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Musculoskeletal Discomfort in Computer Operators of Organized Sector : Tracing The Link With Obesity Status

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Abstract

Musculoskeletal disorder is a major health problem in the working population. The probable cause might be the economic growth and technological improvements in the working sector, which lead to greater interaction between man and machines. It is practically impossible to find an office or a shop floor without a computer workstation. Rapid development of technology, visual display terminals or display screen equipment (DSE) is a common constituent of the modern workplace. Spending long hours before computers has become compulsion due to work urgency, accuracy and demand, without giving attention to the individuals' health, especially body weight. In this backdrop, the present study has been undertaken to find out the relationship, if any, between works related musculoskeletal discomforts and obesity indices among the human resources engaged in human computer interface job. Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) scores have been calculated among 39 computer operators of age range 25-35 years. Significant association was observed between different obesity indices with CMDQ scores ($P < 0.01$).

Keywords: Human Resources; Job Stress; Anthropometry; Check lists; Obesity.

Introduction

The applications of computer technology and the accompanying use of video display terminals (VDTs) are revolutionizing the workplaces; and will continue to grow in the future. Consequently the problems experienced by the video display terminals (VDTs) operators are also complex. Physical discomforts such as eye fatigue and irritation, blurred vision, headaches, dizziness, pain or stiffness in the neck, shoulders and back [5] are commonly reported by the video display operators. These may lead to musculoskeletal disorders (MSDs) which are associated with a number of risk factors. Work related Musculoskeletal Disorders (WMSD) also commonly known as Cumulative Trauma Disorders (CTD) or Repetitive Strain Injuries, is the class of musculoskeletal disorders that include damage of tendons, tendon sheaths, and synovial lubrication of tendon sheaths. It is also related to bones, muscles and nerves of hands, wrists, elbows, shoulders, neck and back. These disorders develop gradually over a period of weeks, months or even years due to repeated exertion and movement of the body. A collection of health problems lead to musculoskeletal disorders and are more prevalent among the occupationally engaged people compared to the general population. MSDs, associated with pain and limitation to daily activity, have a high impact on both, the individuals' and system performance. It generates a high impact on healthcare costs and costs due to productivity loss in terms of absenteeism and work disability [25]. Low back pain, one of the most frequent musculoskeletal disorders, affects up to 80 % of people, while every month 20–30 % of adults are affected globally [17, 28, and 14]. Level of association between the extent of computer use and WMSD is still under debate, while spending long hours before computers has become compulsion due to work

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urgency, accuracy and demand, without giving attention to the individuals' health, especially body weight. On the other hand obesity, excessive fat accumulation in adipose tissue, increases the likelihood of various chronic diseases in developed as well as developing countries [2- 4, 18]. An elevated BMI, common indicator of obesity, is rapidly becoming the norm of our modern society [26]. It also imposes an enormous socio economic and public health burden even in less developed countries [13]. In this backdrop the present study aims to assess the relationship of obesity indices and development of musculoskeletal discomfort among computer operators occupationally engaged in organized sector.

Methods

The study was conducted on a group of human resources engaged occupationally in organized sector and regularly using computer in their daily occupational activity; after receiving initial permission from the authorities of the organized sector. On obtaining the individual consent from the volunteers as well, the study was carried out on mutually convenient dates. The participants had a minimum working experience of 6 years and work for at least 5 hours per day in front of the computer in course of their regular occupational responsibility. Individuals with chronic illness and those with major surgery, post-traumatic stiff joints; fixed deformity (self reported) were excluded from the study purview. Initially information on age (year), working experience (year) and daily activities (e.g. desk job, daily commuting, and internet usage) were collected from 39 human resources with age range 25–35 years in pre-designed schedules. Body height (to the nearest 0.1cm) and body weight (to the nearest 0.1 kg) were measured with volunteers in light clothing and without shoes. Body Mass Index (BMI) was calculated and the individuals were categorized as critical limits of BMI recommended by WHO [7]. Waist circumference (cm) [12] and hip circumference (cm) [27] were measured by using non elastic measuring tape. Conicity index (CI) [22], abdominal volume index (AVI) [10] and Rohrer index (RI) were also calculated. Human resources were interviewed using standardized Nordic Musculoskeletal Questionnaire [16] (NMQ) for workers. Work related musculoskeletal discomfort was assessed by Cornell University's Musculoskeletal Discomfort Questionnaire (CMDQ) [11]. The obtained data were tabulated for statistical analysis. Standard descriptive statistics (mean ± Standard deviation) and ANOVA were carried out with the chosen level of significance being 0.05.

