INTRODUCTION
The prevalence of obesity is rising in both developed and developing nations. Obesity has a strong association with causes of mortality, cardiovascular disease and diabetes. It is an important component of insulin resistance syndrome. Body mass index has also been recommended by WHO as a simple, practical and epidemiological measure for identifying overweight and obese patients. It is nevertheless a crude index and does not take into account the distribution of body fat. Waist hip ratio can serve as an easy screening device used in conjunction with other proven measures to detect those at elevated risk of coronary heart disease (CHD). Waist circumference and waist hip ratio have been used as measures of central obesity (where visceral adipose tissue is stored), and body mass index has been used as a measure of general obesity.

The recognition of central obesity is clinically important, as lifestyle intervention, which in turn, is a better predictor than body mass index. However waist circumference cannot distinguish abdominal subcutaneous fat, total abdominal fat and total body fat and is strongly correlated with body mass index. The distribution of body fat, especially abdominal localisation is a more important determinant than the total amount of body fat of the development of diabetes and other diseases.

Women with waist hip ratios of >0.8, and body mass index >32 have an increased risk of heart disease, stroke and diabetes. Our study aimed to correlate WHR with BMI in different age groups in women of Lahore to detect obesity and provide guidance for its prevention in order to reduce the risk coronary heart disease, cardiovascular disease and type II diabetes in later years.

MATERIAL AND METHODS
Ninety female subjects in age range of 20–55 years matched socio-economically were selected by simple random sampling from the random number table belonging to the city of Lahore from July to December 2009. The subjects were divided into three groups, i.e., G1, G2 and G3. All groups comprised of 30 subjects. Group G1 comprised of subjects with age range 21–29 years, G2 with age range 30–39 years and G3 with age range 40–55 years.

Weight was measured in light clothing without shoes after emptying bladder. Height was measured as the distance from the top of the head to the bottom of the feet (no shoes) using a fixed stadiometer. BMI was calculated as the weight (Kg) divided by the square of the height (m). Waist circumference (Cm) was taken with a tape measure as the point midway between the costal margin and iliac crest in the midaxillary line, with the subject standing and breathing normally. Hip circumference was found between WHR and BMI in all three groups respectively. Comparison also revealed a linear positive correlation graphically in all groups between WHR and BMI.

WHR of all the groups were determined. In G1, WHR was 0.74±0.030 with BMI 21.59±3.07. G2 had WHR 0.78±0.055 and BMI 26.8±2.04, whereas in G3 WHR was 0.80±0.043 and BMI 32.4±4.23. Significant correlation (r=0.65), (r=0.79), (r=0.91) was found between WHR and BMI in all three groups respectively.

Comparison also revealed a linear positive correlation graphically in all groups between WHR and BMI. 

**Keywords:** Waist hip ratio, body mass index, obesity, women, health
(Cm) was measured at the widest point around the
greater trochanter. The waist-to-hip ratio was
calculated as the waist measurement divided by the
hip measurement. The physiometric variables
included measurement of systolic blood pressure
(SBP), diastolic blood pressure (DBP). Two
consecutive readings were recorded for each of SBP
and DBP and the averages were used. The
measurements were taken with the help of mercury
sphygmomanometer in a sitting position with the
right forearm placed horizontal on the table.

All data were analysed using SPSS-16.
Mean, standard deviation, linear regression analysis
(curve estimation) and ANOVA were used to
investigate the relationship between WHR and BMI.

RESULTS

In Table-1 obesity related parameters in different age
groups are shown while Table-2 shows comparison
between WHR and BMI in all the groups. In G1
WHR was 0.74±0.030 with BMI 21.59±3.07. G2 had
WHR 0.78±0.055 and BMI 26.8±2.04 whereas in G3
WHR was 0.80±0.043 and BMI 32.4±4.23.
Statistically significant relation at (r=0.65), (r=0.79),
(r=0.91) was found between WHR and BMI in all
three groups. Comparison also revealed a linear
positive correlation graphically in all groups between
WHR and BMI.

Table-1: Obesity related parameters in women
with different age groups

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (Cm)</td>
<td>65±4.5</td>
<td>64±4.1</td>
<td>64±4.0</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>118±5.8</td>
<td>148±5.8</td>
<td>165±8.8</td>
</tr>
<tr>
<td>WC (Cm)</td>
<td>27.2±2.9</td>
<td>37.2±3.1</td>
<td>38.8±3.5</td>
</tr>
<tr>
<td>Hip circumference (Cm)</td>
<td>37.2±2.5</td>
<td>43.2±2.0</td>
<td>43.9±3.1</td>
</tr>
<tr>
<td>WHR</td>
<td>0.74±0.030</td>
<td>0.78±0.055</td>
<td>0.80±0.043</td>
</tr>
<tr>
<td>Systolic BP (mmHg)</td>
<td>100–110</td>
<td>110–120</td>
<td>115–130</td>
</tr>
<tr>
<td>Diastolic BP (mm Hg)</td>
<td>66–75</td>
<td>75–80</td>
<td>80–90</td>
</tr>
<tr>
<td>BMI (Kg/m²)</td>
<td>21.59±3.07</td>
<td>26.8±2.04</td>
<td>32.4±4.23</td>
</tr>
</tbody>
</table>

WC: waist circumference, WHR: waist hip ratio, BMI: body mass index

Table-2: Comparison between WHR and BMI in
all three groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>WHR</th>
<th>BMI</th>
<th>Regression coefficient (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1: 21–29 year (n=30)</td>
<td>0.74±0.030</td>
<td>21.59±3.07</td>
<td>0.65*</td>
</tr>
<tr>
<td>GII: 30–39 year (n=30)</td>
<td>0.78±0.055</td>
<td>26.8±2.04</td>
<td>0.79*</td>
</tr>
<tr>
<td>GIII: 40–55 year (n=30)</td>
<td>0.80±0.043</td>
<td>32.4±4.23</td>
<td>0.91*</td>
</tr>
</tbody>
</table>

A number of obesity related variables are
recognised risk factors of different diseases. Body
weight, BMI, waist and hip circumference, WHR,
triceps and subscapular are all positively predictor of
obesity related diseases.15 Waist measurement alone
may be relevant when assessing severely obese
subjects whose hip measurements are difficult and
unreliable. However, waist hip ratio may be better
predictor of cardiovascular risk than waist
measurement, as it is less dependent on body size and
height. Furthermore, hip circumference is an index of
muscle mass and may reflect exercise status and
insulin sensitivity.15 BMI is the most commonly used
indicator of obesity in population studies, although it
is not a perfect one. It does not take into account
body fat patterning as waist size, WHR and skin-fold
measurements do.17

In our study there is a statistically significant
correlation between WHR and BMI as shown by
regression coefficients and linear graphical regression
analysis. This is in accordance with other studies,
which document that WHI and BMI have found
equally important indicator to predict the risk of
cardiovascular diseases. However, WHR has shown
better prediction power for cardiovascular disease
among women.13,16 Many investigators advocated
that WC as well as WHR have strongest relationship
with the elevation of blood pressures especially in
females although age and menopause have significant
effect on cardiovascular parameters.18

The weakness of the present data is that the
analysis does not include male data. However, this is
a problem for female investigator in Pakistan
society. There is a need for more such studies still
remains on a vast scale especially in Pakistan.

CONCLUSION

That there is a good correlation between WHR and
BMI for evaluation of obesity. It is suggested that the
women with obesity in different ages should get their
WHR measured and BMI calculated that may help to
maintain better health and prevention of obesity
related diseases.

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