

Ergonomics Assessment of Office Desk Workers Working in Corporate Offices

Chandwani A¹, Chauhan M.K², Bhatnagar A³

¹M.Sc. Resource Management and Ergonomics, Department of Resource Management, SNDTWU, Mumbai.

²Associate Professor, Department of Resource Management, SNDTWU, Mumbai.

³Professor, Department of Resource Management, SNDTWU, Mumbai.

Corresponding Author: Chauhan M.K

ABSTRACT

Background: Organizations today face multiple challenges to maintain the health and performance of employees while attempting to integrate new technologies and support a widening range of work styles. ^[1] The paradigm shift in the lifestyle of office employees from active to sedentary style can be clearly seen in the modern offices. Office computer workers use computers on an average 6-12 hours/day in a static working posture. ^[2] This has impacted greatly the health of the employees. The study was undertaken to provide an insight to the various health-related problems of the office employees due to the workplace design and environmental conditions in the modern offices.

Methodology: 80 desk workers from various corporate offices in the city of Mumbai were interviewed. A structured questionnaire for interview purpose was developed to elicit data pertaining to the work environment, workplace furniture, office equipment, and musculoskeletal disorders. The respondents were office workers who were professionals, managers and administrative workers.

Result: The results revealed that 80% of the respondents suffered from at least one musculoskeletal problem at their workplace. Majority of the respondents reported of suffering from lower back pain (68.5%) followed by neck pain (64.2%), upper back pain (45.7%) and shoulder pain (44.2%) respectively. 81.3% of desk workers did not get any type of ergonomics training on usage of office furniture's and computer related accessories. About 40% and above felt chair and table to be comfortable; but storage and printer placement was not satisfactory. 31.5% of the respondents reported the environment to be noisy and disturbing; leading to mental fatigue.

Conclusion: Sustained prolonged static posture, awkward posture, chair design, placement of keyboard and mouse and non-availability of footrest were stated as the most common causes for the musculoskeletal issues. Majority of the employees reported internal physical environment to be good; but they suffered from lack of concentration and stress respectively.

Key words: workplace design, desk workers, MSD, furniture, environment

INTRODUCTION

An office is a room where professional duties and administrative work is carried out in the organisation building. The details of the work depend on the type of business, but it will usually include using computers, communicating with others by telephone, e-mail, or fax, keeping records and files, etc., in a soft and hard format. Features of an office such as people,

building space, equipment, furniture and the environment must fit together well for workers to feel healthy and comfortable and be able to work efficiently and productively. At least, 50% of the world's population currently works in some form of office. ^[3]

Office work is rapidly changing as new developments in computer technology come along, which can make our jobs easier, but which also can present new

problems for both management and employers. Office employees often spend more than 40 hours per week at their computer workstations; therefore, the office environment plays a significant role in the daily life a large number of people. Office furniture and office environment are major physical conditions that should gain more attention. [4] Workstation designs significantly affect working posture, which in turn, contributes to physical symptoms. [5] In extensive survey in US it was found that almost one out of every five employees rated their workplace environment from, 'fair to poor'; 90% admitted of work being adversely affected by the quality of their workplace environment and 89% blamed their working environment for their job dissatisfaction respectively. [6]

In the workplace, ergonomics is the science of designing or redesigning the workplace to fit the work and improve safety, comfort and productivity. Awkward and prolonged static postures contribute to musculoskeletal discomforts among office desk workers is the known fact. Although we know discomfort due to long periods of intense office work can be mediated by regular postural change; [7] but research suggests that knowledge about the importance of postural change is not enough. The combination of ergonomic furniture and experimental software applications designed to prompt shifts from seated positions to standing positions, help to produce the most dramatic reduction in discomfort. [1] With proper setup, monitor arms help organizations meet ergonomic requirements for safety and reduce risk of injury to employees. [8] Recent studies show that a safe working environment requires more than just ergonomically designed furniture, suggesting that training and behavioural cues may be required to address the ergonomic challenges of today's office worker. [7]

