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Co-Relation of Body Mass Index (BMI) With Hemoglobin Concentration in Health Care Workers at A Tertiary Care Centre.

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ABSTRACT

World Health Organization recommended that 66% of deaths now occur in developing countries and recognizes obesity as a leading risk factor. Body Mass Index (BMI) is a well-known epidemiological marker for obesity. Over the past ten years, there has been an alarming rise in the prevalence of obesity-related chronic diseases in the nation, and obesity may raise the burden of anemia. Very few studies are available regarding correlation of Hemoglobin and BMI in health care workers. In India, there are even very less studies. To co-relate Body mass index (BMI) with hemoglobin concentration in health care workers at a tertiary care centre. After IEC approval and informed Consent, 310 health care workers grouped as per the job categories of Doctor Nurses, technicians were included. Haemoglobin and BMI of each group were measured and compared. There was statistically significant difference in BMI values for male technicians (23.28±2.76 P=0.0039), female technicians (24.19±3.88 P=0.0001), female nurses (22.29±484 P=0.0048), male doctors (25.32+433 P<0.0001), female doctors (24-82±3.75 P<0.0001) Significant negative co- relation between haemoglobin and BMI was found in female Nurses, female technicians, male and female doctors. (P value less than 0.0001). There is highly significant negative co-relation between hemoglobin and BMI in Doctors compared to Nurses and Technician category. Hence more attention is required to the awareness of health care workers regarding the work stress, physical activity and timely healthy food habits.

Keywords: BMI, Co-relation, Haemoglobin, Health care workers.

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INTRODUCTION

World Health Organization recommended that 66% of deaths now occur in developing countries and recognizes obesity as a leading risk factor. Obesity is characterized by chronic, low-grade, systemic inflammation, which, in turn, has been associated with anemia of chronic disease [1]. The concentration of hemoglobin offers information on the prevalence of anemia in the population. Anemia is severe since it has an impact on both physical and emotional health. It negatively impacts productivity by impairing behavioral, cognitive, and immune-competence development. Over the past ten years, there has been an alarming rise in the prevalence of obesity-related chronic diseases in the nation, and obesity may raise the burden of anemia [2, 3].

Body Mass Index (BMI) is a well-known epidemiological marker for obesity. There are also evidences of association of obesity to a number of medical conditions. These include: insulin resistance, glucose intolerance, diabetes mellitus, hypertension, dyslipidemia, sleep apnea, arthritis, hyperuricemia, gall bladder disease, and certain types of cancer. The independent association of obesity seems also clearly established for coronary artery disease, heart failure, cardiac arrhythmia, stroke, and menstrual irregularities [4]. Health care workers (HCW) who are continuously being working in the health set up are under stress and with the improper dietary habits. Obesity among health-care workers (HCWs) is an important issue as it can affect both their health condition and their professional capability too [5]. This obesity is associated with the risk of anemia.

Health-care workers (HCWs) should be role models who increase community awareness of obesity prevention and encourage patients to change their behavior towards a healthy lifestyle. Despite working in an environment related to disease prevention and health promotion, HCWs in several studies have shown a trend towards obesity over time and to have higher levels of obesity than the general population. Different job categories of HCWs bear different risks of becoming obese. Different job categories of HCWs have different work scope areas which will indirectly contribute to a greater risk of obesity among HCWs. Obesity among doctors may affect patients' perception of their credibility in advising patients, especially regarding lifestyle modification among overweight or obese patients [6].

Anemia and nutritional status through body mass index (BMI) are two key indicators in national family health survey of India. Several studies are conducted to determine this correlation in general population or the adolescent, medical students.

Health care workers include many job categories and the responsibilities carried by each job category worker are also different. Hence there may be variable finding as per the job category.

Very few studies are available regarding correlation of Hemoglobin and BMI in health care workers. In India, there are even very less studies. Hence, we conducted this study to correlate the body Mass index with hemoglobin levels in health care workers at a tertiary care centre.

Aims and Objectives

Aim

To co-relate Body mass index (BMI) with hemoglobin concentration in health care workers at a tertiary care centre.

Objectives

- To measure height and weight of health care workers.
- To estimate BMI on the basis of weight (in kg) and height (in meters) in health care workers
- To measure hemoglobin concentration in health care workers
- To correlate BMI with hemoglobin levels.
- To find association between various health care workers job categories and obesity.

