a study, Dr. Majid Motamedzadeh and his colleagues investigated designing and making ergonomic chairs matched with Iranian officials physical dimensions. The level of satisfaction of 60 employees before and after using ergonomic chairs was measured which showed staff's satisfaction about the made chair (6). Static posture and long time sitting in a forward bending mode that most nurses have, causes the creation of physiological tension of muscles, ligaments and discs. Sitting people inclining their hands (arms, wrists and elbow) and shoulders forward accelerate the rate of deformity in their bodies and start to crouch. To

overcome this kind of deformity, tables and chairs must have optimized height; and, standard factors should be considered in order to give the muscles an ordinary and relaxing position (7). The results of a study by Seyed Hamid Sharifnia and his colleagues in 1389, on 400 nurses in the city of Amol, showed that 81% of nurses have suffered back pain, 5/29 wrist pain, 50 neck pain, 5/35 shoulder pain, and 5/63 knee pain, respectively. Which shows musculoskeletal disorders as one of the serious difficulties of nursing profession (8). Abolfazl Rahimi et al. in 1384 carried out a research on 180 nurses in Hamadan hospitals. Results showed that 1/51 cases of nursing profession started to suffer pain in their spine, starting the job, which have been the most common local pain in the back. It was demonstrated that 9/48 percent of cases had average self-awareness about right principles of caring their spine; whereas, 7.6 percent of them always apply the principles (9). Regarding the point that standard chairs can increase satisfaction, health and efficiency, it is requisite to determine the chairs dimensions used by nurses and to compare it with ANSI / HFES100 standard.

Methods

The present study was conducted based on a descriptive and cross-sectional method in 1392. Information was collected in two parts as follows: a) investigating the amount of spread musculoskeletal disorders (to gather data, Nordic standard questionnaire was used and 111 nurses of hospital sections, who were selected on being available, answered the questions respectively. Collected data were calculated and analyzed in terms of percentage. b) Ergonomically evaluation of chairs (in this part, 238 chairs were investigated using a checklist, containing 6 parameters compared with standard ANSI / HFS 100 (10), and chairs used by nurses were evaluated, too). Finally, the obtained information was analyzed using SPSS16 statistical software.

Results

Demographic properties, ANSI / HFS 100 recommendations on the components of chair, an average size of chairs, and the prevalence of musculoskeletal disorders are represented in tables 1, 2, 3, 4 and 5, respectively.

Table1. Demographic characteristics of nurses N: 111.

Row	Variable	Mean	Standard deviation	The least	The most
1	weight	200/65	59/12	47	132
2	stature	5/163	7.7	149	189
3	age	5/30	5.5	23	47
4	work experience	92/6	87/4	2	26

5	daily work	4/7	72/1	4	13
6	sitting work	2/6	5/3	5/0	17

Table 2. Recommendations on the chair components based on ANSI / HFS100 standard.

Row	Chair components	Standard
1	seat	The chair seat must be height adjustable and let you put your feet on the floor in a flat position.
2	backrest	The chair backrest must be adaptable to move horizontally and vertically in order to support the waist and back conveniently in different sitting positions.
3	armrests	Armrests must be adjustable horizontally and vertically and permit you to put your shoulders constantly close to the body and be in a relax mode.
4	legs	The chair should have five wheel legs which permit you to move on the floor easily.

Table 3. Mean of measured chairs' dimensions (n238).

Row	The measured dimensions	Mean	Standard deviation	The least	The Most
1	The least height (chair)	2/48	09/9	39	58
2	The most height (chair)	57/50	7.6	44	39
3	depth	42	15/1	40	43
4	width	1/44	79/2	40	47
5	backrest width	07/38	12/2	35	41
6	backrest height	85/49	4/6	38	57
7	armrest length	4/29	36/3	26	35

Table 4. Results of the assessment of used chairs (n238).

Row	Chair	Position	Condition	Percentage
1	backrest	horizontal movement	standard	9.7
			non-standard	01/92
		vertical movement	standard	0
			non-standard	100

2	armrests	horizontal movement	standard	0
			non-standard	100
		vertical movement	standard	0
			non-standard	100
3	seat	adjustable height	standard	78/45
			non-standard	22/57
4	chair leg	easy movabilityon the floor	standard	89/55
			non-standard	11/44

Table5. Resultsof the spread of musculoskeletal disorders (n: 111people).

Row	Painful organ	Suffering musculoskeletal disordersduring the last12months	Giving up job orpleasureactivitiesdue todiscomfort during the last12months
1	knee	78/55	53/25
2	waist	18/71	16/44
3	neck	36/51	54/22
4	back	87/64	54/
5	elbow	83/19	33/24
6	shoulder	56/39	47/14

Mentioned numbers of the table have been expressed in terms of percentage. According to table 4, the maximum pain is in back organ, 71/1 percent and the minimum pain is of elbow 19/8, respectively.

