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Is librarians' health affected by ergonomic factors at the work place?

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Abstract:

Introduction: It is obvious that every professional worker is known as an active agent in production and productivity. Therefore; employers consider specifically the health of their staff and creating a suitable space in agreement with their physical and psychological characteristics. Librarianship is also among those professions. However; there should be more evidence in order to shed light on the importance of the ergonomic factors for all library managers and policy makers and moreover; make the staff both reach self-awareness and take the right action about the health of their career. The very aim of this study is to find out whether librarians' health is affected by the ergonomic factors or no?

Methods: This is a descriptive survey study. Musculoskeletal disorders were studied using a questionnaire and checklist designed based on NAYUSH and USHA standards. The questionnaire was composed of two parts: the first part included questions about demographic information and the second part included questions related to musculoskeletal disorders based on the Nordic questionnaire. The data were collected and analyzed using SPSS software, and the results were obtained.

Results: The study indicated that librarians' health is affected by ergonomic factors. 52.6% of the staff had some kinds of musculoskeletal symptoms and disorders. The greatest complications were on neck and back discomfort caused by working with improper working tools.

Conclusion: Despite the population being young, the incidence of complications was high and there was a meaningful relationship between increasing work experience and the incidence of experiencing musculoskeletal symptoms. Moreover; the working factors that affected different parts of the body were found mostly in the neck and back regions.

Key Words: Ergonomic Factors, Librarians, Iran,

1-Introduction

The disease and disorders which are the result of workplace are called "workplace problems". These problems are recognized when the incidence of a special problem among the specific group of workers become more than the public population. Musculoskeletal injury is one of these problems, for which there is no compensation in most countries (1). Annually, about 500000 workers in the USA suffer from injuries which are the result of hard working. About 60% of these injuries have occurred during lifting and 20% during pushing and pulling. (2). Around 30% to 50% of workers may face the risk of death (3). Working in hard and disturbing position could cause temporary problems in the whole body and with the passage of time it may lead to musculoskeletal and peripheral nervous problems and even disability. Thus; improper workplace lacking work standards could cause many problems and disorders. (4). Despite the focus on public awareness about occupational health, studies show that occupational injuries in librarians are increasing. In Washington, 50% of injuries lead to 85% of spending costs. Also 88% of these injuries are nonemergency; it means that these injuries appear with the passage of time, for example; Backache and wrist tunnel syndrome. (5). Studies show that musculoskeletal injury related to occupation may cause to waste time, increase costs and human sources injury and ergonomists through the world face these issues. (3). Unfortunately, managers are not usually aware of improper workplace which can reduce the yielding. Workers adapt themselves to inappropriate conditions but the costs of this adaptation are: increase in work time, decrease in work quality, increase in the injures (6) and decrease in health rate and quality of life .By using techniques that are able to analyze the workstation ergonomically, we can prevent these occupational injuries and improve yielding, thus the organization can achieve competitive qualities. (7) Some libraries such as Princeton library in the USA do some supporting effort for improving occupational health through their specific programs. This program is a tool for the recognition of risk factors that threat the university stuffs, a copy of

this program is presented to all of the librarian (8). But the condition of other libraries specially the developing countries and more specifically the condition of public libraries are not recognized. There is a need for more evidence for managers and people in charge to clear the importance of ergonomic factors for all of the managers and principals, so that they can plan the suitable program both to improve yielding and guarantee librarians's health. To create evidence and highlight the significance of the issue in this study we investigated public libraries situation in Hamadan city of Iran as a sample of a developing country context. Thus; the aim of this study is to investigate the effect of ergonomic factor on the incidence of musculoskeletal injury in librarians in Hamadan public libraries.