Tremendous usage of computers in most offices of emerging economies have however, not seen accompanying applications of ergonomics in the design of

computer workstation despite the numerous benefits. Injuries and discomforts therefore have higher propensity to occur since most offices formally designed for paper-based work now accommodate computer workstations, without corresponding redesigning. [9] The need to use computers increases as computer technology advances and software and computer packages are being developed. As a result, occupational health and safety problems are continuously increasing. This, obviously, can lead to reduced performance and dissatisfaction. [10] In addition to these, individuals who use computers for a prolonged period may also experience eye and vision problems, which are caused due to improper viewing distance, poor lighting, glare on the monitor screen, etc. [11]

Indoor air quality is another important factor; not only for workers' comfort but also for their health. Poor ventilation, uncontrolled temperature, too high or low humidity are some of the factors that can cause poor indoor air quality. Exposure to these hazards causes immediate symptoms such as headaches, fatigue, concentration problems, and irritation of eyes, nose and throat. Some of the environment related hazards that are usually presented in offices are poor lighting and noise pollution. Nowadays, some modern offices may lack natural lighting, while some others may face too much noise. [11] A survey was conducted to find the relationship between indoor environment, dissatisfied employees and their productivity. The results revealed that the productivity of the work is affected because the people were unhappy with temperature, air quality, light and noise levels in the office. [12]

Stress can help people complete their tasks more efficiently and accomplish goals; but excessive work-related stress can have health effects like anxiety, irritability, depression, sleeping problems, eating disorders, fatigue, inability to concentrate and loss of interest in work that may contribute to low productivity. Stress can be

caused by poor work organization, over or under work, lack of support from the employer and colleagues, lack of respect and many other factors.

Work styles are becoming more complex, evolving to encompass a wider variety of interactions within a greater diversity of workspace types. All of these factors elevate ergonomic hazards to office workers now and in the future. [1] Previous studies have reported of physical, psychological and organizational problems that office workers face, including problems like incorrect workstation set-up, poor lighting, poor layout of furniture, electrical hazards, etc. Therefore, the present study was carried out with the aim to find out the risk associated with the workplace design, indoor office environment; MSD's problems and other health-related problems among the office workers.

MATERIALS AND METHODS

Study Design: This is a cross-sectional, quantitative and descriptive study conducted to study the health and environment problems associated among the office workers. The study was carried out in 5 similar corporate offices situated in Mumbai. The offices were centrally air conditioned with open planned office arrangement located in suburban Mumbai.

Participants: A total of 80 corporate office employees comprising of 42 females and 38 males, ageing between 20-45years participated in the study. The study was conducted in corporate offices from Mumbai city. Only those office employees working on desk with computer workstation and working more than one year were selected for the study.

Tools for Data Collection: A structured questionnaire was designed to elicit the

required data. This questionnaire consisted of 10 questions in total which focus on the musculoskeletal problems faced by the employees, absenteeism due to health problems, probable causes of the health problems, work environment parameters, workstation comfort, work equipments and training imparted for the use of office furniture. The data was collected through administration of physical questionnaires, telephonic interviews method and Google forms. An insight about the research was explicated to them prior to the commencement of the data collection process. Consent was taken from all the respondents before starting the data collection process.

Statistical Analysis

Statistical analysis was performed using standard descriptive statistical tests with the help of MS Office Word Excel Spreadsheet. Mean and percentages were computed for the tables.

RESULTS

Study Population

The study was carried out on 80 subjects; consisting of 38 males and 42 females with mean age 33.2 years ranging from 20-45 years. All the respondents were graduates and post graduates; working as professionals and at managerial positions. They worked on shared and individual computer workstations for 8 to 12 hours per day.

Workplace and Health-related Issues among Office Workers

In general, the responses were gathered on awareness of workplace ergonomics and health related problems due to workplace design or environment in terms of yes, no and not applicable responses respectively.