Results

The adult male (married) individuals, as per the socio-economic category, belonged to the upper middle class. The basic information on the participants' age (year), body weight (kg), body height (cm), working experience (year) and computer usage (year) and average computer usage time (hr.day^{-1}) has been presented in Table 1.0.

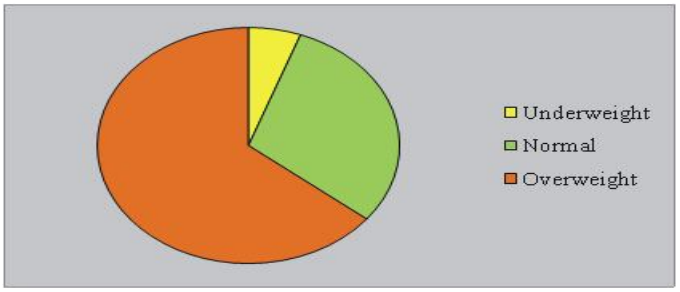
Table 1.0: Basic profile of the study participants

Variables	Values
Sample size (n)	39
Age (year)	31.7 ± 7.25
Body weight (kg)	65.9 ± 9.48
Body height (cm)	168.5 ± 7.69
Working experience (year)	7.7 ± 3.35
Average computer usage (hr.day^{-1})	5.6 ± 1.65

AM±SD

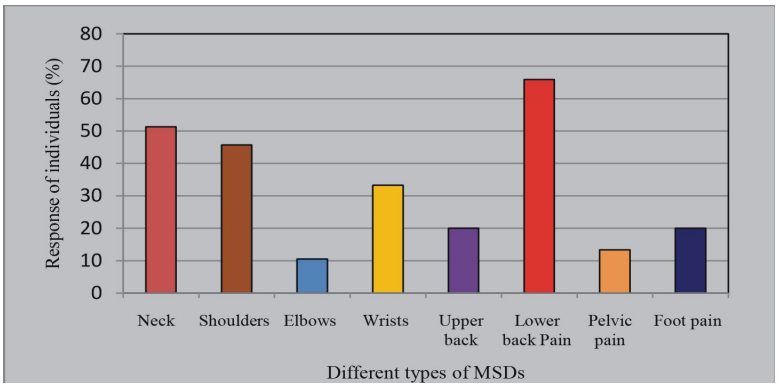
Body Mass Index (BMI) distribution (kg. m^{-2}) of the study participants as per the WHO classification for the Asian [7] has been presented in Figure 1.0.

Fig. 1.0: Distribution of Body mass index (BMI) of the study participants



The prevalence of work related musculoskeletal disorders among the computer operators has been presented in Figure 2.0.

Fig. 2.0: Prevalence of work related musculoskeletal disorders of the study participants



Association of obesity indices and WMSD score have been presented in Figure 3.0.

Fig.3(a): Association of BMI with Work related Musculoskeletal Discomfort scores.

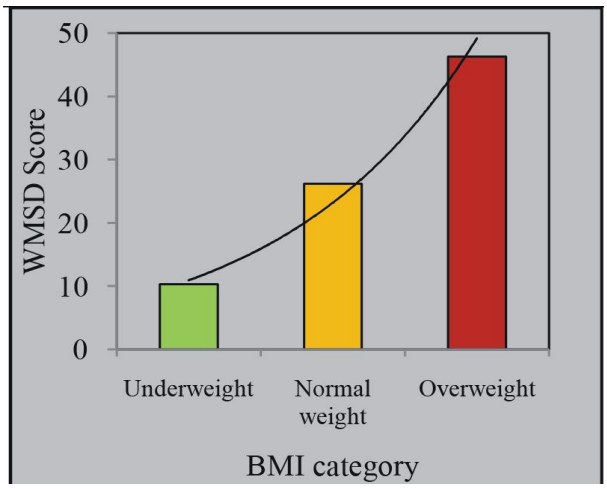


Fig.3(b): Association of CI with Work related Musculoskeletal Discomfort scores.

