

CORRELATION BETWEEN WAIST HIP RATIO AND VO2 MAX

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Abstract

Aim. To find out correlation between waist hip ratio and VO2 max.

Design. Correlational study

Background. These days due to sedentary lifestyle, lack of exercise and unhealthy eating habits, people are becoming more prone to health problems. Waist hip ratio measures the proportion of fat stored around waist, hip and buttocks. People with higher weight around their waist are more prone to certain problems like heart diseases and diabetes but they don't come to know their endurance level. Now it is done by professionals. If correlation is found between simple waist hip ratio and VO2 max, then we can predict (approx) VO2 max by simply measuring waist hip ratio and thus eliminating health risk.

Methods. A sample of 30 subjects were selected to participate in the study on the basis of clinical assessment and after fulfilling inclusion and exclusion criteria. Waist measurements of all subjects were taken in cms by meter tape. The waist circumference is measured at a level midway between the lowest rib and the iliac crest in the standing position. Hip measurement of all the subjects were taken in cms by measuring tape from the hip circumference at the level of the great trochanters, with the legs close together in standing position. Weight of all the subjects was measured in kgs by standing on weighting machine. Height of all the subjects was taken in cms through inch tape by standing against the wall. VO2max was measured by beep test. A brief and clear introduction of the beep test was given and the test was started and the researcher recorded the level.

Results. The findings showed that there is significant correlation between Waist hip ratio and VO2 max. A sample of 30 subjects was taken. Majority of the participants were in age between 18-30 years. The mean of VO2max was 28.87 ml/kg/min and s.d. ± 3.6 and the mean of waist hip ratio was 0.72 and s.d. ± 0.035 in females. Oxygen consumption has a strong and negative relationship with waist-to-hip ratio (-0.776) in females. The mean of VO2max was 31.73 ml/kg/min and s.d. ± 5.790 and the mean of waist hip ratio was 0.848 and s.d. ± 0.054 in females. Oxygen consumption has a strong negative relationship with waist-to-hip ratio (-0.778) in males.

Conclusion. It is conclusive that the result shows there is a relationship between waist hip ratio and VO2 max. Therefore the Research hypothesis that “there is a relation between waist hip ratio and VO2 max” can be accepted and the null hypothesis ‘there is no relation between waist hip ratio and VO2 max’ can be rejected.

Keywords- Waist hip ratio,VO2Max

1.Introduction

Waist-to-hip ratio (WHR) is the ratio of our waist circumference to hip circumference (calculated by dividing the waist circumference by the hip circumference). WHR is a Measurement tool that looks at the proportion of fat stored on our waist, and hips and buttocks. Weight concentrated around the middle is often referred to as an “apple” shape; whereas, weight concentrated around your hips is referred to as a “pear” shape.

In many cases, persons with extra weight located around the middle are at higher risk for diseases such as heart disease and diabetes than those who carry weight around their hips and thighs. Abdominal fat, when out of proportion to total body fat, may be considered an indicator of health risks. A waist circumference measurement of over 88.9 cm in women and over 101.6 cm in men may increase risk because of the fat distribution.

Research shows that people with "apple-shaped" bodies (with more weight around the waist) face more health risks than those with "pear-shaped" bodies who carry more weight around the hips.

WAIST HIP RATIO CHART

Male	Female	Health risk based solely on WHR
0.95 or below	0.80 or below	Low Risk
0.96 to 1.0	0.81 to 0.85	Moderate Risk
1.0+	0.85+	High Risk

Measurement

Strictly, the waist circumference is measured at a level midway between the lowest rib and the iliac crest, and the hip circumference at the level of the great trochanters,(2) with the legs close together. The waist-hip ratio equals the waist circumference divided by the hip circumference.

Practically, however, the waist is more conveniently measured simply at the smallest circumference of the natural waist, usually just above the belly button, and the hip circumference may likewise be measured at its widest part of the buttocks or hippl Also, in case the waist is convex rather than concave, such as is the case in pregnancy and obesity, t he waist may be measureda t a verticall evel 1inch abovet he navel.(1).

Indicator of health

The WHR has been used as an indicator or measure of the health of a person, and the risk of developing serious health conditions.

WHR is used as a measurement of obesity, which in turn is a possible indicator of other more serious health conditions.

