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A DESCRIPTIVE STUDY ON THE RELATIONSHIP BETWEEN BODY MASS INDEX AND BODY POSTURE IN CLINICIANS

Anatomy

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ABSTRACT

BACKGROUND : Clinicians in the today's world are always under sustained levels of physical exertion. As they form backbone of healthcare setup, the health of clinicians themselves is a very significant factor towards providing good health to all.

AIMS & OBJECTIVES - The objective of the study was to determine the relation of body mass index (BMI) on both static standing as well as dynamic sitting body posture in clinicians. This will establish a relation between obesity and postural stress of clinicians

METHODS: The descriptive study was conducted in OPD clinics of our medical college and various private hospitals of Jalandhar. BMI was calculated as ratio of weight (kg) to the square of height (m). Standing posture was assessed with the help of plumb bob passing the line in lateral and posterior aspect of the body finding the correct (YES) or faulty (NO) posture taken for the calculation. Dynamic (work sitting) posture was checked with observation during the OPD work by using the RULA (Rapid Upper Limb Assessment) worksheet. All the values obtained were statistically analysed with Chi square test to determine association.

RESULTS: In high BMI group, three-fourths of the clinicians were found to have faulty standing static posture and 79% had faulty dynamic work posture whereas normal BMI group had minimum faulty posture. Female clinicians showed more level of faulty posture than male clinicians. The results also show that with increase in BMI, faulty posture also takes a higher turn.

CONCLUSION: BMI is positively related to postural stress in clinicians, especially in the higher age group. This information serves as an awareness and warning signal for the clinicians to safeguard their own health and correct their faulty posture.

KEYWORDS

static posture, dynamic posture, obesity, overweight, clinicians, balance

INTRODUCTION

The posture of the body plays an important role in determining long term effects on the weight bearing joints of the body. The importance of maintaining a good and correct posture can be emphasized by stating that a functionally correct body posture is such which puts least strain on the body musculature and other soft tissues. Posture lends balance and stability to the body which is very essential in carrying out routine day to day activities. Maintaining a good sitting posture becomes all the more essential in jobs which involve long periods of sitting, as in the case of clinicians. The occupation of a clinician is very challenging as it may involve continuous sitting in out patient departments (OPDs) or long duration standing in operation theatres. It would be quite an understatement to say that during all this routine work, a clinician has to be mentally more than alert which is only possible if they have a healthy body.

Faulty body posture coupled with extensive and strenuous working hours along with excess fat accumulation can be very detrimental to one's body. The association between excess body weight and postural control was first highlighted by Fregly AR et al. It was found that in obese and overweight people, the size and shape of the human physique might have an impact on static posture [1]. Prolonged sitting job also entails a lot of passive energy expenditure which can put enough strain on muscles and joints [2]. While we maintain sitting posture on a chair for an extended period of time, there is somewhat backward rotation of the pelvis along with flattening of lumbar curvature. Simultaneously, there is an additional load on the vertebrae and their intervening discs and muscles [3]. During standing posture, there is a decreased range of forward flexion. Altered posture while standing is associated with a collateral increase in hip joint movement which possibly explains the reason for musculoskeletal pain associated with incorrect static posture [4]. Studies from obesity related issues have yielded that excess body weight definitely leads to a decreased postural stability which puts a marked constraint on goal directed movements [5]. Obese people may not be as efficient and might be more prone to injuries than those with normal weight. The position of body in relation to space depends on visual, somato-sensory and vestibular functions. The control of muscles in maintaining dynamic balance of the body involves the activity of coordinates of kinetic chains [6]. Sustaining a proper posture not only gives extra life to muscles and weight bearing areas of the body but is also essential in carrying out physical work in a more coordinated and less strained manner. Incorrect posture is bound to put supplemental load on the muscles and weight transmitting points of the body resulting in premature fatigue and inefficiency to complete the task at hand. Protruding belly as often found in case of obese individuals is in itself an obstruction while performing sitting jobs to reach out the target point of work. If clinicians come under this effect, it can have a pronounced malign effect on the health of the patients they are going to treat. Thus, safeguarding the weight and posture of the clinician becomes utmost crucial.

The objective of our study was to determine the relative association of BMI with standing and sitting posture in clinicians. This will establish a relation between obesity and postural stress in clinicians.