2. Literature Review

A review of literature on workers' ergonomic condition in related data base such as: Science Direct, SID (www.Sid.ir), Pub Med and Google Scholar show that there are many investigations about ergonomic factors in workplaces in industrial area. Therefore; we focus on the effect of ergonomic factors on the health in libraries. We include only the literature about the ergonomic factors and their relation with the incidence of musculoskeletal problems. Foad Dehghi's conducted a study among 300 workers in production in a household equipment industry with 150 men and women workers. In his study the QEC method (screening tool for ergonomic risk in musculoskeletal system) was used for evaluating the effect of occupational risk factors on the body. Both QEC method, and the Nordic questionnaire are used. The results show that 85.3% of workers have musculoskeletal problems but only 25.3% of whom consulted a physician. (9).

The results of another study in lab workers in teaching hospitals in Kermanshah University showed that workstations are improper and 91.9% of workers have no suitable workplace. The study used the Nordic questionnaire for the evaluation of ergonomic factors (10). Another study about ergonomic conditions of libraries showed that those who work more than 3 hours a day face visual, joint and skin problems, also they have joint pain and stress. They suffer from epilepsy because of sensitivity to light. One of the disadvantages of this study is that there is no

reference to any method (11). Alamolhodai studied the ergonomic factors in workplace along with problems related to working by computer in 13 librarians in central libraries in the universities of Tehran. Results showed that in these libraries most of workers work with computer more than 3 hours a day. In 60.6% of libraries there is no turn in work, 72.7% of them have suitable position when working with computer and 42,6% of them face work problems. In this study the Nordic questionnaire and the check list based on OSHA and NYOSH standard are also used (12). In the study in librarians in library in Cornell University, the results showed that when the paper lists were changed into computerized ones, 25% of librarians were in therapeutic condition. And more than 70% of them changed their workplace. At the time there is no standard for workplace and workstation (13). Adeym (2010) studied the ergonomic condition in librarians, library stuffs and system engineers in Logos and Covenant University. His study indicated that in both universities there are ergonomic problems such as: stretch, pressure, headache and other problems. Most of these problems are the result of unsuitable chairs, hard working, unsuitable position and having no support for computer screen (14). In another study in Cornell university about 58 libraries, the results showed that in about half of the sample (44. 7%), only 1 staff faced occupational problems and in 55. 7% of them at least once a week, faced occupational problems (15). Studies about the literature reviews showed that there is not enough investigation about the effect of ergonomic factors on musculoskeletal disorders in librarians especially in Iran. The review of study showed that there is no study about the effect of ergonomic factors on the musculoskeletal injuries in public libraries especially in Iran. Therefore; this study is unique and essential in its kind.

The aim of this study is to investigate the ergonomic factors and their effect on the incidence of musculoskeletal problems in Hamadan. This study will answer the following questions:

- 1-**What is the amount of the incident of musculoskeletal disorders in librarians?
- 2-** Is there a meaningful relation between musculoskeletal disorders and personal properties of librarians?

3- Is there a meaningful relation between work equipment and musculoskeletal disorders in librarians?

3- Methods

The study is a cross-sectional survey, it uses analytical-descriptive methods. The study was conducted from November 20th to December 25 in 2011(=Azar 1390 in Iranian Calendar). All librarians were included in the study by being designated as a librarian and working in at least one of public libraries in Hamadan city of Iran. Therefore; we did not have any sampling. Data were collected by questionnaires tool. The questionnaires were presented to librarians and collected after being answered, (after about 1 month). The total questions were divided into two parts: I) Part one was about background information including age, gender, marital status, education level and duration of employment. II) Part two included questions about muscular disorders based on Nordic standard questionnaire, Nordic questionnaire is one of the most current tools for the evaluation of musculoskeletal disorders. We used Likert scale (0-6) to score the answered questionnaires. The librarians' musculoskeletal conditions were graded upon being very comfortable, comfortable, rather comfortable, natural, and a little uncomfortable, uncomfortable and very uncomfortable. The Nordic questionnaire focuses on 17 points of body. In this study , we assessed only the 7 points which are related to muscular and skeletal points.