A WHR of 0.7 for women and 0.9 for men have been shown to correlate strongly with general health and fertility. Women within the 0.7 range have optimal levels of estrogen and are less susceptible to major diseases such as diabetes, cardiovascular disorder and ovarian cancers.(4) Men with WHRs around 0.9, similarly, have been shown to be more healthy and fertile with less prostate cancer and testicular cancer.[5]

WHR has been found to be a more efficient predictor of mortality in older people than waist circumference or body mass index (BMI).[6] If obesity is redefined using WHR instead of BMI, the proportion of people categorized as at risk of heart attack worldwide increases threefold.(7). The body fat percentage is considered to be an even more accurate measure of relative weight. Of these three measurements, only the waist-hip ratio takes account of the differences in body structure. Hence, it is possible for two women to have vastly different body mass indices but the same waist-hip ratio, or to have the same body mass index but vastly different waist-hip ratios.

Even in ancient civilizations globally, female representations are most often in the 0.6-0.7 range for WHR, suggesting a preference towards lower WHR.[8]

Studies have found that waist circumference, not WHR, to be a good indicator of cardiovascular risk factors,(9) body fat distribution,(10) and hypertension in type 2 diabetes.(11)

"Hip size indicates pelvic size and the amount of additional fat storage that can be used as a source of energy, Waist size conveys information such as current reproductive status or health status in westernized societies with no risk of seasonal lack of food, the waist, conveying information about fecundity and health status will be more important than hip size for assessing a female's attractiveness."

V02 max (also maximal oxygen consumption, maximal oxygen uptake, peak oxygen uptake or aerobic capacity) is the maximum capacity of an individual's body to transport and use oxygen during incremental exercise, which reflects the physical fitness of the individual. The name is derived from V - volume per time, O₂ - oxygen, max - maximum.

V02 max is expressed either as an absolute rate in liters of oxygen per minute (l/min) or as a relative rate in milliliters of oxygen per kilogram of bodyweight per minute (ml/kg/min), the latter expression is often used to compare the performance of endurance sports athletes. A less size-biased measure is to divide by rather than mass.

Fitness can be measured by the volume of oxygen one can consume while exercising at maximum capacity. V02max is the maximum amount of oxygen in millilitres, one can use in one minute per kilogram of body weight. Those who are fit have higher V02max values and can exercise more intensely than those who are not as well conditioned.

V02max can be increased by working out at an intensity that raises heart rate to between 65 and 85% of its maximum for at least 20 minutes three to five times a week. A mean value of V02max for male athletes is about 3.5 litres/minute and for female athletes it is about 2.7 litres/minute.

2.Methods

Males and females of age 18-30 years of age and Individuals not involved in any physical fitness activity were included in the present study. Individuals with any neurological abnormalities, any recent joint pathology or recent surgery and trauma and any biomechanical abnormalities of lower extremity were excluded.

Measurement Apparatus

1. Measuring tape
2. Audio tape of V02 max
3. Markers

Procedure

Subjects were explained about the procedure individually and consent form were signed by them.

1. Waist measurements of all subjects were taken in cms by meter tape. The waist circumference is measured at a level midway between the lowest rib and the iliac crest in the standing position.
2. Hip measurement of all the subjects were taken in cms by meter tape from the hip circumference at the level of the great trochanters, with the legs close together in standing position.
3. Weight of all the subjects was measured in kgs by standing on weighting, machine.
4. Height of all the subjects was taken in cms through inch tape by standing against the wall.
5. A brief and clear introduction of the beep test was given and the test was started and the researcher records the level.

The Beep Test procedure is as follows:

The 20m multistage fitness test is a commonly used maximal running aerobic fitness test. It is also known as the 20-meter shuttle run test, beep or bleep test among others.

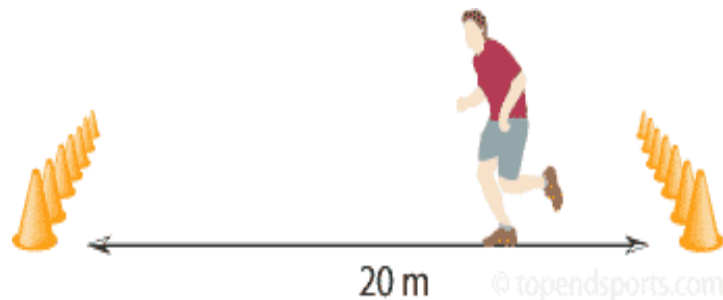


Figure 2.1 procedure of beep test

Equipment required:

Flat, non-slip surface, 20m measuring tape, beep tested, CD player, recording sheets.

Procedure:

This test involves continuous running between two lines 20m apart in time to recorded beeps. For this reason the test is also often called the 'beep' or 'bleep' tests. The test subjects stand behind one of the lines facing the second line, and begin running when instructed by the cd or tape. The speed at the start is quite slow. The subject continues running between the two lines, turning when signaled by the recorded beeps. After about one minute, a sound indicates an increase in speed, and the beeps will be closer together. This continues each minute (level). If the line is not reached in time for each beep, the subject must run to the line turn and try to catch up with the pace within 2 more "beeps". Also, if the line is reached before the beep sounds, the subject must wait until the beep sounds. The test is stopped if the subject fails to reach the line (within 2 meters) for two consecutive ends.

