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Original Article

Anatomy Section

Effect of Body Mass Index on Occupational Health of Clinicians: A Descriptive Study

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ABSTRACT

Introduction: Clinicians in the present scenario are always exposed to constant and sustained levels of physical and mental stress. As they form the backbone of healthcare setup, the health of clinicians themselves is a very significant factor towards providing good health to all.

Aim: To determine the effect of Body Mass Index (BMI) on Work Related Musculoskeletal Discomfort (WMSD) and Occupational Stress (OS) in clinicians.

Materials and Methods: The descriptive study with inferential design was conducted on 200 clinicians working in Out-Patient Department (OPD) clinics of various departments of our Medical College, various private hospitals and clinics of Jalandhar with approximate duration of study being one year. BMI was calculated as ratio of Weight (kg) to the square of height (m). WMSD and OS were determined through reliable and valid questionnaires and their values were associated with demographic variables via statistical tests of Chi-square, ANOVA and Student t-test to infer their inter-relational significance.

Results: High BMI was reported more in above 40-year-old clinicians with higher incidence in surgical doctors than medical doctors. Majority (n=115) 57.5% of the clinicians were found to have mild musculoskeletal discomfort followed by no discomfort (23%) while 19.5% of them exhibited moderate to severe discomfort. Female clinicians showed more level of discomfort than male clinicians. BMI has high significance in relation to the questionnaire score. Clinicians with BMI >25 also showed high percentage (57.1%) of moderate and severe levels of OS.

Conclusion: BMI is positively related to physical as well as mental well-being of clinicians, especially in the middle age group. This information serves as an awareness and warning signal for the clinicians to safeguard their own health.

Keywords: Obesity, Occupational stress, Overweight, Work related musculoskeletal discomfort

INTRODUCTION

The occupation of a clinician involves physical as well as mental exertion. The workload and nature of work that a clinician does for the ailing community can put an undue stress on his body. Since clinicians form the backbone of the entire healthcare setup, the health of clinicians themselves assumes prime importance. Clinicians may become obese owing to prolonged sitting job in OPD, especially the medical stream as compared to the surgical clinicians. Obesity due to excess fat deposition can be expressed in terms of BMI though this is not the only parameter which can reflect obesity. BMI is by definition, weight of the body divided by the square of height.

Musculoskeletal Disorders (MSD) are very common in all working individuals. Similarly, the clinicians have more of sedentary work style in OPD clinics, which can put strenuous burden on the spine and other joints of the body resulting in musculoskeletal pain. These disorders can have a debilitating effect on one's work schedule and which in turn may or may not hamper his professional growth. High BMI has been addressed as an independent risk factor for MSDs apart from various other factors [1]. MSDs may include damage to ligaments, tendons, synovial membranes of joints, muscles of limbs or axial skeleton [2]. These disorders tend to appear due to repeated insult at these points and grow with time. Most of the studies have focussed on incidence of low back pain due to obesity [3]. Previous studies suggest that work related general as well as mental illness has been on the rise in doctors recently which warrants further research [4]. Systematic review based on 18 different studies advocated that better occupational health of doctors can contribute to improved patient care [5]. The present study endeavours to observe the effect and correlation of high BMI with WMSD of not only spine but also other regions of the body like neck, shoulder, hip, upper and lower extremities. It is expected that high BMI might be associated with MSDs of multiple regions in the body. The available literature says that high mechanical requirement and metabolism associated with obesity explains the relation of high BMI and MSDs [1]. The weight bearing joints like spine and lower limb may develop MSD due to increased force and tension across joint. Whereas in non weight bearing joints, increased fatty tissue may lead to nerve entrapment and hence, musculoskeletal pain. Thus, it is quite pertinent to assess different regions of the body because of multiple underlying mechanisms causing the onset of clinical symptoms. Occupational physical workload has been found to have significant relationship with MSD [6].