In this investigation the musculoskeletal problems during filing weren't studied (due to being an obsolete method), and only musculoskeletal problems during working with computer, putting the books into the bookshelves and arranging books are investigated by Nordic questionnaire. Nordic questionnaire uses the 6 points in Likert scale, i.e. very comfortable, comfortable, rather comfortable and natural. For easier analysis, we consider these 6 points such as: lack of discomfort, a little uncomfortable, uncomfortable and very uncomfortable such as: the existence of discomfort and pain, so upon these 6 points there are 2 classes in this study:

- 1- The existence of discomfort
- 2- lack of discomfort.

For the validity conformation of questionnaire, the content validity was used and the idea of professionals was induced. For the reliability evaluation of the questionnaire, the pilot study was done. Data were reported by frequency tables, frequency percent, graphs, dispersion index and central index.

The relation among variables was analyzed by suitable statistical criteria such as: Mean (standard deviation) and frequency for quantitative and qualitative variables. For investigating the relation of existing or not existing the musculoskeletal symptoms with demographic variables, and the relation of pain intensity with variable demographic area, regarding the nature

of demographic variable, the Chi Square test along with precise P-value was used and the Data were analyzed by SPSS13 software. $P < 0.05$ was meaningful.

4- Results

4-1- Basic Information

Total number of 112 librarians, all of the librarians in public libraries in Hamadan, answered the questionnaire. The number of 48 (43%) were men and 64 (57%) were women. The mean age was 25-35 years. The education levels of librarians were as follows: master degree (8%) , bachelor degree (65.2%), associate degree(18.8%), and diploma and lower(8%). In both female and male groups, most of the librarians (51.8%) had 5-1 years of experience and 7.1% of librarians had 21-29 years of experience.

4-2- The Incidence of musculoskeletal disorders in librarians

There are 3 physical activities in public libraries known as unsuitable ergonomic conditions which may lead to acute or chronic disorders in musculoskeletal system that are as follows:

- I) Placing the books on the bookshelves and arranging them by classification codes,
- II) Working with computer for data entry, acquiring and receiving, searching the web for information , circulation and reference works.
- III) Filing. Therefore; it was essential to find out to what extent the librarians' health is affected by the above mentioned activities.

In this study, the musculoskeletal injuries during filing was not investigated because due to being obsolete. The musculoskeletal disorders in librarians during working by computer, placing books to the bookshelves and arranging books were investigated by Nordic questionnaire.

To find out the incidence of musculoskeletal disorders in librarians, we answer the following questions:

Is there a statistically significant relationship between working tools and musculoskeletal disorders in librarians?

Is there a statistically significant association between musculoskeletal disorders and the demographic properties of librarians?

4-2-1- Incidence of discomfort in organs during a year among librarians

During a year most musculoskeletal disorders in librarians in Hamadan public libraries were found in their waist 50.8% (n=57) and neck 48.2% (n=54).

Table1. Common incidence rate of problems upon organs in one year.

Organ	Neck	Shoulder	Wrist	Upper back	Reins	Hips	Knee	Leg	Heel
Status	N (%)	N (%)	N (%)	N (%)	N (%)	N(%)	N(%)	N (%)	N (%)
No discomfort	58 (52%)	66 (59%)	80 (71.5%)	66 (59%)	55 (49%)	100 (89%)	73 (65%)	92 (82.1%)	93 (83%)
Discomfort	54 (48%)	46 (41%)	32 (28.5%)	46 (41%)	57 (51%)	12 (11%)	39 (35%)	20 (17.8%)	19 (16.9%)
Sum	112 (100%)	112 (100%)	112 (100%)	112 (100%)	112 (100%)	112 (100%)	112 (100%)	112 (100%)	112 (100%)

Lack of adaptation between working tools and personal properties could lead to problems such as unsuitable chair and desk, and if this condition continues it may cause more serious problems.

Most injuries were in upper area in back (n=46) 41.1%, shoulders (n=42) 45%, knee (n=30) 34.8% and wrist (n=32) 28.5%.

Fewer injuries a year ago were in legs (n=20) 17.8%, ankle (n=19) 16.9% and buttocks (n=12) 10.8% (table 1).

