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ASSESSMENT OF WAIST-HIP RATIO BETWEEN HIGH SCHOOL ATHLETES AND NON-ATHLETES AFTER ONE YEAR OF COVID-19 PANDEMIC

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ABSTRACT

Waist-Hip Ratio augmentation has a detrimental prevalent effect on athletic performance. Last year athletes could not continue their workouts as before due to lockdown and restriction in movement due to the COVID-19 pandemic. The main purpose of the study is to identify the pandemic effect on the health of young athletes. Data were collected from the Midnapore district of West Bengal in India on high school athletes and sedentary students in April 2021. Waist and hip circumference were measured with a non-stretchable tape and to calculate Waist-Hip Ratio (WHR), waist circumference (WC) was divided by hip circumference (HC). The independent-sample t-test was associated with a statistically significant difference $t(64) = 2.1$, $p = .048$, $\alpha = .05$, power $1\text{-}\beta = 0.89$ with a large effect size. The non-athletes had a significantly better waist-hip ratio than the athlete students. Though, WHR (waist-hip ratio) of both the groups (Athletes $\mu = 0.79$; Non-athletes $\mu = 0.77$) belongs to the low health risk category. High school athletes have got out of shape mainly in the central area more than the non-athlete students by last year of lockdown and restriction in movements due to the COVID-19 pandemic.
Keywords: *Waist circumference, hip circumference, waist-hip ratio, health, fitness.*

1. INTRODUCTION

Waist-Hip Ratio (WHR) also known as Waist-to-Hip Ratio is a tool to measure fat distribution in the body quickly to understand a person's overall health condition (Burgess, 2017). Put on more weight around the waist reason is the central obesity of an individual than his hip reason may put him at higher risk of health (Wong et al., 2020). The waist-Hip ratio is one of the measures of body fat (WHO, 2008). Due to the limitation of BMI (Body Mass Index) to measure visceral fat that is highly responsible for non-communicable diseases (NCDs) related morbidity particularly cardiac and diabetes type-2, hence WHR can be complemented for better understanding (WHO, 2000). This technique also can be used as an additional tool to have a better perception of the body fat since it measures subcutaneous and abdominal fat is advantageous than the other body fat measurement techniques (Björntorp, 1997; Hussain, Mohammad, & Khan, 2011). BMI suffers limitation to differentiate body fat and lean masses, whereas WC is a better predictor for metabolic and cardiovascular risk factors as the result of poor health conditions (Baioumi, 2019; Mohammad, 2015a,b,c). WHR is a better indicator than BMI and three skin-fold techniques to measure NCDs-related death since WHR measures the distribution of fat better is more associated with NCDs than the subcutaneous

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fat deposit in the body among the young men (Larsson et al., 1984). This phenomenon has been found true for women too (Larsson et al., 1984). NCDs have a strong relationship with central obesity (De, 2017). Waist circumference keeps on increasing as the age of both the sexes progresses (Ford et al., 2003; Stevens et al., 2010). Cardio-respiratory fitness is negatively affected by waist circumference augmentation due to abdominal obesity (Dyrstad et al., 2019). Waist circumference and physical fitness of sportspersons have an inverse relationship (Gui et al., 2017). Inferior physical fitness is the direct result of poor aerobic capacity that was observed among the boys with higher waist circumference scores (Martone et al., 2014).

After retirement soccer players put on significant weight in their bodies (Arliani et al., 2014). Sudden intensive physical activity may have some adverse effect on the digestive system due to shifting of blood to the skeletal muscles, but in adaptation with the exercise up to sub-maximal intensive workout, these problems diminish as because the less dramatic decrease in blood flow does not take place to the gastrointestinal (GI) system (Brouns & Beckers, 1993). Regular physical activity augments GI motility (Peters et al., 2001). GI motility takes care of digestive motor functions that play a favorable role in digestion (Surjanhata & Kuo, 2014). Regular exercise can increase the capacity of the GI system and the GI system also adaptive to regular exercise (Gisolfi, 2000). Literature suggests that participation in regular physical activity stimulates anabolism of the skeletal muscle (Dickinson et al., 2013). Long-term regular involvement in workouts stimulates a local long-lasting adaptive response of synthesizing protein is one of the components of nutrition (Miller, 2007; Singh, Raza, & Mohammad, 2011). When more protein is consumed than the requirement of the body that cannot be stored in the boy, but surplus protein breaks down to convert into fat and stored in the body (Youdim, 2019).