OS is a psychosocial entity that has been defined as organisational or interpersonal factors leading to raised mental stress [1]. Various outcomes of OS on obesity can be related with unhealthy behaviour including poor diet. Beyond that, chronic stress leading to elevated plasma cortisol levels can have an association with visceral fat accumulation [7]. Stress in clinicians can have two attributes- the first is associated with dealing with the disease and the diseased, which is inherent among clinicians; the second is related with the workplace demands, peer relations and job position. Occupational psychosocial stress apart from personal and work life balance, may be related to mental fatigue [8], which a clinician can suffer from, upon coming in contact with human sufferings repeatedly, monotony of work and even fear of patient's relatives' retaliation in today's world. For some, the more pronounced reason of stress might be the dissatisfaction with their position and workplace domain. The OS has been shown to predict various obesity related disorders like diabetes, ischaemic heart disease, cerebrovascular accident and other metabolic disorders like hypertension [9,10]. OS, overall, can have an impounding effect on both psychological as well as behavioural pattern in an individual. And if clinicians come under this effect, it can have a very detrimental effect on the health of the patients they treat. Therefore, it becomes imminent to safeguard the health of clinicians physically as well as mentally.

To evaluate both physical as well as mental components of occupational health of clinicians, we have taken one parameter of physical health, that is WMSD and one parameter of mental health,

that is OS. The objective of the present study was to determine the correlational effect and association of BMI on the WMSD and OS in clinicians. The present study will bring out the effect of obesity in clinicians and also its impact on the OS at their workplace.

MATERIALS AND METHODS

The current descriptive study was conducted on 200 clinicians working in OPDs of National Institute of Medical Sciences and Research, Jaipur, Rajasthan and Punjab Institute of Medical Sciences, Jalandhar, Punjab, India and various private hospitals in Jalandhar from July 2019 onwards till December 2020. The study was carried forward after prior approval from the Institutional Ethics Committee.

Inclusion criteria: Subjects between age 25 to 60 years, of both genders, having minimum clinical work experience of three years, with working duration of minimum six hours per day and willing to participate in the study were selected by systematic random sampling method.

Exclusion criteria: Clinicians suffering from any chronic illness other than related to occupation, having underwent major surgery in the past one year, having history of trauma leading to stiff joints, suffering from any weakness or paralysis of limbs, or having any congenital physical deformity were excluded from the study.

Sample size calculation: The sample size of minimum 197 was calculated at 90% confidence level, keeping margin of error at 5% from a total study population of 721 specialists in our city, using software G*power version 3.1.9.2. The participants were selected by systematic random sampling method. To even out the differences, 100 male and 100 female clinicians were selected. Based on the type of speciality, clinicians were also categorised into 100 medical and 100 surgical clinicians.

Procedure

Standard height frame and electronic weighing machine were used for measuring height and weight, respectively. BMI was calculated by taking the ratio of weight (in kilograms) to the square of height (in metres). As per World Health Organisation (WHO) norms, BMI was divided into four groups: low BMI (<18.5 kg/m^2), normal BMI (18.5-24.9 kg/m^2), high BMI (25-29.9 kg/m^2) and very high BMI (>30 kg/m^2) [11].

Work Related Musculoskeletal Discomfort

WMSD was determined through a reliable and valid Cornell University's WMSD Questionnaire [12] consisting of questions on pain and discomfort in 18 different body parts namely neck, shoulder (right and left), upper back, lower back, upper arm (right and left), forearm (right and left), wrist (right and left), hip, thigh (right and left), knee (right and left), and leg (right and left). This questionnaire contains three entities of WMSD, that is, frequency (number of times in a week when discomfort was felt), discomfort (level of discomfort ranging from mild to moderate to severe) and interference in day-to-day work (ranging from no interference to substantial interference in routine work). Thus, the questionnaire contains Frequency score, Discomfort score and Interference score. The frequency score consists of: (a) never=0; (b) 1-2 times/week=1.5; (c) 3-4 times/week=3.5; (d) every day=5; and (e) several times a day=10. The discomfort score consists of: (a) slightly uncomfortable=1; (b) moderately uncomfortable=2; and (c) very uncomfortable=3. The interference score consists of: (a) not at all=1; (b) slightly interfered=2; (c) substantially interfered=3. Final score of each body part was calculated by multiplying above frequency score (0, 1.5, 3.5, 5, 10) by discomfort score (1, 2, 3) and interference score (1, 2, 3) [1]. Net score of all body parts was calculated by adding the final scores of each body part. Scores of all body parts have been measured and interpreted as follows. No discomfort: 0, Mild discomfort: 1-150, Moderate discomfort: 151-300, Severe discomfort: >300.

