EVALUATION OF THE RELATIONSHIP BETWEEN BODY MASS INDEX AND REPRODUCTIVE HORMONES IN INFERTILE FEMALES

MAHWASH MENGAL¹, MUHAMMAD ALAM MENGAL², SOBIA HUMERAH³

ABSTRACT

OBJECTIVE: To evaluate the relationship between body mass index and reproductive hormones (FSH and LH) in infertile females.

STUDY DESIGN: Analytical Case Control study.

PLACE AND DURATION OF STUDY: Department of Physiology, Islamic International Medical College, Rawalpindi from 1st January 2013 to 31st December 2013.

METHODOLOGY: One hundred and fifty (150) normal, overweight and obese infertile females aged 20 to 39 years, who had ovarian and tubal blockage and causes of infertility, were included in the study. They were sub-divided into three groups in accordance with World Health Organization (WHO) classification for Body Mass Index (BMI). Each group comprised of fifty (50) subjects. After detailed history and general physical examination, samples of blood were drawn on day three (3) of the menstrual cycle in the subjects for the assay of serum reproductive hormone levels.

RESULTS: Effect of increased BMI on serum hormone levels in normal, overweight and obese groups are observed in table below. Serum FSH was highly statistically significant (p=0.001**). Serum LH was statistically significant (p=0.048*). Analysis of Variance test revealed that serum FSH and LH levels were significantly associated with BMI in all the three groups.

CONCLUSION: Increased BMI leads to significant negative association with reproductive hormones (FSH and LH) in infertile women.

KEY WORDS: Obesity, Reproductive Hormones, Infertility, Body Mass Index

INTRODUCTION

Infertility happens to be a widespread debilitating health concern in the world. Admittedly, one hundred and eighty six (186) million married women of reproductive age remain affected by it in developing countries. This translates the nuisance to be one in every four couples. Nevertheless; a high infertility rate approximately 21.9% prevails in the married population in Pakistan. The incidences of primary and secondary infertility are estimated to be 3.5% and 18.4% respectively. The aforesaid annoyance can affect either gender alike. It is caused due to menstrual irregularities, anovulation, blockage of fallopian tubes, uterine malformations, inflammation of the uterus and uterine fibroids etc. in women.

Subsequent reasons which gigantically shed emotional catastrophic effects on infertile couples embrace uncertainty about the triumph of fertility treatment, grief, anxiety, loss of self-esteem, financial strain, marital stress and social pressure. Astonishingly, there is more likelihood of infertility in obese females as compared to normal.

Obesity is defined as body mass index (BMI) of more than 30kg/m². Individuals are classified into the ensuing groups of normal-weight (BMI < 25 kg/m²), over-weight (BMI 25 to 30 kg/m²) and obese (BMI > 30 kg/m²) respectively. Excess of adipose tissue affects altered reproductive hormone secretion and bioavailability by both direct and indirect mechanisms. The fecundity in females is sensitive to obesity, which may exist thanks to several endocrine and metabolic changes. They include altered metabolism of steroids and variations in secretion as well as action of hormones.

Concurrently, scarcity of Follicle Stimulating Hormone (FSH) and Luteinizing Hormone (LH) can either lead to irregular ovulation (oligovulation) or absence of ovulation (anovulation). During the menstruation phase of the menstrual cycle, the blood levels of FSH continue to rise. Resultantly, estrogen increases towards maximum, which signals the pituitary for gonadotropin synthesis. Thus, LH and FSH levels commence to rise. The abovementioned state leads to hyperandrogenaemia, which eventually results in disturbed folliculogenesis. Resultantly, infertility is witnessed in women. Moreover, Testosterone is fetched to granulosa cells in a “bucket brigade” manner. Testosterone is changed into estrogen mostly estradiol due to enzymatic activity. In the wake of which, serum estrogen concentrations rise increasingly in the body. Consequently, reproduction in women would end to a cut short devoid of admittance to ovarian testosterone.

The hormone prolactin may impede a female from ovulating. In such case, the menstrual cycles would come to a halt. Moreover, high levels of prolactin may merely disrupt ovulation. Deficiency in progesterone levels after ovulation may result in a uterine lining having less capability to contain an embryo implant. Since, there happens to be a dire paucity in the availability of rationalized regional as well as local data pertaining to the association between BMI and reproductive hormones (FSH and LH) among infertile women, we have attempted to evaluate the relationship between BMI and reproductive hormones (FSH and LH) in infertile females.


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LH). In addition, the mutual influences between the aforesaid and infertility remain abstruse in local population due to scanty data. Hence, this study was designed.

**METHODOLOGY**

This analytical case control study was carried out in the Department of Physiology, Islamic International Medical College, Rawalpindi from 1st January 2013 to 31st December 2013. Inclusion criteria consisted of normal, overweight and obese infertile females having ovarian cause of infertility. Females aged 20 to 39 years having tubal blockage as cause of infertility. Exclusion criteria consisted of male partners and females having uterine and cervical causes of infertility.