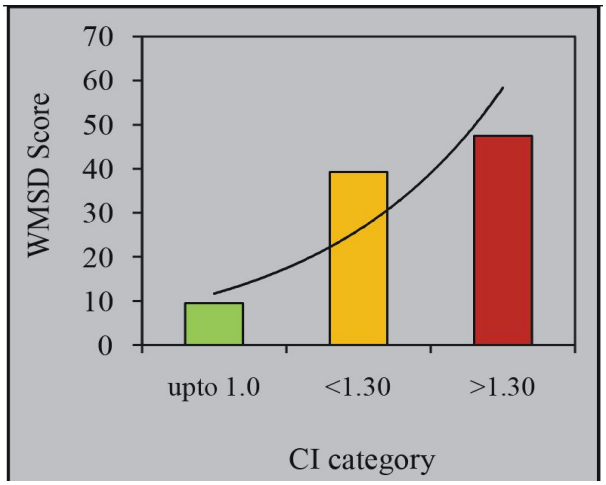


Fig.3(c): Association of RI with Work related Musculoskeletal Discomfort scores.

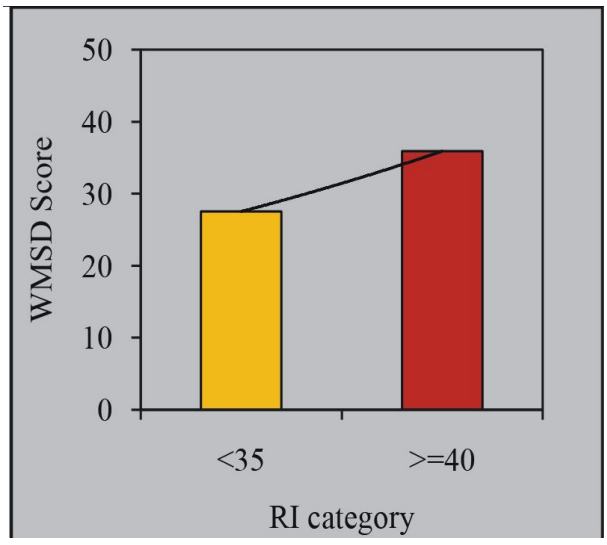
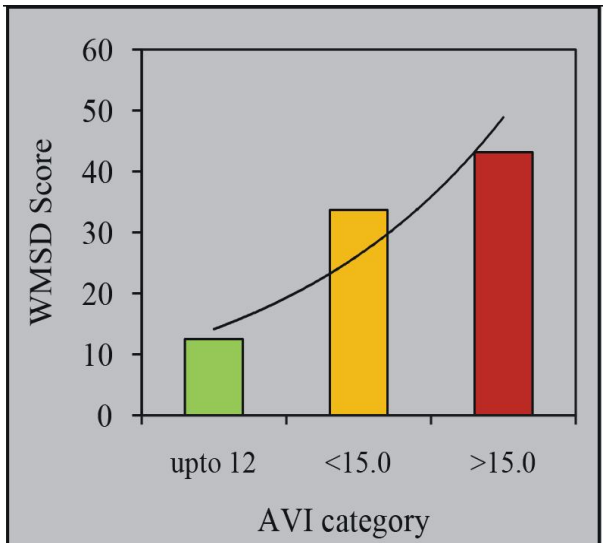


Fig.3(d): Association of AVI with Work related Musculoskeletal Discomfort scores.