4-2-2- The number of consultation with a physician and restriction for working due to workplace problems

Lack of safety and health at work leads to not only a cost of low productivity and efficiency but also cost of manpower rehiring/replacement and overtime work.

Table 2. The number of consultation with physician and work limitation in studied group during a year

	Consulting a physician during a year	Continuing discomfort during a week	Constant pain in Individual	Restrictions on work/ sick leaves
Yes	42 (37.5%)	40 (35.5%)	5 (4.5%)	32 (28.5%)
No	70 (62.5%)	72(64.5%)	107(95.5%)	80 (71.5%)
Total	112 (100%)	112 (100%)	112 (100%)	112 (100%)

Among the librarians, 37% consulted a physician due to musculoskeletal problems a year ago 40 of which (35.5%), recurred their problems and 5 (4.5%) had pain during a year and 32 (28.5%) were restricted or interfered with the work .1/3 of librarians had serious problems and consulted a physician. About 1/3 of them had limitation in their work and because of physical problems they were unable to perform their duty.

These findings show that unsuitable ergonomic factors in public libraries in Hamadan have threatened the health of librarians and also they have had a negative effect on their work. (Table 2).

4-2-3- The incidence of occupational harms in libraries

For precise investigation of the incidence of occupational harms in libraries for librarians, we asked librarians about the area of the body in which they had problems during work. Thus; the most vulnerable points for library work could be recognized. The OSHA and NIOSH standard check lists were used to evaluate the ergonomic factors in library work. Among all, we just examined the most common equipment such as chair, desk and computer screen.

4-2-3-1- The incidence of problems in organs during arranging books

In this study the librarians were asked about the kinds of musculoskeletal problems they may face during arranging the books (Upon Nordic questionnaire)

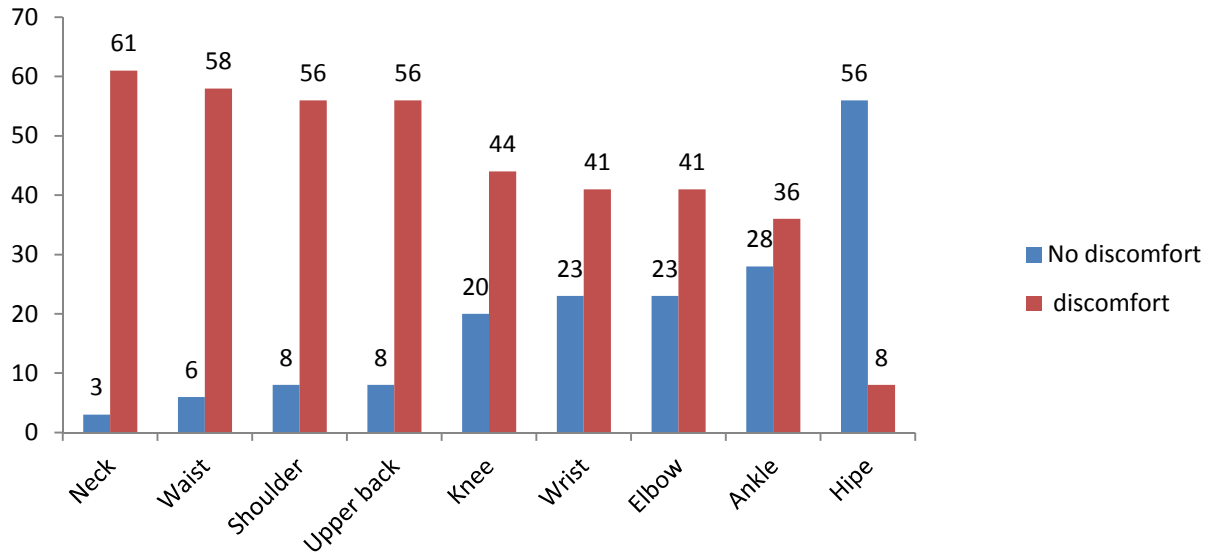


Figure1. The incidence of harms in different organs of body during arranging the books on the shelves