Dietary carbohydrate converts into glucose that gives us energy immediately but when it remains unused then it enters into the liver in the form of glycogen (Ashwell, 1925), further, in the presence of insulin it transforms into fatty acids then it is circulated throughout the body and finally stored as fat in the body (Ferramosca et al., 2014). This deposition of fatty acids in the body increases body weight and leads to a number of health hazards. The creation of fat from a non-fat source that may occur in the body is called de novo lipogenesis, by this process body deposits fat by converting glucose into lipids (Song et al., 2018). Diet reach in high fat is likely towards weight gain and it plays a major role too to put on weight in the body (Warwick & Schiffman, 1992).

In a decrease in WHR general health-related physical fitness improves in the young sportsmen (Singh & Kumar, 2016). WHR augmentation has an association with an increase in blood pressure (Patel & Singh, 2009). Indian young male athletes daily consume approximately calories between 3300 kcal to 3800 kcal (Atreya & Varghese, 1991). Whereas the average calories required for Indians is between 2100 kcal to 2400 kcal (Sharma et al., 2020). Athletes always possess better health than non-athletes (Alamdarloo et al., 2019). Athletes eat more, produce more energy, burn more energy as their metabolic rate is higher (Sjödin et al., 1996).

The aim of the study was to clarify the health condition of the athlete and non-athlete high school boys during the COVID-19 pandemic situation where they have no or little opportunity for workouts. The objective of the study is to compare the health condition between high school athletes and sedentary students' in particularly visceral fat gain as a consequence of inactivity due to lockdown and restriction in movement during the COVID-19 pandemic situation and to identify the subsequent research needs. Identifying health conditions in cessation of workouts for prolong period due to COVID-19 of the young athletes' is the main purpose of the study.

2. METHODS AND MATERIALS

2.1 Subjects

Subjects were selected from the Midnapore district of West Bengal state in India. They are high school male students from different schools in the district. They come from rural and suburban areas. Subjects were selected using a random sampling technique. Athletes were from track & field events only and at least they have taken part in different level athletics competitions were selected for the study as the subject. Non-athletes were simply high school students; mainly they enjoy a sedentary lifestyle and do not take part in any form of physical activity but daily life activity. Average age and standard deviation of athletes and non-athletes were successively μ = 16:7 years, σ = .736 and μ = 17:1 years, σ = .790.

2.2 Procedure and Material

As per WHO (2008) guidelines for WHR, measurements were taken in the study. Subjects' waist circumference (WC) was measured by placing a tape that is capable of resisting stretch while applying a tension of 100 g at the middle point between the iliac crest and least palpable rib i.e. usually the narrowest part of the abdominal region while observed from the back of a slim subject (WHO, 2008). This measurement was taken from a standing posture from the back of the subject. Hip circumference (HC) was taken placing tape parallel to the ground and around the widest portion of the buttocks. This measurement was taken standing at the side of the subject. Subjects were asked to stand with minimum attires keeping feet close together distributing body weight evenly and arms at the side. Measurement was taken just after normal expiration confirming subjects were in relaxing condition. Each measurement was taken twice and the average was counted in the case where the difference remains within 1 cm, but when this range exited, both the measurement was discarded and the measurement was repeated. Data were collected in April 2021.