Association of obesity indices with CMDQ score has been presented in Figure 3.0

Discussion

BMI is considered as one of the most popular indicator of obesity status [15], [21]. In the present study, according to the BMI status of the participants, it was found that 5.6 % of the participants were underweight, 30.1 % were within normal BMI range and 64.3 % of study participants were overweight as per WHO recommendation of BMI classification. The findings of the present study are in agreement with the findings other studies done on organized sector workers [21]. In the present study the number of individuals suffering from the most prevalent musculoskeletal disorder, lower back pain and neck pain, are 65.9 % and 51.3 % respectively. This is in agreement with earlier studies done on individuals of organized sector [19]. The present study indicates that the least prevalent musculoskeletal symptom was elbow pain with 10.5 % of individuals which is in agreement with earlier studies [1] while the most affected body parts were neck with 53.5%, lower back with 51.1%, shoulders with 49.2% and upper back with 38.4% of individuals. The main focus of the study was to assess the musculoskeletal discomfort score among the study participants. CMDQ is a reliable and valid tool, for measurement of WMSD in computer professionals. Maximum CMDQ score has been found with individuals categorized as overweight followed by normal weight and underweight individuals; this may be attributed to the fact that higher BMI increase the chance of MSD occurrence. Significant association ($P < 0.01$) existed between BMI and CMDQ scores (Fig.1) which is in agreement with previous studies [8, 20 and 25]. Studies on obesity indices observed that, CI similar to WHR is related with atherogenic risk factors in adults, but CI has the advantage of calculating central adiposity without the measurement of hip circumference [9]. Thus CI is considered to be a better indicator, compared with WHR for identifying adolescents with high trunk fat. CMDQ score is found to be significantly associated with CI ($P < 0.01$) and AVI ($P < 0.01$). Earlier studies [21] found a positive association existed between BMI and musculoskeletal pain and its related symptoms. Another study [6] reported that, the risk of musculoskeletal pain among over-weight/obese individuals was 1.7-times more as compared to individuals with normal body weight. The present study indicates that there exist a relationship between obesity indices and WMSD score. This may indicate that the body tissues are in stress due to increased BMI which may contribute to musculoskeletal discomforts [23] which may indicated the association between weight-related factors and the prevalence of low back pain. Studies also reported [24] significant correlation between high BMI and low back pain attributable due to lesser flexibility, especially poor hip mobility. From the present study, it may be concluded that obesity indices are associated with musculoskeletal symptoms; and a rise in BMI, CI and AVI increases the chance of MSD occurrence in computer operators, occupationally engaged in organized sector.

References

[1] Akrouf Q AS, Crawford JO, Al-Shatti AS, Kamel MI. Musculoskeletal disorders among bank office workers in Kuwait. Eastern Mediterranean Health Journal 2010; 16: 94–0.

[2] Banerjee N, Chatterjee S, Chatterjee A, Kundu S,De S, Mukherjee S, Relationship between two body adiposity estimating methods: a study in bengalee female adolescents being trained inbharatnatyam dance. International Physiology (ISSN 2347–1506) 2014: 2: 41–49.

[3] Banerjee N, Chatterjee S, Chatterjee A, Mukherjee S, Body Fat Estimation by anthropometric and impedance techniques in bengalee females engaged in sedentary work, *In*: Ergonomics for Rural Development (ISBN 978-93-5174-905-9), Vidyasagar University; 2013: 434 –440.

[4] Banerjee N, Santra T, Chatterjee S, Mukherjee S e, Prevalence of overweight in rural sedentary human resources in southern part of west bengal, India, In: Ergonomics for Rural Development (ISBN 978-93-5174-905-9), Vidyasagar University, 2013, 88–96.

[5] Berner K, Jacobs K. The gap between exposure and implementation of computer workstation ergonomics in the work place. Work 2002; 19: 193–9.

[6] Bihari V, Kesavachandran C, Pangtey BS, Srivastava AK, Mathur N. Musculoskeletal pain and its associated risk factors in residents of National Capital Region. Indian Journal of Occupational and Environmental Medicine 2011; 15: 59–63.

[7] Carreira H, Pereira M, Azevedo A, Lunet N. Trends of BMI and prevalence of overweight and obesity in Portugal (1995-2005): A systematic review. Public Health Nutrition 2012; 15: 972–81.

[8] Chatterjee A, Chatterjee S, Santra T, Mukherjee S, The influence of anthropometric variables for

development of musculoskeletal discomfort among computer operators in organised sectors, In: User Centred Design and Occupational Wellbeing, McGraw Hill Education (ISBN 978-93-392-1970-3); 2014: 499 –503.

[9] Chatterjee S, Banerjee N, Santra T, Chatterjee A, Chatterjee S, Manna I, Banerjee U, Mukherjee, S, 2014. Impact of dancing on obesity indices on Bengalee female adolescents of Kolkata. American Journal of Sports Science and Medicine 2014; 2: 40–44. doi: 10.12691/ajssm-2-5A-9.

[10] Ezeukwu O, Agwubike EO. Anthropometric measures of adiposity as correlates of atherogenic index of plasma in non-obese sedentary Nigerian males. Libyan Journal of Medicine 2014: Citation, 9: 23798 - http://dx.doi.org/10.3402/ljm.v9.23798.