MATERIAL AND METHODS

The present descriptive study was carried out on 200 clinicians working in OPDs of our medical institution and various private hospitals in Jalandhar after obtaining prior approval from Institutional Ethics Committee. All participants were given an information sheet regarding this study and its consequences, and prior written informed consent was taken from all the voluntary participants. The data collected was kept absolutely confidential. No expenditure or cost of any kind was inflicted on the participants. 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 study participants were selected by Systematic random sampling method. To even out the differences, 100 male and 100 female clinicians were selected. And based on the type of speciality, clinicians were also classified 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)[7]. As per World Health Organization, BMI was divided into four groups: low BMI ‹ 18.5 (underweight), normal BMI (18.5 - 24.9), high BMI 25 - 29.9 (overweight) and very high BMI ›30 (obese) [8].

Static standing posture was assessed as correct (YES) or faulty (NO) with the help of a plumb bob passing through two plumb lines, one on lateral side of the body and another on the posterior aspect of the body

[9], Dynamic posture during sitting was checked by observation during the OPD work (after minimum two working hours of the day) by using the RULA (Rapid Upper Limb Assessment) employee assessment worksheet [10]. The RULA score of two or less is considered normal and acceptable whereas a score of three onwards is considered faulty with increasing incorrectness of posture which requires further rectification.

Inclusions

Subjects aged above 25 years, of both genders, having minimum clinical work experience of three years, with working duration of minimum 6 hours per day and willing to participate in the study were selected.

Exclusions

Clinicians suffering from any chronic musculoskeletal disease, 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.

STATISTICALANALYSIS

The demographic independent variables taken for the study were age, gender, BMI and type of clinician. These were associated with dependent variables i.e standing and sitting posture. The data was statistically analyzed with the software IBM SPSS Statistics 21. The association was checked between different BMI groups and faulty posture with regards to their significance value via Chi square test, and p value was determined.

RESULTS

Estimating the BMI, a very high percentage (63.5%) of the clinicians were found to be having a BMI greater than 25. Among these, 11% fall under Obese category which contained more number of female clinicians, while 52.5% were found to be overweight where again females marginally outnumbered the males. (Table 1)

Table 1 Body mass index distribution with gender, age, type of clinician

BMI	%	Male	Female	≤ 30 years	31-40 years	41-50 years	›50 years	Medical (n=100)	Surgical (n=100)
< 18.5 (n=6)	3 %	2	4	2	1	3	0	5	1
18.5 – 24.9 (n=67)	33.5 %	39	28	10	24	17	16	39	28
25 – 29.9 (n=105)	52.5 %	51	54	6	34	41	24	46	59
≥ 30 (n=22)	11 %	8	14	2	7	12	1	10	12

With regards to the faulty standing posture, it was seen in (n= 133) 66.5% of the clinicians and it was expectedly found more in above 50 years age category. Age has a significant relationship with faulty standing posture, determined through Chi-square test (p=0.018). Standing posture was also associated with gender and type of clinician. Faulty standing posture was more evident in females (68%) than males (65%). Comparing the medical and surgical doctors, it was found that faulty standing posture was more common among surgical clinicians (71%) than their medical colleagues (62%). But overall relation between BMI and age as well as gender was statistically insignificant (p>0.05). (Table 2)

Table 2 – Association of Standing posture with age, gender and type of clinician

Age	Correct Standing Posture (Score = 0)	Faulty Standing Posture (Score >0)	$x^2 = 10.061$; df = 3; p = 0.018; Significant
≤30 (n=20) % within group	12 60%	8 40%	
31-40 (n=66) % within group	25 37.9%	41 62.1%	
41-50 (n=73) % within group	21 28.8%	52 71.2%	
› 50 (n=41) % within group	9 22%	32 78%	
Male (n=100)	35	65	P = 0.653; NS
Female (n=100)	32	68	
Medical (n=100)	38	62	P = 0.178; NS
Surgical (n=100)	29	71	

About two-thirds of clinicians (n = 136) reported faulty sitting posture with a RULA score of more than 2. It was more evident in age group of above 50 years. As the age advances, incidence of faulty posture increased. Comparing it with gender, it was evident that females had more faulty sitting posture than males. Association between faulty sitting posture and type of clinician was statistically significant (p<0.05). Surgical specialists had higher incidence of faulty sitting posture as compared to medical counterparts (Table 3).