Occupational Stress Index

OS was determined by OS Index (OSI) questionnaire [13]. OSI questionnaire containing 12 components has been used in the current study for finding out the levels of stress on a clinician. OSI developed by Srivastava and Singh [14] has been used extensively in Indian population for evaluating OS in various research studies. The OSI questionnaire consists of 46 questions, rephrased as per the work of clinicians, each question being rated on the 5-point scale. Out of 46, 28 are true keyed and 18 are false keyed. The stressors upon which the questionnaire is based are patient overload, role conflict, role ambiguity, unreasonable group pressure, powerlessness, poor peer relations, low status, strenuous working conditions and unprofitability. The OSI scores and grades have been taken as, <115 mild stress (Grade I), 116-161 moderate stress (Grade II) and >161 as severe stress (Grade III) [15].

All participants were given participant information sheet, were explained about the intended study and prior informed consent was taken. All the data of various clinicians which was collected via these questionnaires was labelled independently with the unique subject identification number, and was kept totally confidential. No expenditure was inflicted on the participants.

STATISTICAL ANALYSIS

The demographic independent variables taken for the study were age, gender, BMI and type of clinician. These were associated with dependent variables i.e., WMSD and OSI. The data was statistically analysed with the software IBM SPSS Statistics 21. The association was checked between different BMI groups and categories of WMSD and OSI with regards to their significance value via Chi-square test, and p-value was determined. Pearson correlation coefficient was also determined for correlation of WMSD and OSI with different age as well as BMI categories.

RESULTS

Comparing BMI with other demographic independent variables, it was found that high to very high BMI was more prevalent in clinicians aged above 40 years. A total of (n=127) 63.5% clinicians presented with high to very high BMI. Out of these, 11% fall under obese category and 52.5% came under overweight category. Surgical clinicians were found to have higher incidence of high BMI [Table/Fig-1], though there was an insignificant p-value (>0.05) determined through Chi-square test when BMI was associated with age, gender as well as type of clinician.

WMSD was compared with age, gender and type of work. Overall, 19.5% of clinicians presented with moderate to severe WMSD.

BMI category	Total n (%)	Gender		Age				Type of clinician	
		Male (n=100)	Female (n=100)	≤30 years n (%)	31-40 years n (%)	41-50 years n (%)	>50 years n (%)	Medical (n=100)	Surgical (n=100)
Low	6 (3)	2	4	2 (10)	1 (1.5)	3 (4.1)	0 (0)	5	1
Normal	67 (33.5)	39	28	10 (50)	24 (36.4)	17 (23.3)	16 (39.0)	39	28
High	105 (52.5)	51	54	6 (30.0)	34 (51.5)	41 (56.2)	24 (58.5)	46	59
Very high	22 (11)	8	14	2 (10)	7 (10.6)	12 (16.4)	1 (2.4)	10	12

[Table/Fig-1]: Body Mass Index (BMI) distribution with gender, age, type of clinician.
#Chi-square test; p>0.05; NS: Not significant

Specifically (n=15) 20.5% of those among age group 41-50 years and (n=16) 39% among age group >50 years had moderate to severe WMSD in some regions of the body [Table/Fig-2]. Chi-square test done on association of WMSD with different age categories was highly significant with p-value <0.001, but the same test for comparison with gender and type of clinician resulted in insignificant p-value (>0.05).