2.3 Statistical Methods

Statistical analysis was performed using SPSS, version 22. The normal distribution of variables to characterize the waist-hip ratio was evaluated applying Shapiro-Wilk and Kolmogorov-Smirnov tests. An Independent *t*-test (2-tailed) was performed to compare the waist-hip ratio between high school athletes and sedentary students. Level of significance was set $\alpha = 0.05$ and power of the test was calculated $1-\beta = 0.89$ with a large effect size as N_1 = 35 & N_2 = 31 using GPower 3.1 software. A probability of $p < 0.05$ was deemed as significant.

3. RESULTS

Table 1: Descriptive statistics of Waist-Hip Ratio

	Group	N	Mean	Std. Deviation	Std. Error Mean
Waist-Hip Ratio	Athlete	35	0.7909	0.03995	0.00675
	Non-Athlete	31	0.7735	0.02799	0.00503

Table 2: The test of normality of data

	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Waist-Hip Ratio	Athlete	0.091	35	0.200*	0.967	35	0.363
	Non-Athlete	0.137	31	0.142	0.957	31	0.242
α = .05							

Table 3: Independent Sample t-test (2-tailed) of Waist Hip Ratio

		Levene's Test for Equality of Variances		*t*-test for Equality of Means		
		F	***Sig.***	***t***	***df***	***Sig. (2-tailed)***
Waist-Hip Ratio	*Equal variances assumed*	2.010	0.161	2.013	64	0.048
	Equal variances not assumed			2.056	60.923	0.044

$\alpha = 0.05$

The athlete group (n_1 = 35) was associated with numerically lower waist-hip ratio ($\mu = 0.79$; $\sigma = 0.04$) compared to the non-athlete (n_2 = 31) male school students ($\mu = 0.77$; $\sigma = 0.03$) as Table-1 illustrates. To test the hypothesis that the athlete and non-athlete students were associated with significantly different in the mean of waist-hip ratio, an independent sample *t*-test (2- tailed) was performed. As may be seen in Table 2, the athlete and non-athlete distributions were approximately normally distributed to conduct a *t*-test as p = 0.36 & 0.24 respectively. Additionally, Table 3 explains the assumption of homogeneity of variance was tested and satisfied via Levene's *F* test, F (64) = 2.01 & p = .16 as α = 0.05. The independent-sample t = test was associated with a statistically significant difference t (64) = 2.1, p = 0.048, α = 0.05. The power of the test was calculated $1-\beta$ = 0.89 with a large effect size. Thus, the non-athletes had a statistically significantly better waist-hip ratio than the athlete students.

4. DISCUSSION

The findings of the present study confirm that the mean value of WHR (waist-hip ratio) of both the groups (Athletes μ = 0.79; Non-athletes μ = 0.77) belong to the low health risk category as WHO suggests healthy WHR is > 0.90 for South Asian men (WHO, 2008). Since they are young boys thus it is usual to fall in this category. It is an obvious fact that the visceral fat of the athletes would be lesser and health would be better than the sedentary persons (Singh & Kumar, 2016) but the finding of the study shows that athletes are having poorer WHR than sedentary students. This might have happened due to inadequate physical activity through the last year and intake of the same amount of food as before the COVID-19 pandemic lockdown and restrictions in movements. Athletes have a better digestive capacity (Dickinson et al., 2013). The higher ability to synthesize nutrients from diet lasts for prolong period even after stopping physical exercise (Arliani et al., 2014). Dietary surplus nutrients such as carbohydrates, protein, and fat convert into fat and deposit it in the body (Ashwell, 1925; Ferramosca et al., 2014; Song et al., 2018; Warwick & Schiffman, 1992). Aforementioned all these factors might have contributed athletes to stand with poorer WHR than sedentary students.

5. CONCLUSION

Athletes have got out of shape mainly in the central more than their fellow non-athletes high school students in the last year of lockdown and restriction in movement due to the COVID-19 pandemic situation. Athletes should concentrate to find out some way to continue their workouts and should be cautious about their dietary intake and that also should be adjusted according to their daily calorie burning in this tough pandemic condition before getting out of hand to maintain good health and future sports performance.