The most frequently occurred problems were in following organs: neck (n=51) 45.6%, the upper area of back (n=41) 46%, shoulders (n=42) 37.5%, waist (n=36) 33.9%, wrist (n=30) 26.7%, knee (n=27) 24.1% and buttocks (n=12) 10.8% (fig.1)

4-2-3-2- The incidence of harms in different areas of the body during work with computer

Based on occupational ergonomics, the position, size and the kind of computer could have an effect on easy use of the computer and this is important in occupational ergonomic. Therefore; we asked librarians to state if they face problem or harm during the work with computer at workplace.

57 librarians indicated that they have pain in neck during work with computer and 46 librarians (41%) have problem in upper area of their back, 42 in shoulders (45%), 38 in waist (33.9%), 30 in wrist (26.7%), 29 in legs (25.8%) and 27 in knee (24.1%) (Fig .2)

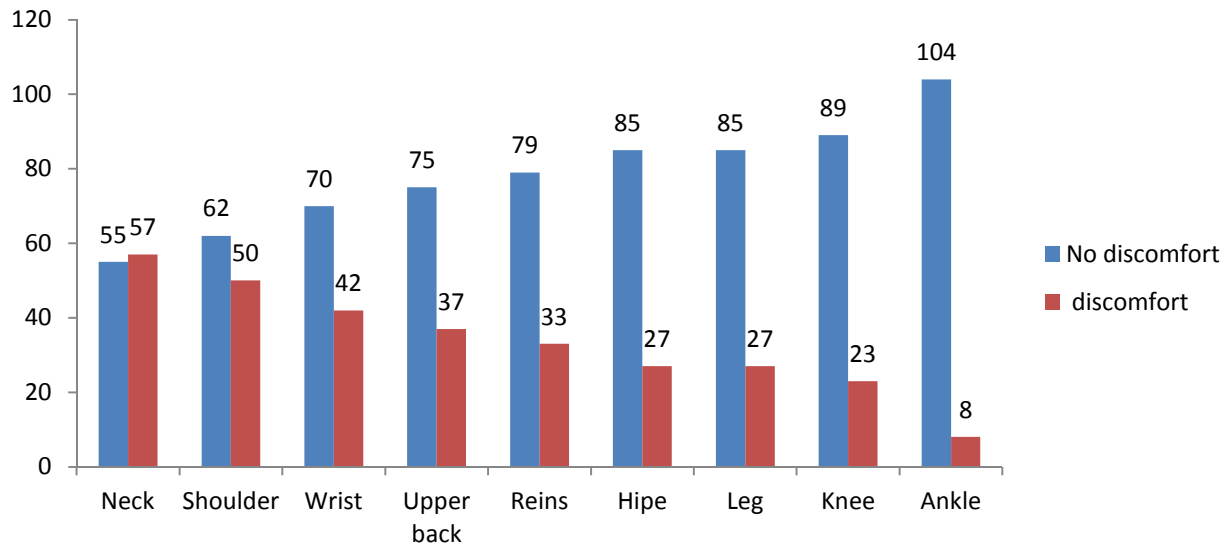


Figure2. The incidence rate of problems in different areas in the body during work with computer

4-2-4-The incidence of musculoskeletal problems among librarians by gender (male/female)

It is important to know which group (male or female) is more susceptible to musculoskeletal injury related to ergonomic factors. Thus; the dispersion of musculoskeletal disorders between male and female and also difference in their musculoskeletal disorders were investigated. Therefore; the musculoskeletal problems in 9 points of the body in these 2 groups (male and female) were studied. (table3).