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MATERIAL & METHODS

Study type

This was a Cross-sectional study.

Study design

Health care workers working at tertiary care hospital were included in this study.

Study setting

Health care workers as per their job categories (Nurses, technicians Doctors) working at tertiary care center were included in the study.

Study population

Health care workers (male and female) as per above mentioned job category above the age of 20 -50 years.

Study Duration

1st September 2023 to 30th October 2023.

Sample size

As per NFHS-5, in India about 24.4% women and about 23% of men are overweight or obese. Hence considering this as 'p', sample size was calculated using the formula

$N=4p(1-p)/l^2$ (p=0.244 and l= 20%of p=0.048) which comes as 308.

Hence, 310 Health Care workers (which included job categories like (Nurses, technicians, Doctors)

Ethical consideration

Approval to conduct the study was obtained from Institutional Ethics Committee (IEC). Participants who consented to participate after explaining the study details were included in the study. Participants were assured that their participation is voluntary and their information would be completely confidential.

Inclusion criteria

Health care workers in the defined age group and in the defined job category without any co-morbidity.

Exclusion criteria

- Health care workers who were not in the defined age group.
- Health care workers who were not in the defined job category.
- Health care workers in the defined age group and in the defined job category with any co-morbidity.

Data collection tools and procedure

After IEC approval, the data was collected with the help of validated proforma profile and the consent form. After the consent, the anthropometric measurements i.e. height (in meters) and weight (in kg) were obtained from all the participants. Health care workers were classified as per job categories as doctors, nurses and technicians. Using these parameters, Body Mass Index (BMI) was calculated as per formula-

Body Mass Index (BMI) =Weight (kg)/Height^2 (m^2).

Depending upon job category of health care workers and BMI values obtained, further classification as HCW with BMI> 22.9 and HCW with BMI <22.9 was done based on Asian classification of obesity.

Asian classification of obesity is as follows [7]:

Classification	Asian criteria BMI cut off
Underweight	<18.5
Normal	18.5-22.9
Overweight	23-24.9
Obese class I	25-29.9
Obese class II	>=30

Hemoglobin concentration was measured for all the health care workers in the laboratory setting on the Nyhon Kohden cell counter. For this, adequate sample was collected in EDTA bulb with all aseptic precautions. For comparison, normal levels of Hb for females and males were considered [8].

Statistical analysis

The data collected was compiled using Microsoft excel and analyzed using SPSS. The quantitative data was represented using mean and standard deviation.

The level of significance is 0.0001.

RESULTS

A total of 310 health care workers were included in the study, out of which 99 were males and 211 were females. These were been categorized into 3 classes as per job category- nurses, technicians and doctors. (Table 1)

Table 1: Number of Health care workers as per Job category, gender

	Male	Female	Total
Nurses	10 (0.99%)	91(90.09%)	101
Technicians	18(39.13%)	28 (60.86%)	46
Doctors	71 (43.55%)	92 (56.44%)	163
Total	99 (31.31%)	211 (68.06%)	310

Health care workers, BMI and Gender

The distribution of health care workers based on BMI and Gender showed that females with BMI more than 22.9 were 56.40% while BMI less than 22.9 were 43.60%. Males were 68.68% in group with BMI more than 22.9 while 31.31% in group with BMI less than 22.9. Overall distribution shows 60.32% health care workers were having BMI more than 22.9. Only 39.68% were having BMI less than 22.9.(Table 2)

Table 2: Distribution of health care workers based on BMI and Gender

	BMI<22.9	BMI>22.9	Total
Male	31(31.32)	68(68.68%)	99
Female	92(43.60%)	119(56.40%)	211
Total	123(39.68%)	187(60.32%)	310

We compared the Hemoglobin and BMI in each job category with the standard normal ranges also. This comparison included gender wise distribution also. This analysis was done by unpaired t test. The comparison showed following results.