Variables	No WMSD (n=46)	Mild WMSD (n=115)	Moderate WMSD (n=33)	Severe WMSD (n=6)	p-value#
Age (years)					
<30 (n=20) (%)	12 (60)	8 (40)	0 (0)	0 (0)	<0.001**
31-40 (n=66) (%)	13 (19.7)	45 (68.2)	7 (10.6)	1 (1.5)	
41-50 (n=73) (%)	14 (19.2)	44 (60.3)	12 (16.4)	3 (4.1)	
>50 (n=41) (%)	7 (17.1)	18 (43.9)	14 (34.1)	2 (4.9)	
Gender					
Male (n=100)	27	55	16	2	0.511; NS
Female (n=100)	19	60	17	4	
Type of clinician					
Medical (n=100)	26	60	13	1	0.161; NS
Surgical (n=100)	20	55	20	5	

[Table/Fig-2]: Association of WMSD with age, gender, type of clinician.
#Chi-square test; p>0.05; NS: Not significant; *p<0.05; Significant; **p<0.001; Highly significant

Finding the association of BMI with WMSD, it was revealed that among clinicians having BMI more than 25, a staggering 27.6% accounted for moderate to severe WMSD. Highly significant p-value <0.001 suggests a clear-cut relation between BMI and WMSD levels as depicted in [Table/Fig-3].

BMI category	WMSD levels			
	No WMSD (n=46)	Mild WMSD (n=115)	Moderate WMSD (n=33)	Severe WMSD (n=6)
Low (n=6) (%)	5 (83.3)	1 (16.7)	0 (0)	0 (0)
Normal (n=67) (%)	32 (47.8)	31 (46.3)	3 (4.5)	1 (1.5)
High (n=105) (%)	6 (5.7)	76 (72.4)	21 (20)	2 (1.9)
Very high (n=22) (%)	3 (13.5)	7 (31.8)	9 (40.9)	3 (13.6)

[Table/Fig-3]: Association of BMI with WMSD.
χ^2=76.599; df=9; p<0.001; Highly significant

The OS was found to be categorically higher in the middle ages of 31-50 years, overall (n=86) 43% of clinicians showed signs of moderate OS while 3.5% had an OSI score in the severe category [Table/Fig-4]. The level of OS varies very significantly (p<0.001) with different age categories and also showed a significant difference with respect to medical and surgical clinicians (p=0.012).

Variables	Mild OS (n=107)	Moderate OS (n=86)	Severe OS (n=7)	p-value#
Age (in years)				
<30 (n=20) (%)	18 (90)	2 (10)	0 (0)	<0.001**
31-40 (n=66) (%)	26 (39.4)	36 (54.5)	4 (6.1)	
41-50 (n=73) (%)	31 (42.5)	39 (53.4)	3 (4.1)	
>50 (n=41) (%)	32 (78)	9 (22)	0 (0)	
Gender				
Male (n=100)	54	45	1	0.152; NS
Female (n=100)	53	41	6	
Type of clinician				
Medical (n=100)	43	53	4	0.012*
Surgical (n=100)	64	33	3	

[Table/Fig-4]: Association of OSI with age, gender, type of clinician.
#Chi-square test; p>0.05; NS: Not significant; *p<0.05; Significant; **p<0.001; Highly significant

Comparing BMI with OSI, it was found that there exists a significant association between the two (p<0.001) determined through Chi-square test. Among clinicians with high BMI, a very high number of patients (n=60) 57.1% had moderate to severe OS while on the contrary, among clinicians with normal BMI, only (n=20) 29.9% had moderate to severe OSI [Table/Fig-5].

BMI category	Mild OS (n=107)	Moderate OS (n=86)	Severe OS (n=7)
Low (n=6) (%)	6 (100)	0 (0)	0 (0)
Normal (n=67) (%)	47 (70.1)	19 (28.4)	1 (1.5)
High (n=105) (%)	45 (42.9)	58 (55.2)	2 (1.9)
Very high (n=22) (%)	9 (40.9)	9 (40.9)	4 (18.2)

[Table/Fig-5]: Association of BMI with OS.
χ^2=33.665; df=6; p<0.001; Highly significant

Evaluating the overall results, there was a highly significant correlation between age, BMI and WMSD determined through Pearson correlation coefficient (r-value) which yielded a highly significant p-value <0.001 [Table/Fig-6]. Extracting similar results for OSI, age was an insignificant factor, while BMI has a highly significant correlation with OSI.