Factors to consider:

Although the beep test is primarily a fitness test of the aerobic energy system, there are a range of other factors that can affect performance in the test and are important to consider. These include:

- a. running efficiency and turning technique
- b. anaerobic capacity
- c. motivation and social dynamics
- d. motor skills and cognitive ability (especially in children)
- f. clothing and running surfaces
- g. test familiarization and instructions
- h. the purpose and context of testing

Advantages:

Large groups can perform this test all at once for minimal costs. Also, the test continues to maximum effort unlike many other tests of endurance capacity.

Disadvantages:

Practice and motivation levels can influence the score attained, and the scoring can be subjective. As the test is often conducted outside, the environmental conditions can affect the results.

3 Results

A sample of 30 subjects was taken. Majority of the participants were in age between 18-30 years. The mean of VO₂max was 28.87 ml/kg/min and s.d.±3.6 and the mean of waist hip ratio was 0.72 and s.d. ±0.035 in females. Oxygen consumption had a strong and negative relationship with waist-to-hip ratio (-0.776) in females.

The mean of VO₂max was 31.73 ml/kg/min and s.d. ±5.790 and the mean of waist hip ratio was 0.848 and s.d. ±0.054 in males. Oxygen consumption had a strong negative relationship with waist-to-hip ratio (-0.778) in males.

The findings showed that there is significant correlation between Waist hip ratio and VO₂ max.

Table 4.1 correlation between VO₂ max and waist hip ratio (female)

	MEAN	STANDARD DEVIATION
VO ₂ MAX	28.87 ml/kg/min	± 3.6
WAIST HIP RATIO	0.72	±0.035

Correlation between waist hip ratio and vo₂ max r= -0.787

Table 4.2 correlation between vo₂ max and waist hip ratio (males)

	MEAN	STANDARD DEVIATION
VO ₂ MAX	31.73 ml/kg/min	± 5.790
WAIST HIP RATIO	0.848	±0.054

Correlation between waist hip ratio and vo₂ max r= -0.786

4. Discussion

This study was undertaken to investigate the relationship between waist hip ratio and VO₂ max in both males and females age 18-30 years. The data obtained showed that there is negative correlation between WHR and VO₂ max which could be due to the fact that WHR is an index of fatness of an individual and as a general trend, fat individual are less fit and hence lower VO₂ max is expected.

If the WHR of an individual is high, the body surface area is proportionately larger and hence more VO₂ is needed to be delivered and hence the efficiency is lower.

It is predicted that the more food-rich a society, and the longer it has been food-rich, the more likely a low WHR will be preferred. However, in stratified societies such as India, a low WHR preference might begin among upper strata men and spread to lower strata men, even if lower strata women are too poor to be at risk of obesity.

During exertion or maximal aerobic output, VO_2 max tests provide a score, in milliliters, based on the volume of oxygen per kilogram of body weight per minute.

Our VO_2 max is a valuable measure for gauging your level of physical fitness. The more in Shape you are, the more our body works as a fine-tuned engine. This means that the some body's natural processes work without highly taxing the body. The fitness level of an obese individual is generally low and hence the VO_2 max also comes out to be low, which are depicted by the results of the current study.

In prescribing exercise, the proper exercise intensity recommended by ACSM is as follows: Apparently healthy individuals: 50-85% of VO_{2max} . Therefore, according to the results of this study, different guidelines need to be followed for prescribing exercises for obese individuals.

LIMITATIONS OF STUDY

- a. Small Sample Size
 - b. Other areas were not covered
 - c. other factors affecting the test could not be controlled
 - d. practice and motivation levels can influence the score attained, and the scoring can be subjective.
- As the test is often conducted outside, the environmental conditions can affect the results.

CLINICAL RELEVANCE

This study will help the individuals to know their approximate VO_2 max by simply measuring waist and hip circumference.

FUTURE RESEARCH

- a. Further studies are needed considering more sample size to draw the generalized statement.
- b. Other age group can be assessed
- c. Other areas can be covered
- d. Comparison between athlete and common individual can be taken for future study.

5. Conclusion

Hence the result shows that there is a relationship between waist hip ratio and VO_2 max. Therefore the Research hypothesis that "there is a relation between waist hip ratio and VO_2 max" can be accepted and the null hypothesis 'there is no relation between waist hip ratio and VO_2 max' can be rejected.

Future research and follow up studies need to be done.

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