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Hemoglobin and BMI in Nurses

In male nurses, there was statistically no significant difference for hemoglobin and BMI. In female nurses, there was statistically extremely significant difference in hemoglobin levels while it was also significant for BMI (Table 3a)

Table 3a: Comparison of Hemoglobin and BMI of Nurses gender wise with standard normal reference ranges

	Hb Male	BMI Male	Hb Female	BMI Female
Nurses	13.83±1.24	22.47±3.40	11.20±1.50	22.29±4.84
Normal	13.8-17.2	18.5-22.9	12.1-15.1	18.5-22.9
P value	0.9843	0.1838	less than 0.0001	0.0048

Hemoglobin and BMI in Technicians

In male technicians, there was statistically no significant difference for hemoglobin. But BMI was significantly high. In female technicians, there was statistically extremely significant difference in hemoglobin levels. BMI was also extremely significantly high in female technicians. (Table 3b)

Table 3b: Comparison of Hemoglobin and BMI of Technicians gender wise with standard normal reference ranges

	Hb Male	BMI Male	Hb Female	BMI Female
Technicians	14.41±1.66	23.28±2.76	11.34±2.07	24.19±3.88
Normal	13.8-17.2	18.5-22.9	12.1-15.1	18.5-22.9
P value	0.6001	0.0039	less than 0.0001	0.0001

Hemoglobin and BMI in Doctors

As compared to the above two job categories, Doctors showed extremely significant difference in hemoglobin levels compared to the normal ranges. This result was found in both the genders. There were statistically significant high BMI in both the gender. (Table 3c)

Table 3c: Comparison of Hemoglobin and BMI of Doctors gender wise with standard normal reference ranges

	Hb Male	BMI Male	Hb Female	BMI Female
Doctors	13.28±1.27	25.32±4.33	11.74±1.09	24.82±3.75
Normal	13.8-17.2	18.5-22.9	12.1-15.1	18.5-22.9
P value	less than 0.0001	less than 0.0001	less than 0.0001	less than 0.0001

Co-relation of Hemoglobin and BMI in Female Nurses

Female nurses with BMI more than 22.9 were 37 and with BMI less than 22.9 were 54. Both the groups showed that there is significant negative co-relation between Hemoglobin and BMI (Table 4a)

Table 4a- Co-relation of Hemoglobin and BMI in Female Nurses

Females with BMI > 22.9		Females with BMI<22.9	
N	37	N	54
Hb	11.04±1.68	Hb	11.30±1.36
BMI	26.95±3.60	BMI	19.08±2.34
P value	less than 0.0001		less than 0.0001

Co-relation of Hemoglobin and BMI in Male Nurses

Male nurses with BMI more than 22.9 were 5 and with BMI less than 22.9 were 5. Both the groups showed that there is no significant negative co-relation between Hemoglobin and BMI (Table 4b)

Table 4b: Co-relation of Hemoglobin and BMI in Male Nurses

males with BMI > 22.9		males with BMI<22.9	
N	5	N	5
Hb	13.66±1.73	Hb	14.00±0.60
BMI	25.16±1.55	BMI	19.76±2.30
P value	0.1907		0.183

Co-relation of Hemoglobin and BMI in Female Technicians

Female technicians with BMI more than 22.9 were 17 and with BMI less than 22.9 were 11. Both the groups showed that there is significant negative co-relation between Hemoglobin and BMI (Table 5a)

Table 5a: Co-relation of Hemoglobin and BMI in female Technicians

Females with BMI > 22.9		Females with BMI<22.9	
N	17	N	11
Hb	11.51±1.49	Hb	11.84±1.13
BMI	26.58±2.69	BMI	20.47±2.01
P value	0.0005		0.0082

Co-relation of Hemoglobin and BMI in Male Technicians

Male technicians with BMI more than 22.9 were 9 and with BMI less than 22.9 were 9. Both the groups showed that there is no significant negative co-relation between Hemoglobin and BMI (Table 5b)

Table 5b: Co-relation of Hemoglobin and BMI in male Technicians

males with BMI > 22.9		males with BMI<22.9	
N	9	N	9
Hb	14.41±1.30	Hb	14.41±2.04
BMI	25.36±1.95	BMI	21.19±1.59
P value	0.2337		0.3033

Co-relation of Hemoglobin and BMI in Female Doctors

Female Doctors with BMI more than 22.9 were 65 and with BMI less than 22.9 were 27. Both the groups showed that there is highly significant negative co-relation between Hemoglobin and BMI (Table 6a)