Table 3 - Association of Sitting posture with age, gender and type of clinician

Age	Correct Sitting Posture (RULA - 2 or less)	Faulty Sitting Posture (RULA more than 2)	P value
≤30 (n=20) % within group	10 50%	10 50%	**$x^2 = 5.243$; df = 3; p = 0.155; Not Significant**
31-40 (n=66) % within group	23 34.8%	43 65.2%	
41-50 (n=73) % within group	22 30.1%	51 69.9%	
› 50 (n=41) % within group	9 22%	32 78%	
Male (n=100)	36	64	0.225; NS
Female (n=100)	28	72	
Medical (n=100)	39	61	0.034* **Significant**
Surgical (n=100)	25	75	

#Chi-Square Test: NS: p > 0.05; Not significant; *p<0.05; Significant

Table 4 – Association of BMI with standing and sitting posture

	Standing posture		Sitting posture	
BMI category	Correct	Faulty	Correct	Faulty
Low (n=6) % within group	2 33.3%	4 66.7%	4 66.7%	2 33.3%
Normal (n=67) % within group	39 58.2%	28 41.8%	38 56.7%	29 43.3%
High (n=105) % within group	26 24.8%	79 75.2%	22 21%	83 79%
Very high (n=22) % within group	0 0%	22 100%	0 0%	22 100%
	<0.001**		**<0.001****	

#Chi-Square Test: NS: **p<0.001; Highly Significant

Faulty posture, both standing as well as sitting, has a highly significant association with BMI determined via Chi-square test, having p value <0.001. Finding the association of BMI with standing posture, it was revealed that among clinicians with high to very high BMI, a striking high 79.5% (101 out of 127) had developed faulty static standing posture. Extracting similar association with sitting posture, the percentage of faulty sitting posture in case of overweight and obese clinicians stood at a staggering high of 82.6% (105 out of 127). (Table 4)

DISCUSSION

The physical well-being of doctors plays a huge part in fulfilling the objectives of healthcare system. As has been seen all over the world during the Covid-19 pandemic, clinicians have been put to extreme limits of physical endurance. Thus, safeguarding the health of doctors must be of prime importance. Accumulation of excess fat leading to obesity not only disturbs the metabolic functions of the body but also the physical structure and form. Weight gain can affect posture, causing individuals to bend their spine and joints in unusual ways to accommodate that extra weight. Over time, excess weight can cause poor posture, including stooped shoulders, a bent spine, hips that may rotate out of alignment, and a protruding belly.

Carral JM et al has reported a statistically significant relation between BMI and balance in obese individuals irrespective of the level of their physical activity [11]. Obese persons have increased body mass but on

the other hand a weaker lower body muscle power which accounts for unstable posture [12]. It has also been reported that older people have more fat mass compared to muscle mass and hence fat mass also influences balance in obese older people [13]. This also corresponds to our study findings in which more aged clinicians having high BMI are affected more in terms of faulty posture. It has been observed in the past that high BMI persons exhibit a more flexed curvature at thoracic and pelvic spine level, and these postural deviations rose with increased BMI [4]. The similar reflection in the form of faulty standing and sitting posture in case of high to very high BMI group was elicited in the present study. An earlier research has also put it this way that patients with BMI more than 30 kg/m^2, falling under obese category, tend to remain in balanced posture for a short period of time and in unbalanced posture for longer periods of time when compared with non-obese individuals [6]. This has been interpreted as obesity affecting the selection of motor co-ordination to maintain postural balance [14]. Numerous studies have dwelled upon impact of BMI on postural balance but there are very few significant studies which stress on relation between different categories of BMI and static and dynamic posture. The present study highlights a statistically significant association ($p < 0.001$), so that as the age advances and with increase in BMI, the deviation from normal posture also increases.

Another aspect which warrants attention is the consequence of faulty posture among obese people. An incorrect posture over a period of time is bound to cause pain and discomfort in the affected joints. Although there has been no well-defined documented association between BMI and low back pain [15]. But self reported pain and discomfort in the lower back as well as cervical region which hinders routine work is very commonly found in obese population [16]. Much of these increasing pain and discomfort complaints in case of obese individuals can be attributed to altered posture deviations from the normal as highlighted by the present study. The above findings are also in line with a report which suggests an enormous association between increased body mass and frequency of development of osteophytes in vertebral column [17]. Owing to this, constant with previously reported literature, forward flexion of trunk becomes restricted in both sitting as well as standing postures [18]. In support of this, there have been studies which suggest that reduction in weight leading to lowering of BMI can have favourable effect on postural stability [19]. Especially pertaining to dynamic stability, it has been said that obesity has a critical influence on dynamic posture and balance [20]. Increased body mass also results in functional adaptation of altered posture which may not manifest as discomfort initially but tends to bring on pain related symptoms as the time goes by and the strain on particular joints and muscles increases [21]. Our study stresses upon the important relation between high BMI and postural deviation, but it does not link this association with incidence of pain and discomfort which can be explored in future studies.

CONCLUSION

The present study draws conclusion that there is a prominent association of high BMI with regards to faulty standing as well as dynamic sitting posture. Surgical specialists had more incidence of faulty sitting posture. This study reflects that clinicians tend to ignore their own health and guides them to protect their own body from enormous workload especially in terms of musculoskeletal symptoms.

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