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7. REFERENCES

Alamdarloo, G. H., Cheric, M. C., Doostzadeh, M., & Nazari, Z. (2019). The comparison of general health in athlete and non-athlete women. *Health Psychology Research, 7*(1), 8047.

Arliani, G. G., Lara, P. S., Astur, D. C., Cohen, M., Gonçalves, J. P. P., & Ferretti, M. (2014). Impact of sports on health of former professional soccer players in Brazil. *Acta Ortopedica Brasileira, 22*(4), 188-190.

Ashwell, G. (1925). Carbohydrate metabolism. *Nature, 115.* https://doi.org/DOI:10.1038/115137a0

Atreya, N., & Varghese, M. A. (1991). An evaluation of nutritional and physical fitness status of young athletes. SNDT Womens University. http://shodhganga.inflibnet.ac.in:8080/jspui/handle/10603/110220

Baioumi, A. Y. A. A. (2019). Chapter 3 - Comparing Measures of Obesity: Waist Circumference, Waist-Hip, and Waist-Height Ratios. In: R. R. Watson (Ed.), Nutrition in the Prevention and Treatment of Abdominal Obesity (Second Edition) (pp. 29–40). Academic Press.

Björntorp, P. (1997). Body fat distribution, insulin resistance, and metabolic diseases. *Nutrition (Burbank, Los Angeles County, Calif.), 13*(9), 795-803.

Brouns, F., & Beckers, E. (1993). Is the gut an athletic organ? Digestion, absorption and exercise. *Sports Medicine, 15*(4), 242–257.

Burgess, L. (2017, September 17). Waist-to-hip ratio: How does it affect your health? Medical News Today. https://www.medicalnewstoday.com/articles/319439

De, K. (2017). Study Nutritional Status by Waist Circumference and Waist Hip Ratio. *Journal of Health & Medical Informatics, 8*(1), 248.

Dickinson, J. M., Volpi, E., & Rasmussen, B. B. (2013). Exercise and nutrition to target protein synthesis impairments in aging skeletal muscle. *Exercise and Sport Sciences Reviews, 41*(4), 216-223.

Dyrstad, S. M., Edvardsen, E., Hansen, B. H., & Anderssen, S. A. (2019). Waist circumference thresholds and cardiorespiratory fitness. *Journal of Sport and Health Science, 8*(1), 17-22.

Ferramosca, A., Conte, A., Damiano, F., Siculella, L., & Zara, V. (2014). Differential effects of high-carbohydrate and high-fat diets on hepatic lipogenesis in rats. *European Journal of Nutrition, 53*(4), 1103-1114.

Ford, E. S., Mokdad, A. H., & Giles, W. H. (2003). Trends in waist circumference among U.S. adults. *Obesity Research, 11*(10), 1223-1231.

Gisolfi, C. V. (2000). Is the GI system built for exercise? *Physiology, 15*(3), 114-119.

Gui, Z., Sun, F., Zhu, Y., Cai, L., Ma, L., Jing, J., & Chen, Y. (2017). Waist circumference, health-related physical fitness, and cardiovascular disease risk factors in Chinese adolescents. *MOJ Public Health, 5*(2).

Hussain, I., Mohammad, A., & Khan, A. (2011). A relationship between anthropometrical and kinematical variables of spike jump of intercollegiate level male volleyball players. *International Journal of Performance Analysis in Sports, 11*(3), 583-588.

Larsson, B., Svärdsudd, K., Welin, L., Wilhelmsen, L., Björntorp, P., & Tibblin, G. (1984). Abdominal adipose tissue distribution, obesity, and risk of cardiovascular disease and death: 13 year follow up of participants in the study of men born in 1913. *British Medical Journal (Clinical Research Ed.), 288*(6428), 1401-1404.

Martone, D., Russomando, L., Gallè, F., Gallarato, V., Mancusi, C., Mastronuzzi, R., Valerio, G., Liguori, G., & Buono, P. (2014). Effects of physical fitness on waist circumference in a group of school children living in Southern Italy. *Sport Sciences for Health, 10*(3), 261-267.