Table3. The incidence of musculoskeletal problems among librarians by gender

Organ gender	Frequency	Neck	Shoulder	Wrist	Upper back	Reins	Hips	Knee	Leg	Ankle
		Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)
comfort female	64	3(4.5%)	8 (12.5%)	23(36%)	8(12.5%)	6(5.5%)	56(87.5%)	20(31.25%)	(43.75%) 28	(%43.75) 28

	male	48	7(14.5%)	12(25%)	28(58%)	15(31.25%)	13(27%)	44(91.5%)	14(%29)	22 (46%)	26 (54)
discomfort	female	64	61(95.5%)	56(87.5%)	41(64%)	56(87.5%)	58(94.5%)	8(12.5%)	44(%69.75)	(56.25%)	(56.25%)
	male	48	41(85.5%)	36(75%)	20(42%)	33(68.75%)	35(73%)	4(8.5%)	34(%71)	26(54%)	22(46%)
Total			112(100%)	112(100%)	112(100%)	112(100%)	112(100%)	112(100%)	112(100%)	112(100%)	112(100%)

The results of this study showed that the most common problems were in neck (female (n=61) 95.3% and male (n=41) 85.4% and the fewer problems were in buttocks (female (n=8) 12.5% and male (n=4) 8.3%. There is no difference between gender and musculoskeletal problems, but the females had more problems in 9 points of their body.

More than half of the females (n=56-58) had problem in their waist, shoulders and upper area in their back, while only 33-36 males had problems.

In addition to neck, most problems in males were in the shoulders and the knee, while most problems in females were in the shoulders, the waist and the knee.

There is a statistical meaningful relation between gender and musculoskeletal problems (p=0.019)

4-2-5- The incidence rate of musculoskeletal problems in librarians related to age

To understand the dispersion in musculoskeletal problems in work place related to age, the librarians were classified in 3 groups (25-35, 36-45 and 46-55).

Table4. The frequency rate of problems in different points of body in all age

Organ age		Frequency	Neck	Shoulder	Wrist	Upper back	Reins	Hips	Knee	Leg	Ankle
			Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)
comfort	25-35	41	1(2.5%)	6(14.5%)	10(24.5%)	6(14.5%)	5(12%)	0(0%)	11(27%)	16(39%)	19(46%)
	36-45	51	8(15.5%)	11(21.5%)	27(53%)	10(19.5%)	9(17.5%)	46(90%)	19(37%)	24(47%)	21(41%)
	46-55	20	1(5%)	3(15%)	14(70%)	7(35%)	5(25%)	13(65%)	4(20%)	9(45%)	14(70%)
Discomfort	25-35	41	40(97.5%)	35(85.5%)	31(75.5%)	35(85.5%)	36(88%)	41(100%)	30(73%)	25(61%)	22(54%)
	36-45	51	43(84.5%)	40(78.5%)	24(47%)	41(80.5%)	42(82.5%)	5(10%)	22(63%)	27(53%)	30(59%)
	46-55	20	19(95%)	17(85%)	6(30%)	13(65%)	15(75%)	7(35%)	16(80%)	11(55%)	6(30%)

In all of 3 groups the most vulnerable organ was the neck (regardless of age). However; the musculoskeletal problems in the age groups 25-35 were more than other age groups so that 6 out of 9 points of the body including the neck, the waist, the upper area in the back, the shoulders, the wrist and the legs were involved. The least vulnerable organs with all the age groups were the buttocks.

The proportion of discomfort (having difficulty) in group 46-55 year olds in 9 points of the body were more than the 2 other groups. This study showed that there is a statistically meaningful relationship between the age of librarians and the musculoskeletal problems (P=0.001).

4-2-6- Dispersion and relation between musculoskeletal disorders and librarians' job experience

To understand the relation between musculoskeletal disorders and librarian's job experience, the dispersion of musculoskeletal disorders upon their experience was studied. We classified the age groups in three including 10 -20 years and 30 years. The results showed that workers with more than 20 years job experience had musculoskeletal problems in the neck (100%), the shoulders (87.5%), the waist (87.5%),the knee (75%) and the upper back (75%) (5 of 9 points). The study

pointed out a statistically meaningful relation between 20 years of job experience and musculoskeletal problems (p=0.031).

