Correlation of Physical Fitness Levels with Body Mass Index (BMI) in Medical Students

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Abstract
Background: *The aim of present study to find out physical fitness levels in male and female medical students and these levels were correlated with BMI. The study was conducted amongst 104 healthy medical student's age 17-29 years (51 males and 53 females) selected from NIMS medical college jaipur. Subjects suffering from any chronic disease or subjects addicted to tobacco, alcohol and drugs were excluded from study.*
Material and methods: *A structured proforma was given to subjects to elicit lifestyle and systemic diseases. Parameters like BP, pulse rate, respiratory rate and temperature were also recorded. The physical fitness was assessed by measuring height and weight and BMI was calculated by using Quetelets body mass index formula (BMI = Weight (Kg.) /height² (meter). Waist and hip ratio was also observed. Similarly estimation of aerobic capacity (VO₂ max) of subjects was done as classification given by (1) .*
Result: *The result of this study suggest that physical fitness performance was better in male subjects but the aerobic capacity of female subjects was higher than males and they have normal BMI as compared to males. It was also observed that obesity has adverse impact on physical activity.*
Conclusion: *The female subjects have lower level of physical fitness as compare to males but the aerobic capacity was found to be higher in females than males and obesity has an adverse impact on physical activity.*
Keywords: *physical fitness, body mass index, waist hip ratio, aerobic capacity.*

I. Introduction

Physical fitness comprises a set of outcome or traits that relates to ability to perform physical activity (2). Fitness in general has five components: - aerobic capacity, muscle power and strength, muscular indurance, flexibility and body composition. So nowadays physical fitness is considered as production of morbidity and mortality for cardiovascular disease (3, 4, 5). Obesity is characterized by increased mass of adipose tissue that results from systemic imbalance between food intake and energy expenditure (6). Obesity is also being recognised as public health epidemic and modifiable risk factor for coronary heart diseases (7, 8). The magnetic impact of obesity on health includes an increase risk of several chronic diseases such as type II diabetes (9), hypertension (10), and dyslipidemia (11) CVS diseases (12). Obesity is also associated with increase total mortality (13). Altered respiratory functions due to obesity may lead to sleep apnoea and respiratory failure (14).

The present study emphasis on:-Physical fitness of medical students The need for students to measure and analyse their physical fitness for their own benefit To correlate between physical fitness and BMI

II. Material And Method

The present study was conducted on medical students in Department of Physiology, NIMS Medical College Jaipur. Subjects consisted of 104 medical students from NIMS medical college jaipur.51 male and 53 female students between age group of 17-29 years. Subjects suffering from any chronic disease or addiction were excluded from study. A Performa was given to subjects to elicit the details of life style and systemic disease. Height and weight of each subject was recorded and various vital parameters like blood pressure, pulse rate, respiratory rate, and temperature were recorded. A detailed physical examination was done with the consent of the subjects. The physical fitness was assessed by measuring height (Holtain stadiometer) and weight (digital balance scale) and BMI (Body mass index was calculated by using Quetelets formula) BMI= weight (kg) / height² (m). Based on this the subjects were classified as International classification of BMI given by WHO. The International classification of adult overweight, underweight and obesity is according to BMI (15, 16, 17). Waist-hip ratio was determined as fat store around waist poses a great risk to health than fat stored anywhere else in body (WWW. Women -health info.com). Aerobic capacity (VO₂ max) of subjects was estimated by using following formula.

VO_2 max (L/min) = 0.023× body weight (Kg) – 0.034 × age (years) + 1.652

VO_2 max (ml/Kg.min) = VO_2 max (L/min)/ body weight × 1000

Aerobic capacities were calculated and subjects were classified accordingly in various fitness grades (1). The subjects also performed push up test (18) and sit and reach test (19) to determine their general physical fitness. The statistical analysis was done and results were presented as mean and SD independent 't' test to assess overall difference between male and female in relation to height, weight and BMI. P value less than or equal to 0.05 on two side test were considered statistically significant.

Observation Tables

Table 1: Distribution of Weight (Kg) in male and female subjects

Sex	n	Mean ± SD
Male	51	70.52 ± 13.54
Female	53	55.03 ± 8.18

All values are Mean±SD
P< 0.5

Table 2: Distribution of Height (cm) in male and female subjects

Sex	n	Mean ± SD
Male	51	166 ± 9.95
Female	53	152 ± 16.2

All values are mean ± SD
P< 0.5

Table 3: Distribution of BMI (Kg/m^2) in male and female subjects

Sex	n	Mean ± SD
Male	51	25.15 ± 5.34
Female	53	22.15 ± 4.13

All values are mean ± SD
P< 0.05

Table 4: Number of male / female subjects in different grades of BMI (Kg/m^2)

Grade of BMI	Male n = 51	%	Female n =53	%
Normal	28	54.9	39	73.6
Underweight	2	3.9	4	7.5
Overweight	10	19.6	5	9.4
Obese	11	21.6	5	9.4

Table 5: Mean ± SD of Waist Hip ratio in male and female subjects

Sex	n	Mean ± SD
Male	51	0.82 ± 0.10
Female	53	0.75 ± 0.05

All values are mean ± SD
P< 0.5

Table 6: Different risk group of Waist – Hip ratio in subjects

Risk Groups	Male n = 51	Female n = 53	Total n = 104
Low	46 (90.1%)	53 (100%)	99
Medium	1 (1.9%)	0(0%)	1
High	4 (7.8%)	0 (0%)	4

Table 7: Aerobic capacity (ml/Kg.min) in subjects

Sex	n	Mean	SD (±)	Std. Error Mean
Male	51	37.44	3.90	0.54
Female	53	41.63	3.14	0.43

All values are mean ± SD
P < 0.05

Table 8: Number of subjects in different Grades of Aerobic capacity.