Table 1. Responses on Workplace and Health-related Issues among Office Workers

Sr. No.	Parameters Studied	Responses (n=80)					
		Yes	%	No	%	N/A	%
1.	Awareness about good ergonomic workplace	45	56.5	35	43.8	0	0
2.	Suffer from any muscular/ physical ailments at your workplace	64	80.0	16	20.0	0	0
3.	Absent due to ailments in the past 12 months	12	15.0	61	76.3	7	8.8
4.	Effect of the ailments on work output	12	15.0	61	76.3	7	8.8
5.	Trained for use of office furniture (chairs, tables, etc.)	15	18.8	65	81.3	0	0

Note: N/A – Not Applicable

Table 1 shows the responses on workplace and health issues among office desk workers. Overall, 43.8% respondents were not aware of principles of good workplace ergonomics; therefore, used the workplace without making any changes. About 80% of the respondents complained of some sort of muscular/ physical ailments due to the awkward postures adopted at workplace as the arrangement and workstation design was not good. 18.8% office workers had grievance that they did not get any formal training for how to use the office furniture's. Some of the office workers complained of low concentration, no frequent breaks in between work and stress at work as major effects of problems on work output. Few workers were forced to remain absent from work due to muscular pains and aches due to workplace set-up. In a study 70% of the workers acknowledged not having knowledge of ergonomics while; 100% did not have any ergonomic assessment of their workstations. [9] It was astonishing to find that 81.3% of desk workers in table 1 did not received any training on how to adjust and use office furniture's with respect to chairs, tables, computer monitor, keyboards, mouse, etc. Similar findings were reported in another study were 82% of employees did not

receive any ergonomics training and among those who had, 54% were dissatisfied with it. [10] A study provided some ground rules in the design of an education and training program for a computer workstation. The training program was effective in producing positive changes in workstation configuration and posture, and reducing the severity of symptoms. [13]

Overall, majority of office workers suffered from muscular and physical ailments at workplace as they were not aware about ergonomics factors that need to be observed and implemented.

Office Furniture's, Equipment's and Internal Work Environment

The information on the comfortability of the desk workers with respect to furniture and equipment's and work environment was studied. For furniture compatibility table, chair and storage were considered; whereas, for equipment's placement of printer, monitor, keyboard and mouse were measured; while for physical work environment; lighting, thermal comfort and noise were studied. The responses were collected using 5 – point scale ranging from 1- Poor to 5 - Excellent category. The responses of the workers are presented below in table 2.

Table 2. Response of the Workers with respect to Furniture, Equipment's and Internal Physical Environment

Sr. No	Parameters	Responses (n=80)									
		P	%	S	%	G	%	VG	%	E	%
Furniture and Office Equipment											
1.	Chair	7	8.8	24	30	33	41.3	11	13.8	4	5
2.	Table	5	6.3	20	25	34	42.5	13	16.3	4	5
3.	Storage	16	20	15	18.8	25	31.3	6	7.5	5	6.3
4.	Placement of Printer	5	6.3	11	13.8	24	30	9	11.3	7	8.8
5.	Placement of Monitor	0	0	11	13.8	44	55	19	23.8	5	6.3
6.	Placement of Keyboard	1	1.3	11	13.8	42	52.5	19	23.8	6	7.5
7.	Placement of Mouse	1	1.3	11	13.8	42	52.5	18	22.2	6	7.5
Work Environmental Parameters											
8.	Lighting	3	3.8	17	21.3	41	51.3	11	13.8	8	10
9.	Thermal comfort	5	6.3	18	22.2	39	48.8	11	13.8	7	8.8
10.	Noise	12	15	25	31.3	31	38.8	7	8.8	5	6.3

Note: 5-Point Scale - P-Poor, S- Satisfactory, G- Good, VG- Very Good, E- Excellent.