[11] Hedge A, Marimoto S, McCrobie D. 1999. Effect of keyboard tray geometry on upper body posture and comfort with the use of CMDQ (Cornell university musculoskeletal discomfort questionnaire). *Ergonomics 1999*; 42:1333–49.

[12] Hu G, Tuomilehto J, Silventoinen K, Barengo N, Jousilahti P. Joint effects of physical activity, body mass index, waist circumference and waist-to-hip ratio with the risk of cardiovascular disease among middle-aged Finnish men and women. European Heart Journal 2004; 25:2212–19.

[13] James WPT, Chen C, Inoue S. Appropriate Asian body mass indices? Obesity Review, 2002; 3:139.

[14] Janwantanakul P, Pensri P, Jiamjarasrangsri V, Sinsongsook T. Prevalence of self-reported musculoskeletal symptoms among office workers. Occup Med. (Lond) 2008; 58: 436–38

[15] Kostiæ R, Đuraškoviæ R, Miletiæ Đ, Mikalaèki M. Changes in the Cardiovascular Fitness and Body Composition of Women under the Influence of the Aerobic Dance. Physical Education and Sport 2006; 4:59–71.

[16] Kuorinka I, Jonsson B, Kilbom A, Viterberg H, Biering SF, Andersson G, Jorgensen K. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms, Applied Ergonomics 1987; 18: 233–37.

[17] Meerding WJ, IJzelenberg W, Koopmanschap MA, Severens JL, and Burdorf A. Health problems lead to considerable productivity loss at work among workers with high physical load jobs. J Clin Epidemiol 2005; 58: 517–3.

[18] Mukherjee S, Banerjee N, Chatterjee S, Chatterjee S, Chatterjee A, Santra T, Saha B, effect of bharatnatyam dancing on body composion of bengalee female children. American Journal of Sports Science and Medicine 2014; 2: 56–59. doi: 10.12691/ajssm-2-1-10.

[19] Refat AR AG, Mohammed AH, Aboel-Magd SA E, Hammam RA E. Ergonomics aspect and health hazards on computer workstations' operators at Zagazig University: An occupational risk management approach. Zagazig J of Occupational Health and Safety 2008; 1:15–31.

[20] Sethi J, Sandhu JS, Imbanathan I, 2011. Effect of Body Mass Index on work related musculoskeletal discomfort and occupational stress of computer workers in a developed ergonomic setup. *Sports* Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2011; 3: 1–7.

[21] *Silva IM, Santos RS, Abreu S, Mota J,* Associations between body mass index and musculoskeletal pain and related symptoms in different body regions among workers. SAGE Open 2013: 1–6.

[22] Shidfar F, Alborzi F, Salehi M, Nojomi M. Association of waist circumference, body mass index and conicity index with cardiovascular risk factors in postmenopausal women. Cardiovascular Journal of Africa 2012; 23: 442–45.

[23] Shiri R Solovieva S, Husgafvel-Pursiainen K, Taimela S, Saarikoski LA, Hupponen R, Viikari J, Raitakati OT, Viikari-Juntura E.The association between obesity and prevalence of low back pain in young adults: the cardiovascular risk in young Finns study. Am J Epidemiol 2008; 167: 1110 – 19.

[24] Sjolie AN. Low Back Pain in Adolescent is Associated with poor hip mobility and high body mass index. Scand J Med Sc in Sport 2004; 14: 168–75.

[25] Viester L, Verhagen EA LM, Oude Hengel KM, Koppes LL J, Van der Beek AJ, Bongers P.The relation between body mass index and musculoskeletal symptoms in the working population, BMC Musculoskeletal Disorders 2013; 14: 1–9.

[26] WHO. Obesity: Preventing and managing the global epidemic, Report of a WHO consultation on obesity. Technical Report Series, No. 894, World Health Organization, Geneva, Switzerland, 2000; 256.

[27] WHO: *WHO Step wise approach to surveillance (STEPS)*. Geneva: World Health Organization; 2008. .

[28] Ye Z, Abe Y, Kusano Y, Takamura N, Eida K et al. The influence of visual display terminal use on the physical and mental conditions of administrative staff in Japan. J Physiol Anthropol 2007; 26: 69–3.