Variables	WMSD score		OSI score	
	r-value	p-value	r-value	p-value
Age	0.359	<0.001**	-0.045	0.528; NS
BMI	0.412	<0.001**	0.300	<0.001**

[Table/Fig-6]: Correlation of WMSD and OSI score with age and BMI.
r value: Pearson Correlation coefficient; p>0.05; NS: Not significant; **p<0.001; Highly significant

Associating mean of WMSD score with independent variables like age through ANOVA, it was evident that with increasing age groups, mean WMSD score rose very significantly. Similar association was found with increasing BMI categories and type of clinician, where surgical specialists had a much higher mean WMSD score than medical ones [Table/Fig-7].

Variables	Category	WMSD score		p-value
		Mean	SEM	
Age# (in years)	≤30 (n=20)	11.55	6.791	<0.001**
	31-40 (n=66)	37.16	8.532	
	41-50 (n=73)	58.62	9.363	
	>50 (n=41)	100.40	13.235	
BMI#	Low (n=6)	6.50	6.500	<0.001**
	Normal (n=67)	24.66	7.322	
	High (n=105)	61.58	7.141	
	Very high (n=22)	132.82	21.485	
Gender$	Male (n=100)	49.23	7.334	0.267; NS
	Female (n=100)	61.57	8.300	
Type of clinician$	Medical (n=100)	40.51	6.134	0.007*
	Surgical (n=100)	70.28	9.018	

[Table/Fig-7]: Association of mean WMSD score with age, BMI, gender, type of clinician.
#ANOVA; $Student t-test; SEM: Standard error mean; p>0.05; NS: Not significant; *p<0.05; Significant; **p<0.001; Highly significant

Associating mean OSI score for different demographic variables, it was found that in different age as well as BMI categories, mean OSI score varied very significantly among different groups [Table/Fig-8].

DISCUSSION

The present study has seen that overall high BMI is highly associated with WMSD in such a way that clinicians having BMI greater than 25 had far high incidence of musculoskeletal symptoms than those having BMI less than 25. WMSD has previously been studied in various other occupations in Indian population [2] but this is one of very few studies on clinicians of Indian population. Here, high

Variables	Category	OSI		p-value
		Mean	SEM	
Age[#] (in years)	≤30 (n=20)	106.45	2.010	<0.001**
	31-40 (n=66)	122.68	2.395	
	41-50 (n=73)	121.51	2.323	
	>50 (n=41)	112.29	2.471	
BMI[#]	Low (n=6)	106.83	2.664	<0.001**
	Normal (n=67)	111.31	1.830	
	High (n=105)	121.48	1.653	
	Very high (n=22)	129.36	6.274	
Gender[$]	Male (n=100)	117.51	1.686	0.459; NS
	Female (n=100)	119.49	2.072	
Type of clinician[$]	Medical (n=100)	121.15	1.852	0.047*
	Surgical (n=100)	115.85	1.893	

[Table/Fig-8]: Association of mean OSI score with age, BMI, gender, type of clinician. [#]ANOVA; [$]Student t-test; SEM: Standard error mean; p>0.05; NS: Not significant; *p<0.05; Significant; **p<0.001; Highly significant

BMI has a definite influence in increasing WMSD. Our results reflect a clear correlation between WMSD and age as well as BMI, such that with rise in BMI and increase in age, chances of having musculoskeletal discomfort increase manifold. Clinicians having a BMI more than 25 are more prone to having pain and discomfort in musculoskeletal elements of the body. And this is all the more evident as the age advances due to natural gradual age-related degenerative changes occurring at various joints in the body. The excess weight puts more burden on the already degenerating articular surfaces and associated soft tissues which is why clinicians older than 50 years and having high BMI were having maximum incidence of WMSD. The author suggests that pathophysiological factors associated with these changes can be explored further in case-control based studies.