Table 2 shows the overall responses of comfort level of office workers with respect to office furniture and equipments. Overall 41.3% of the office workers reported chair design to be comfortable and good, 30% reported it to be satisfactory;

18.8% found it to be very good and excellent and only 8.8% found it poor respectively. With reference to table, 42.5% found it to be good; 25% felt it to be satisfactory; 21.5% found it to be good and excellent; while, 6.3% found it to be poor.

The desk workers were not satisfied with the comfort, material, height, adjustability and ease of use of tables and chair respectively. With respect to storage 31.3% found it to be good; but 20% and 18% felt it to be poor and satisfactory as they were not able to use the storage space with comfort and ease.

Considering office equipment's like printer placement, monitor, keyboard and mouse; majority of the office workers felt it to be good and very good; except some felt printer placement to be poor and not very satisfactory as height, adjustability and ease of use was the problem they faced.

Most of the private modern offices have comfortable internal environment. Majority of the office desk workers reported the internal environment with respect to lighting and temperature/thermal comfort to be good. Some of the respondents reported the lighting and noise levels to be less satisfactory because of the open office environment. 31.5% of the respondents reported the environment to be noisy and

disturbing; leading to mental fatigue. It was observed that the offices were well organized and designed for good internal environment as they were designed as per the standards. In a study on modern office buildings; highest satisfaction rating was obtained for light comfort, followed by thermal comfort, noise, and air quality. [14]

Some of the environment related hazards that are usually presented in offices are poor lighting and noise pollution. Nowadays, some modern offices may lack natural lighting, while some others may face too much noise. [11]

Problems related to Workplace Design

The office desk workers problems related to workplace design with respect to chair & table design, awkward posture, computer equipments, non- availability of foot rest & awkward placement of power supply points was investigated. The responses were analysed and presented in table 3.

Table 3. Responses on Problems related to Workplace Design

Sr.No	Cause of the Problem/Ailment	Responses (n=80)	Percentage (%)
1.	Chair design	33	41.3
2.	Table design	15	18.8
3.	Distance of computer screen	11	13.8
4.	Awkward placement of power points	7	8.8
5.	Computer equipments/accessories	5	6.3
6.	Non- availability of foot rest	35	43.8
7.	Awkward Posture	38	47.5
8.	Other	11	13.8

In general, majority (47.5%) of the respondents reported that they have to adopt awkward posture as the footrest (43.8%) was not provided making them lean forward to perform the activity on computers. Secondly, the type and design of chair (41.3%); was also another major issue responsible for awkward posture as reported by the employees. Few employees felt that the distance of the computer screen for the workers was not correct and placement of power points was not good, as they had to bend down and sideways to operate them leading to awkward posture.

The problems related to posture can thus be associated with design of the chair,

table and placement of equipments and furniture that could be one of the major causes for the musculoskeletal problems among office workers. A study reported 33% of employees dissatisfied with chair type and design. [10] In a survey on 2,000 office workers in the USA; 90 percent of the respondents believed that better workplace design and layout result in better overall employee performance. [6]

Musculoskeletal Problems among the Office Desk Workers

Awkward and prolonged static postures contribute to musculoskeletal discomforts

among office desk workers. Along with environment, furniture and internal environment the MSD's were also studied

for the office workers. The results of the MSD problems experienced by the office desk workers are presented in table 4.