Table5. Dispersion and relation between musculoskeletal disorders and librarians' job experience

Organ Duration		Frequency	Neck	Shoulder	Wrist	Upper back	Reins	Hips	Knee	Leg	Ankle
			Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)
comfort	Less than 10 years	76	7 (7%)	13(15.5%)	(41.5%) 32	15 (17%)	(17%) 14	73(98%)	26 (38%)	36 (48%)	(48%) 36
	10-20 years	28	3 (14%)	6 (35.5%)	13 (43%)	6(21.5%)	4(14%)	23(86%)	6 (28.5%)	8(31%)	(43%) 12
	More than 20 years	8	0(0%)	1(12.5%)	6(75%)	2(25%)	1(12.5%)	4(50%)	2(25%)	5(62.5%)	6(75%)
discomfort	Less than 10 years	76	(93%) 69	63(84.5%)	(58.5%) 44	61(83%)	(83%) 62	3(2%)	50(62%)	40(52%)	(52%) 40
	10-20 years	28	(86%) 25	22(64.5%)	15(57%)	(78.5%) 22	(86%) 24	5(14%)	(71.5%) 22	19(69%)	(57%) 16
	More than 20 years	8	(100%) 8	7(87.5%)	2(25%)	6(75%)	7(87.5%)	4(50%)	6(75%)	3 (37.5%)	2(25%)
total			112(100%)	112(100%)	112(100%)	112(100%)	112(100%)	112(100%)	112(100%)	112(100%)	112(100%)

5. Discussion

The aim of this study was to detect the effect of ergonomic factors on the incidence of musculoskeletal problems in librarians. A cross-sectional study in public libraries in Hamadan from October to December 2012 (Aban to Azar 1390 in Iranian Calendar), was done.

Total number of 112 questionnaires were administrated among all of the librarians (n=112) working in public libraries of Hamadan city in Iran. The answers were collected and the data were analyzed.

The results of the study showed that most of the librarians (71.5%) had at least one musculoskeletal problem, among whom more than 1 out of 3 (37.5%) consulted a physician.

32 librarians (28.5%) had limitation in free movement and performing job because of musculoskeletal problems and 40 librarians had musculoskeletal problems that continued 1-7 days and 5 (4.5%) librarians suffered from pain all the time. This shows that harmful ergonomic factors had negative effects of musculoskeletal system on librarians.

The majority of the librarians were categorized in 25-35- year- old range. The study found a statistically significant relation between age and job experience, so it is expected that if the effective effort is not performed in work station and workplace, there will happen more musculoskeletal problems in the future.

The study also found a statistically significant relation between equipment and musculoskeletal problems in the waist and the wrist (for chair $P=0.040$, for desk $P=0.039$ and for computer screen $P=0.032$), thus; these problems will be more intensive if these conditions continue. In this association, Foladi Dehghi (1386) found a statistically meaningful relation between experience and disease in workers in production part ($P<0.001$) Alamolhodai (1381) indicated that there are many physical injuries related to work among librarians, also he found that some factors (such as: gender, age, education level, experience, time of work with computer, kind of duty and the light position) have a statistically significant relation with injures.

But in Heidarian's (1382) study it is indicated that his study has found a statistically non significant relation between background factors such as: gender, age, education level, and the injuries; but he indicated that 9.19% of librarians had unsuitable ergonomic conditions which forced them to be in a bad position.

Recent studies showed that no standards have been developed for the design of workspaces and purchasing of equipment (12).

This study is unique and offers new findings. It examines the work and all the appropriate and inappropriate tools with OSHA standards and NIOSH were compared. This study suggested the following issue to prevent musculoskeletal problems in libraries.

_ The improvement of the work tools and equipment upon universal standards based on personal properties.

_ Regular exercise training and practice exercises for the prevention of chronic musculoskeletal injuries

Correct forming and training had very positive effects on recognition and the prevalence of musculoskeletal injuries, so that the managers and workers and public relations in organizations should notice this suggestion for the prevalent musculoskeletal problems and the improvement of economical yielding in organization.

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