Sex	Aerobic capacity (ml/Kg.min)						Total
	Excellent	Very Good	Good	High Average	Low Average	Poor	
Male	0 (0%)	26 (50.9%)	22 (43.1%)	3 (5.8%)	0 (0%)	0 (0%)	51
Female	7 (13.7%)	44 (83.01%)	1 (1.88%)	1 (1.88%)	0 (0%)	0 (0%)	53
Total	7	70	23	4	0	0	104

P < 0.5

Table 9: Number of subjects in different grades of Sit –Ups test.

Sex	Sit Ups grades (reps/min)							Total
	Excellent	Good	Above Average	Average	Below Average	Poor	Very Poor	
Male	0 (0%)	0 (0%)	3 (5.88%)	30 (58.82%)	3 (5.88%)	5 (9.80%)	10 (41.1%)	51
Female	0 (0%)	0 (0%)	1 (1.88%)	8 (15.09%)	8 (15.09%)	6 (11.3%)	30 (56.6%)	53
Total	0	0	4	38	11	11	40	

P < 0.5

Table 10: Number of subjects in different grade of Push –Up test.

Sex	Push –up Grades (reps/min)							Total
	Excellent	Good	Above average	Average	Below average	Poor	Very poor	
Male	0 (0%)	2 (3.92%)	8 (15.68%)	23 (45.09%)	7 (13.72%)	10 (19.6%)	1 (1.96%)	51
Female	0 (0%)	0 (0%)	1 (1.88%)	22 (13.72%)	23 (43.3%)	5 (9.4%)	2 (3.77%)	53
Total	0	2	9	45	30	15	3	104

P< 0.5

Table 11: Number of subjects in different grades of Sit and Reach test.

Sex	Sit and Reach Grades (cm)						Total
	Super	Excellent	Good	Average	Fair	Poor	Very poor
Male	0 (0%)	1 (1.96%)	32 (62.7%)	17 (33.33%)	1 (1.96%)	0 (0%)	0 (0%)	51
Female	0 (0%)	10 (18.86%)	37 (69.81%)	6 (11.32%)	0 (0%)	0 (0%)	0 (0%)	53
Total	0	11	69	23	1	0	0	104

p < 0.5

III. Result And Conclusion

As per table no. 1 showing distribution of weight (kg) in male and female subjects it was observed that mean ± SD of male subjects was 70.5 ± 13.56 and female subjects was 55.03 ± 8.18. Distribution of height (cm) in subjects was observed and it was found that mean ± SD of male subjects was 106 ± 9.95 and female subjects was 152 ± 16.2 (table 2) with p < 0.5. The mean ± SD of BMI of male subjects was 25.15 ± 5.34 and female subjects was 22.15 ± 4.13 (table 3). In present study 54.9% male subjects and 73.6% of female subjects were in normal BMI ($kg/m^{2)}$, 21.6% male subjects and 9.4% female subjects was obese, 19.6% male subjects and 9.4% female subjects were overweight and about 3.9% male subjects and 7.5% female subjects were underweight (table 4). The mean ± SD of waist to hip ratio in male and female subjects was 0.82 ± 0.10 and that of female subjects was 0.75 ± 0.05. Here 90.1% of male subjects were at low risk, 1.9% at moderate risk and 7.8% were in high risk group of waist to hip ratio but 100% female subjects were at low risk (table 5).

The mean ± SD of aerobic capacity in male subjects were 37.44 ± 3.90 and or female subjects were 41.63 ± 3.14. 83.01% female subjects were in very good grade and 13.7% female subjects were in excellent grade of aerobic capacity (ml/kg.min) as compared to male subjects who have poor aerobic capacity (table 7).

The sit up test grade (reps/min), 5.88% male subjects and 1.88% female subjects were in above average grade, 58.82% male subjects and 15.09% of female subjects were in average grade, 5.88% male subjects and 15.09% female subjects were below average, 9.80% male subjects and 11.3% female subjects were in poor grades (table 9).The push up test (reps/min), 3.92% male subjects were in good grade, 15.68% male subjects and 1.88% female subjects were above average, 45.09% male subjects and 41.5% female subjects were in average grade, 13.72% male subjects and 43.3% female subjects were below average and 19.60% male subjects and 9.4% female subjects were in poor grade and 9.6% male subjects and 3.77% female subjects were in very poor grade (table 10)The sit and reach (flexibility) test in cm, about 62.7% male subjects and 69.81% female subjects were in good grade, 33.33% male subjects and 11.32% female subjects were average and 1.96% male subjects and 18.86% female subjects were excellent and 1.96% male subjects were in fair grade (table 11).

IV. Discussion

Physical fitness is an important marker in youth (20). The result of present study showed the prevalence of physical fitness according to BMI. It was reported that more percentage of obesity and overweight in male subjects as compared to females (21, 22). These findings are in support with the present study. In this study maximum numbers of male and female subjects were in low risk of waist to hip ratio. Majority of rural female subjects belong to a very good grade of aerobic capacity (23), similarly it was observed that aerobic capacity was higher in female subjects as compared to male subjects. VO_2 max levels were found decreased significantly in obese group (24, 25). In present study it was found that percentage of overweight and obesity was higher in male subjects than female and this is the reason for low aerobic capacity in males. But our results contradict with the findings which showed that Iranian male students were significantly taller, heavier and had higher VO_2 max level than female students. Our result correlate with the findings that majority of female student belong to poor physical fitness condition (20, 26, 21, 23) these results support our study. The result is affected because of physical life style and physical activity levels of subjects. Further the performance of subjects is affected due to different physical characteristics. The research has provided early information to help the students to understand their performance level or their physical fitness.

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