Table 4. MSD Problems among the Office Desk Workers

Sr. No	Body Parts	Number of Responses (n=70)											
		Intensity of Pain (1-Minimum Pain to 5-Severe Pain)											
		Total	1	%	2	%	3	%	4	%	5	%	
1.	Head	34.2	8	11.4	9	12.9	2	2.9	2	2.9	3	4.3	
2.	Neck	64.2	8	11.4	21	30	11	15.7	2	2.9	3	4.3	
3.	Shoulders	44.2	10	14.3	13	18.6	4	5.7	3	4.3	1	1.4	
4.	Upper Back	45.7	11	15.7	12	17.1	6	8.6	3	4.3	0	0	
5.	Elbows	22.8	9	12.9	4	5.7	3	4.3	0	0	0	0	
6.	Low back	68.5	9	12.9	12	17.1	22	31.4	4	5.7	1	1.4	
7.	Wrist/ Hands	32.8	9	12.9	10	14.3	2	2.9	1	1.4	1	1.4	
8.	Hips/ thighs	22.8	10	14.3	2	2.9	2	2.9	2	2.9	0	0	
9.	Knees	31.3	8	11.4	5	7.1	6	8.6	2	2.9	1	1.4	
10.	Ankle / feet	35.6	7	10	9	12.9	6	8.6	2	2.9	1	1.4	

Note: Out of 80 subjects only 70 responded to MSD problems.

Overall, out of 80 respondents; 70 respondents (87.5%) reported of having atleast one MSD problem. In general, majority of the respondents reported of suffering from lower back pain (68.5%) followed by neck pain (64.2%), upper back pain (45.7%) and shoulder pain (44.2%) respectively. With respect to the intensity of pain; few reported of having severe pain in the neck (4.3%) and head (4.3%) and moderate to heavy pain (31.4% and 5.7%) in the lower back respectively. In similar study on office workers reported a significant association between head posture during computer work and neck pain. [15] In another study, similar findings were reported; wherein the musculoskeletal problems, such as neck, back, shoulder, and arm pain were significant. [9, 10, 16, 17] The literature also reveals a correlation between the duration of computer use and upper extremity pain, back pain, and eye strain. [17]

Mostly, MSD problems reported were related to upper extremity due to high chair height compelling workers to sit with dangling feet, high height of table and incorrect placement of monitor, keyboard, mouse, file cabinets and switchboards forcing employee to twist and bend forward to reach them, non-availability of footrest making employees adopting slouched static posture for long hours of work respectively.

DISCUSSION

Researchers are increasingly finding links between employee health and aspects of the physical environment at work such as indoor air quality, ergonomic furniture and lighting. [18-20] In present study also researchers tried to study the impact of office environment and furniture on the employees. When office work environments are not conducive to their users it can be referred to as "poor work environments"; which may increase the risk of WRMSD problems. For instance, a workstation where the keyboard and mouse are placed at different levels, causing the user to elevate/abduct shoulders can be considered a poor workstation. A workstation without adjustable components (work surface, office chair, etc.) and necessary accessories (hands-free phone, document holder, etc.) can also be construed as a poor work environment. [21]

In the present study the major problems identified MSD problems are due to mismatch between furniture and equipments to the users. These problems could be attributed to workplace and furniture design forcing employees to adopt awkward posture. Further, the workers were not very satisfied with the type and design of the chairs and tables and many workstations did not have foot-rest under the table; making workers lean forward to work. The seat height of the chair was either

too high or too low and same was the case with armrest which was responsible for back, neck and shoulder problems. High rate of shoulder back and neck problems can also be related to the long working hours on computer workstation in awkward posture in addition to improper design of workplace. Thirty-three percent of employees were dissatisfied with the chair, 20% with the keyboard, and 20% with the number of rest breaks and the musculoskeletal problems, such as back, shoulder, and arm pain were significant indicating effects of ergonomic deficiencies in the workstation system. [10] Similar findings were also reported; where neck, lower back, shoulders and upper back symptoms were found to be the most prevalent problems among the office employees. [16] Low back problem (28.8%) was found to be the most common problem among the office workers. Significant differences was in the prevalence rates of musculoskeletal in upper back, lower back and feet/ankle regions before and after intervention programme. [22]