Sethi J et al., has reported high incidence of WMSD among high BMI people and those in the age group 31 to 35 years. The study says that overweight can contribute significantly to increase in physiological and mechanical load on tissues, resulting in pain and discomfort in the musculoskeletal system [2]. Increase in weight increases intradiscal pressure of the nucleus pulposus which acts as a load transducer and results in an increased muscular effort to maintain the optimum posture of the body and hence an undue stress on the vertebral column [16]. Overweight also badly affects the control of upper limb movements, thus inferring that clinically obese persons might be less efficient and more prone to musculoskeletal injuries than those having normal weight [17]. Shiri R et al., conducted a study to find the relation between obesity and low backache and concluded that there is a positive association between weight related factors and low back pain [18]. Further, it has been said that longer the time spent in sitting job, higher is the tissue load on different body parts which can aggravate in case of high BMI. Clinicians are bound to sit continuously for long hours in OPDs as a routine part of their work and hence, are subjected to greater load on those body parts resulting in muscular and skeletal pain. The time factor is dependent on the pace of work which may get slowed down in case of obese professionals leading them to more WMSD [19].

In the current study, maximum clinicians have OSI score in the mild stress category, whereas an OSI score of more than 115 indicating moderate to severe stress was found in less than half of clinicians. It is however pertinent to note that OSI was been found to have a significant interrelation with high BMI (p<0.001). Moreover, it was analysed that as the BMI increases, the OSI score also shoots up remarkably (Pearson coefficient=0.300, p<0.001). Hence, it would not be wrong to say that high BMI has a definite impact on OS. Ostry AS et al., also explored that there exists a significant relationship between BMI and OS [20].

The incidence of occupation related stress has increased globally with many factors contributing towards it, such as less job opportunities, time constraints, stiffer competition at workplace and job insecurities. To add to that, clinicians encounter extra stress at their workplace, because the results of their work is not completely in their hands. The recovery of any patient needs a lot of factors, clinician being just one of it. With the increasing incidences of patients and their relatives' outburst in the form of not only verbal but also physical attacks, the stress to perform has increased manifold on the doctors [21].

The link between job stress and obesity can be worked out through factors like dietary intake, sedentary work and metabolic rate of individuals [7]. Many studies have indicated various type of stress including work related stress in relation to obesity related behaviours, like diet and exercise [22,23]. On the contrary, one study has not found any significant association between stress and dietary changes leading to obesity [24]. A meta-analysis study has cleared the air on this controversial factor, finding that around 40% of people increasing their intake, another 40% decreasing their intake and remaining 20% reporting no change in dietary intake in response to stress [25]. It was interesting to find that people who were overweight generally increased their food intake with stress whereas those who were in the underweight or normal weight category did not do so [26]. A study on young doctors found that one-third of the doctors experienced stress at work, caused by an effort-reward imbalance which led to a negative impact on their personal health and life contentment [27]. A systematic review indicated that physicians' good occupational health can contribute to better patient satisfaction and interpersonal aspects of care [5].

The clinical implication of this study lies in the fact that deterioration of the health of clinicians is bound to have an impact on the health of the society in general which must be carefully addressed. Amid the extensive rise in workload of doctors, especially during the ongoing COVID-19 pandemic, the health status and safeguarding of the physical as well as psychological health of clinicians assumes heightened importance. The impact which obesity has on a person's physical health is well-documented. Accumulation of excess fat in the body leads to various metabolic disturbances and also puts extra load on joints and their supporting muscles and ligaments. This can manifest gradually as pain and discomfort in those joints. Weight gain basically causes individuals to bend their spine and joints in unusual ways to accommodate that extra weight [28]. Future studies are recommended which should include effect of BMI on different subject specialists among clinicians and compare general mental stress with OS. Further research can also include common metabolic disorders like diabetes mellitus and hypertension to find their correlational effect of BMI on WMSD and OS.

Limitation(s)

The major limitation of the present study is number of study participants and their geographical generalisation. Also, many confounders of the current parameters can also be added as separate parameters for increasing the validity of the study.

CONCLUSION(S)

The present study draws conclusion that there is a prominent outcome of high BMI with regards to increase in WMSD and OS. This study reflects the ignorance of clinicians on part of their own health and guides them to safeguard their own health especially in terms of musculoskeletal symptoms and perceiving stress at their workplace. They must formulate ways to overcome overweight in spite of their high workload, and sedentary and stress inducing occupation.

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