Table 6a: Co-relation of Hemoglobin and BMI in female Doctors

Females with BMI > 22.9		Females with BMI<22.9	
N	65	N	27
Hb	11.78±0.98	Hb	11.68±1.37
BMI	26.54±2.84	BMI	20.67±2.02
P value	less than 0.0001		less than 0.0001

Co-relation of Hemoglobin and BMI in Male doctors

Male doctors with BMI more than 22.9 were 54 and with BMI less than 22.9 were 17. Both the groups showed that there is highly significant negative co-relation between Hemoglobin and BMI (Table 6b)

Table 6b- Co-relation of Hemoglobin and BMI in male Doctors

males with BMI > 22.9		males with BMI<22.9	
N	54	N	17
Hb	13.19±1.30	Hb	13.57±1.19
BMI	26.61±4.16	BMI	21.22±1.13
P value	less than 0.0001		0.0043

DISCUSSION

Many studies regarding the co-relation of Hemoglobins and BMI are done in general population, students and patients [2, 3, 9-16]. Very few studies regarding this are available in health care workers**.** This study was conducted to assess co-relation of hemoglobin level and Body mass index (BMI) in health care workers which includes job categories along with gender distribution in each category. This study is one of the few studies conducted in India.

Our findings show unequal gender distribution in the job categories. This is in consistent with the studies done by Sharma S.V. et al [14]**,** Ehsan et al [15], Hazmi H et al [17]**,** and Hegde SKB et al [18].

Increasing prevalence of Obesity is a global health issue. Obesity (BMI> 25) increase the risk of type 2 Diabetes Mellitus, Hypertension, heart diseases, stroke, dyslipidemia and many more. Obesity is characterized by chronic, low grade systemic inflammation which in turn has been associated with anemia of chronic disease [18].

Our study showed that there is significant negative co-relation between Hemoglobin and BMI in female health care workers of all job categories. These results are supportive to the studies done by Shailendra Kumar B. Hegde et al [18] and Muhammad Adil et al [19].

BMI was extremely significantly high in doctors compared to the technicians and Nurses. This is in accordance to the study done by Mahammed M Alfagi et al [10]**,** Dr Dabota Y.B.et al [12] and Shailendra Kumar B. Hegde et al [18] but this result is not in accordance with the study results of Muhammad S K et al which showed these findings in nurses [6].

In the job category of Nurses, our study showed that in female nurses, there is extremely significant negative co-relation between hemoglobin and BMI in both the subcategories that is BMI>22.9 and BMI<22.9. In male nurses, there was statistically no significant co-relation between hemoglobin and BMI in both the subcategories that is BMI>22.9 and BMI<22.9. These results support the study of Muhammad S K et al [6].

Our study also included technicians as a separate job category for which we didn't find any specific reference. But studies done by Muhammad S K et al [6] and Kyle et al [16, 20] included them in 'others' as job category in health care workers. Their studies showed that risk of obesity was lower in these compared to nurses and doctors. In our study, there was significant negative co-relation between hemoglobin and BMI in female technicians' category while no significant co-relation was found in male technicians' category.

Doctors play a vital role in the health care delivery system. As a doctor, their responsibility is irrespective of the time, sleep, food, physical activity. Attending the patient becomes an utmost priority where no healthy and happy schedule is defined. This may lead to the alteration in BMI, Hemoglobin which ultimately may lead to its impact on health.

Our study showed that out of all the job categories, doctors showed significant negative co-relation between hemoglobin and BMI. This is evident in both female and male doctors' category. These results are in support with the studies done by Umamaheshwari Kannan et al [2] and Sephati Acharya et al [11].

The limitations of our study were that it was conducted in a smaller size and in a small region of India. Similar studies should be conducted at a larger scale. Additionally, our study included limited job-categories. Other job categories like pharmacist, Physiotherapist, medical assistants, dieticians, and helpers were not included in our study. More studies including these job categories should be conducted on larger scale. Our study excluded the health care workers with co morbidity which can be studied in addition.

CONCLUSION

This study demonstrated the co-relation of hemoglobin and BMI in health care workers. This sample population showed that there is decreased hemoglobin and increased BMI in majority of job categories. There is highly significant negative co-relation between hemoglobin and BMI in Doctors compared to Nurses and Technician category. Hence more attention is required to the awareness of health care workers regarding the work stress, physical activity and timely healthy food habits. Strategies like increasing the man power and decreasing the duty hours also can play an important role.

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