Office workers were generally satisfied with lighting and internal office environment, as the offices were open offices with centrally air conditioned. A study reported that office workers in European “modern” office buildings were generally satisfied with IEQ (Indoor Environment quality) in their work environment. [14] The highest satisfaction rating was obtained for light comfort, followed by thermal comfort, noise, and air quality. Also, they found that satisfaction with overall noise was the strongest IEQ component associated with occupants’ comfort. Noise was considered as one of the most important factors affecting the productivity and comfort of the workers. A study on open-plan offices found that the occupants felt noise in their environment to be high. [23] In another study it was found that amount of space and noise were two important parameters that affect overall comfort. [24] The physical environment could be controlled, 25% of the employees

reported heat, 23% noise, and 18% light problems in their offices. [10]

CONCLUSION

The study revealed that office workers were not aware about office ergonomics which contributed to discomfort in posture and poor work conditions. Prolonged hours of working in sustained static posture, awkward posture, with uncomfortable design of chair and under table storages, placement of keyboard and mouse and non-availability of footrest were stated as the most common causes for the musculoskeletal issues. Majority of the employees reported lighting and indoor environment to be comfortable and good; but they suffered from lack of concentration and stress due to noise. Proper ergonomics and comfortable work environment can improve the satisfaction level among individuals leading to satisfaction simultaneously reducing the MSD problems.

Understanding of the workplace design, placement of office equipments and internal office environment may help in providing healthier and more comfortable working environment to the office workers. Future research and modifications based on longer period of time may be needed to resolve the workplace discomfort and health related MSD problems.

Recommendations

- The standard ergonomics guidelines for the office design and comfortable indoor environment should be laid down by the management.
- Adequate amount of space needed per person per computer workstation should be provided to each employee for better productivity.
- Special attention should be given to lighting; disturbance through internal noise and thermal comfort; while designing internal physical environment.
- Ergonomics Training on placement of keyboard, mouse, how to set the layout of work environment, how to adjust

chairs and tables as per their need and comfort; and most importantly how to maintain good posture at work should be imparted to the office desk workers .

- Importance of 20-20-20 computer workplace principle and micro-breaks in between the continuous working on computers should be explained to the office employees.

ACKNOWLEDGEMENT

The authors are thankful to Mr. Devnani S.K. Marketing Director, Innofitt Systems Private Limited., and Mr. Kaprekar M. Consultant, Innofitt Systems Private Limited for funding the project and giving the opportunity to carry out internship program at their premises. The present study is the outcome of the research carried out during internship period.