Results and Discussion

Sitting is a kind of habit all we experience several times daily. Each British citizen spends average 41 years of his/her life sitting. In other words, each person stands up average 5 hours daily, 5/12 and 5/6 hours sits, and 6/5 hours sleeps (17). For some people, based on their jobs, the process takes long and continuous time, and shows several musculoskeletal problems resulting from changing the natural posture of different parts of body (18, 19). According to table 4, a large percentage of used chairs in various parameters are nonstandard, which means that they are not adjustable or they are not easily adjustable to be used by all users. More than 90 % of chairs could not be displaced horizontally and vertically, which causes lack of matching between back curvature with natural curvature of body spine in a large number of users, and does not properly support the back, resulting in inappropriate posture of users and making tension in waist, back, neck and shoulders' muscles. Repetition of this case for a long time can be one of

the important causes of making, or intensifying the musculoskeletal problems. The results show that back of all chairs' arms could not be moved horizontally and vertically. According to the current standard, if the chair arms are too high, it will cause muscular tension and fatigue of neck and shoulders, and if it is far away from the body, the user will be forced to bend forward to support his elbow. In this posture, arms are far from the body and cause the fatigue of shoulder and neck muscles; meanwhile, extra pressure is also imposed on waist, arm and shoulders. Furthermore, if arms are very close to the body, it will result in movement restrictions. Back of all checked chairs' arms are made from hard materials. According to the standard, the chair's arm should not be made of hard materials or should not have sharp points; because, it causes the stimulation of nerves and forearm blood arteries, and burning or pain of fingers and arms. According the results, 11/44 percent of the rated chairs' legs are non-standard, which means that they do not have five wheel legs or they do not provide easy movement. Based on the standard, the chair legs must be appropriate with the kind of workplace floor cover in order to provide the easy movement on the floor. The chair height is appropriate only in the case that the feet are quite on the floor and knee back is slightly higher the edge of the chair. On the basis of findings, 22/57 percent of chairs in this case did not have conformity with standard, which can cause disruption of leg blood circulation. The obtained results show that the most incompatibility with standard, were related to chair backrest, chair arm, and chair back, respectively. Without any doubt, applying non-standard equipment, such as chairs, can have a great influence on making and intensifying these disorders. Findings of this study show the most pain in back, and the lowest pain in the elbow, calculated 71/1 and 19/8 percent, respectively. According to the findings of this research, backache is the most spread, and the main cause of failing daily activities and work absence. Bad sitting and use of non-standard chairs can affect on its outbreak and intensification. According to Sharifnia.SH, et al study, being female increases the chance of catching neck pain and backache to 122% and 203%, respectively (14). Since a majority of nursing societies are the women who do a lot of work at home, it can be concluded that nonstandard equipment (such as chair) will give adverse impact on life quality of nurses and their families. The results of Abedini's study showed that the prevalence of musculoskeletal disorders is high among nursing personnel, which equals to 2/88 percent. The findings are in accordance with both the results of other studies and our study (20- 22). In addition, the prevalence of MSDs, based on the study of Choobineh et al. in 83-84 which was about the same nursing society matches with the findings of present research (23). In the present research, the highest and the lowest chair height obtained at 58 cm and39 cm, respectively. Chair height should not be more than the recommended ergonomic limit, because it imposes pressure on the lower part of thigh. Due to the pressure, blood

flow decreases in the lower organs of the body resulting in feet sleepy feeling, tingling and inflation (24). with decrease of chair height, the user will have willingness to bend his own waist more , will experience more problems for sitting down and standing up, and will need more empty space for his legs(25,26). In our study, the obtained average depth of chairs was 42 cm. chair depth should not be more than standard limits. If the depth is more or less than the recommend limit, there will be pressure on the popliteal part and lower part of thigh which leads to disorder of blood circulation system and problems of sitting and standing (27, 28). Most of the modern chairs are about 45 cm deep. Whereas, regarding the anthropometry dimensions, it should be 41 cm. The available references have mentioned the maximum amount of this dimension 43 cm. According to the previous studies, chair depth in our study was appropriate. In a study by Motamedzadeh et al., ergonomic chair were designed and made matching with physical dimensions of some companies' staff (29). Comparison of the obtained anthropometric dimensions of Motamedzadeh's research with the research by Sharifi, showed some dissimilarity in sizes. For example, in the study by Motamedzadeh the back height was 52 cm, while in our study it was between 38 to 57 cm. in our study, the back width was estimated between 35 to 41cm, in Motamedzadeh's study, back width was 45 cm and seat height was estimated 44 cm maximum. Other authentic references also mentioned backrest height 50 cm, and seat height 38 to 5/53 cm (30-31). Finally, it is suggested to increase the level of satisfaction, health and work efficiency among nurses by purchasing the chairs which are close to the ergonomic standards, to buy chairs with consultation by professional health expert of the center to have the most matching with the standard, and to educate people to sit right and to be informed about the risks caused from false sitting postures, all would have great impact on the decrease of musculoskeletal disorders. Doing exercises during work time, also, is of the factors which has effect on decreasing musculoskeletal disorders.

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Corresponding Author:
Hamed Yarmohammadi*,
Email: *yarmohammadi68@yahoo.com*