Miller, B. F. (2007). Human muscle protein synthesis after physical activity and feeding. *Exercise and Sport Sciences Reviews, 35*(2), 50-55.

Mohammad, A. (2015a). Anthropometric variables between high and low performer sub-junior female gymnasts: A comparative study. *European Academic Research, 2*(10), 13334-13346.

Mohammad, A. (2015b). Contribution of anthropometric characteristics as well as skinfold measurements to performance scores in sub-junior female gymnasts. *World Journal of Sport Sciences, 10*(4), 34-38.

Mohammad, A. (2015c). Relationship of anthropometric characteristics with the performance score of gymnasts. *Academic Sports Scholar, 4*(12), 01-09.

Patel, M. P., & Singh, J. (2009). A study of body composition, body surface area, waist-hip ratio among varying levels of blood pressure group. INFLIBNET, 135. http://shodhganga.inflibnet.ac.in:8080/jspui/handle/10603/2734

Peters, H. P. F., Vries, W. R. D., Vanberge-Henegouwen, G. P., & Akkermans, L. M. A. (2001). Potential benefits and hazards of physical activity and exercise on the gastrointestinal tract. *Gut, 48*(3), 435-439.

Sharma, M., Kishore, A., Roy, D., & Joshi, K. (2020). A comparison of the Indian diet with the EAT-Lancet reference diet. *BMC Public Health, 20*(1), 812.

Singh, J., Raza, S., & Mohammad, A. (2011). Physical characteristics and level of performance in badminton: A relationship study. *Journal of Education and Practice, 2*(5), 6-9.

Singh, P., & Kumar, A. (2016). A study of health related physical fitness of junior free style wrestlers. Punjabi University. http://shodhganga.inflibnet.ac.in:8080/jspui/handle/10603/255330

Sjödin, A. M., Forslund, A. H., Westerterp, K. R., Andersson, A. B., Forslund, J. M., & Hambraeus, L. M. (1996). The influence of physical activity on BMR. *Medicine and Science in Sports and Exercise, 28*(1), 85-91.

Song, Z., Xiaoli, A. M., & Yang, F. (2018). Regulation and metabolic significance of de novo lipogenesis in adipose tissues. *Nutrients, 10*(10). https://doi.org/10.3390/nu10101383

Stevens, J., Katz, E., & Huxley, R. (2010). Associations between gender, age and waist circumference. *European Journal of Clinical Nutrition*, *64*(1), 6-15.

Surjanhata, B. C., & Kuo, B. (2014). *Gastrointestinal motility and enteric neuroscience in health and disease. in reference module in biomedical sciences*. Elsevier. https://doi.org/10.1016/B978-0-12-801238-3.00051-9

Warwick, Z. S., & Schiffman, S. S. (1992). Role of dietary fat in calorie intake and weight gain. *Neuroscience and Biobehavioral Reviews*, *16*(4), 585-596.

WHO. (2000). Obesity: Preventing and managing the global epidemic (Consultation ISBN: 92 4 120894 5). World Health Organization. http://www.who.int/entity/nutrition/publications/obesity/WHO_TRS_894/en/index.html

WHO. (2008). Waist circumference and waist-hip ratio: Report of a WHO expert consultation (Book ISBN 978 92 4 150149 1). https://www.who.int/publications-detail-redirect/9789241501491

Wong, M. C. S., Huang, J., Wang, J., Chan, P. S. F., Lok, V., Chen, X., Leung, C., Wang, H. H. X., Lao, X. Q., & Zheng, Z.-J. (2020). Global, regional and time-trend prevalence of central obesity: A systematic review and meta-analysis of 13.2 million subjects. European Journal of Epidemiology, 35(7), 673-683.

Youdim, A. (2019). Carbohydrates, proteins, and fats-disorders of nutrition. MSD Manual Consumer Version. https://www.msdmanuals.com/en-in/home/disorders-of-nutrition/overview-of-nutrition/carbohydrates-proteins-and-fats.