REFERENCES

1. O'Neill M. New Workplace Ergonomics Research: Emerging Risks and Solutions. 2013, Knoll Topic Brief, Knoll Inc., New York, NY.
2. Mani K, Provident I, Eckel E. Evidence-based ergonomics education: Promoting risk factor awareness among office computer workers. *Work*. 2016, 55(4):913-922.
3. Vimalnathan K., Babu R. A Study on the Effect of Ergonomics on Computer Operating Office Workers in India. *Journal of Ergonomics*, 2017, 21657556.
4. Samani SA. The Impact of Personal Control over Office Workspace on Environmental Satisfaction and Performance. *Journal of Social Science and Humanities*, 2015, 1(3): 163-172.
5. Lu H, Aghazadeh A. Risk factors and their interactions in VDT workstation systems. In: Proceedings of the Human Factors and Ergonomics Society 40th Annual Meeting. Santa Monica, CA, USA: Human Factors and Ergonomics Society; 1996. p. 637-41.
6. Gensler. The Gensler Design + Performance Index, The U.S. Workplace Survey. 2006. www.gensler.com
7. Davis K, Kotowski S, Sharma B, Herrmann D, and Krishnan A. Combating the Effects of Sedentary Work: Postural Variability Reduces Musculoskeletal Discomfort, in Proceedings of the Human Factors and Ergonomics Society, 2009, 53rd Annual Meeting.
8. O'Neill M. and Albin T. A Guide to Trouble-Free Selection and Ergonomic Set Up of Monitor Arms. 2012, Knoll White Paper, Knoll, Inc., New York, NY.
9. Kumah DB, Akuffo KO, Affram DE, Ankamah E, Osa AE. Ergonomic Challenges of Employees Using Computers at Work in a Tertiary Institution in Ghana. *Optometry*. 2016, 1(2), 2476-2075.
10. Shikdar AA, Al-Kindi MA. Office Ergonomics: Deficiencies in Computer Workstation Design. *International Journal of Occupational Health and Ergonomics*. 2007, 13(2): 215-223, 1080-3548. https://www.researchgate.net/publication/6237406_Office_Ergonomics_Deficiencies_in_Computer_Workstation_Design
11. www.pecb.com – Health and Safety in the Office
12. Leaman, A. (1995). Dissatisfaction and office productivity. *Journal of Facilities Management*. 1995, 13(2), 3-19.
13. Ivergård T. Handbook of Control Room Design and Ergonomics. London, UK: Taylor & Francis; 1989.
14. Ioannis A. Sakellaris , Dikaia E. Saraga, Corinne Mandin, Céline Roda, et al. Perceived Indoor Environment and Occupants' Comfort in European "Modern" Office Buildings: The OFFICAIR Study. *Int. J. Environ. Res. Public Health*. 2016, 13, 444.
15. Chiu TT, Ku WY, Lee MH, Sum WK, Wan MP, Wong CY, Yuen CKA. Study on the prevalence of and risk factors for neck pain among university academic staff in Hong Kong. *Journal of Occupational Rehabilitation*, 2002, 12(2):77-91.
16. Singh LP, Singh H. Assessment of Work Postures and Musculoskeletal Disorders among Insurance Office Employees: A Case Study. *HWWE Conference Proceedings*. 2015, 978-93-5258-836-7, 531-536.
17. Ye Z, Abe Y, Kusano Y, Takamura N, Eida K, Takemoto T, et al. The influence of visual display terminal use on the physical and mental conditions of administrative staff in Japan. *Journal of Physiological Anthropology*. 2007, 26(2):69-73.
18. Dilani, A. Design and health III: Health promotion through environmental design. Stockholm, Sweden: International Academy for Design and Health, 2004.
19. Milton DK, Glencross PM, & Walters MD. Risk of sick leave associated with outdoor

- air supply rate, humidification and occupant complaints. *Indoor Air*. 2000, 10(4), 212–221.
20. Veitch JA, & Newsham GR. Exercised control, lighting choices, and energy use: An office simulation experiment. *Journal of Environmental Psychology*, 2000, 20(3), 219–237.
 21. Mani K. Chapter 4. Ergonomics Education for office computer workers: Evidence based strategy. Cited in book *Anatomy, Posture, Prevalence, Pain, Treatment and Interventions of Musculoskeletal Disorders*. Intech Open. 2018, 47–62. Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), <http://dx.doi.org/10.5772/intechopen.72221> <https://www.researchgate.net/publication/321134910>
 22. Choobineh A, Motamedzade M, Kazemi M, Moghimbeigi A, Pahlavian AH. The impact of ergonomics intervention on psychosocial factors and musculoskeletal symptoms among office workers. *International Journal of Industrial Ergonomics*. Volume 41, Issue 6, November 2011, Pages 671-676. <https://doi.org/10.1016/j.ergon.2011.08.007>
 23. Pierrette M, Parizet, E, Chevret P, Chatillon J. Noise effect on comfort in open-space offices: Development of an assessment questionnaire. *Ergonomics*. 2015, 58, 96–101.
 24. Frontczak M, Schiavon S, Goins J, Arens E, Zhang H, Wargocki P. Quantitative relationships between occupant satisfaction and satisfaction aspects of indoor environmental quality and building design. *Indoor Air*. 2012, 22, 119–131.

How to cite this article: Chandwani A, Chauhan MK, Bhatnagar A. Ergonomics assessment of office desk workers working in corporate offices. *Int J Health Sci Res*. 2019; 9(8):367-375.