The calculated sample was computed to be one hundred and fifty (150). Considering the confounders, misreporting etc. 10% more subjects were recruited. Therefore, the total enrolled subjects were one hundred and fifty (150). The data was collected by carrying out questionnaire-administered interviews which aimed at acquiring demographic, anthropometric, laboratory and other pertinent information.

Samples of blood were assayed for hormonal variables like serum FSH, LH, Testosterone and Prolactin by Architect hormonal assay technique, which were analyzed on Architect i optical system. BMI was determined according to WHO classification based upon the following criteria as follows;

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Normal Weight (n=50)</th>
<th>Over Weight (n=50)</th>
<th>Obese (n=50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Year)</td>
<td>31.56±6.38</td>
<td>32.30±7.46</td>
<td>34.88±6.24</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>56.28±6.18</td>
<td>63.28±8.52</td>
<td>80±9.70</td>
</tr>
<tr>
<td>Height (Cm)</td>
<td>155.74±3.52</td>
<td>153.62±6.46</td>
<td>152.81±7.57</td>
</tr>
<tr>
<td>BMI (Kg/m²)</td>
<td>23.20±2.06</td>
<td>26.80±3.16</td>
<td>34.30±3.12</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Obesity is deemed to be allied with hormonal disorders and infertility. The association of BMI on reproductive hormones was pondered among normal weight, over weight and obese groups in accordance with the classification of World Health Organization. Results of our study showed a highly statistically significant association between serum FSH levels and BMI (p=0.001**). Conversely, Holte et al. observed that serum FSH levels were low in obese women indicating anovulation. It could be due to the reason that they considered only polycystic ovarian disease (PCOD) factor as cause of infertility. However, Wittemer et al. and Dereur et al. reported unchanged concentrations of FSH among the three aforesaid BMI groups. A statistically significant association was found between serum LH levels and BMI (p=0.048*). In line with our results, Brewer &

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Desirable Ranges</th>
<th>Normal Weight (n=50)</th>
<th>Over Weight (n=50)</th>
<th>Obese (n=50)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follicle Stimulating Hormone (mIU/MI)</td>
<td>3.09 - 7.90</td>
<td>5.70±1.89</td>
<td>6.15±1.89</td>
<td>7.05±1.59</td>
<td>0.001**</td>
</tr>
<tr>
<td>Luteinizing Hormone (mIU/MI)</td>
<td>1.00 - 18.00</td>
<td>5.02±3.67</td>
<td>6.27±4.33</td>
<td>6.93±3.65</td>
<td>0.048*</td>
</tr>
<tr>
<td>Testosterone (ng/mL)</td>
<td>0.10 - 0.57</td>
<td>0.67±0.10</td>
<td>0.61±0.12</td>
<td>0.59±0.32</td>
<td>0.132</td>
</tr>
<tr>
<td>Prolactin (ng/mL)</td>
<td>2 to 29</td>
<td>23.29±16.75</td>
<td>24.08±13.12</td>
<td>25.88±14.33</td>
<td>0.67</td>
</tr>
</tbody>
</table>

One hundred and fifty infertile women were enrolled who were equally divided into three groups in accordance with BMI categorization i.e. Normal Weight 50 (33.33%), Over Weight 50 (33.33%) and Obese 50 (33.34%) as shown in Table-I. A highly statistically significant association was found between Serum FSH levels and BMI (p=0.001**) as shown in (Table-II). A statistically significant association was found between Serum LH levels and BMI (p=0.048*) as shown in (Table-II). Whereas, Serum Testosterone and Prolactin levels were not found to be statistically significant (p=0.132) and (P=0.67) respectively as shown in (Table-II).
Balen et al. and Huber et al. observed in their studies that increased BMI was associated with increased serum LH levels proving anovulation in obese population. On the contrary, Witttemer et al. reported that serum LH levels were decreased in subjects having increased BMI. The abovementioned difference could be due to the inclusion of merely PCOD factor as cause of infertility. Serum Testosterone levels were not found to be statistically significant (p=0.132). These results of our study were in agreement with the findings of Nardo et al. who reported that serum testosterone concentrations and BMI didn't have a statistically significant relationship. However, Sharique et al. showed a statistically significant increase in mean serum testosterone levels in obese patients in comparison with control. Furthermore, Sowers et al. reported that obese women had higher serum testosterone concentrations than normal weight. Serum prolactin levels were not found to be statistically significant (p=0.67). This result of our study was consistent with the findings of Seth et al. and Kumkum et al. who found no statistically significant association. In opposition, Al-Ali et al. found that prolactin significantly (statistically) influenced BMI. So it remains crystal clear that there happens to be an inevitable profound association between BMI and reproductive hormones (FSH and LH) in terms of their mutual influences towards occurrence of infertility in females. Body mass index has no impact on sperm quality but on reproductive hormones levels
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CONCLUSION

Our study illustrated a significant negative association between BMI and Serum Reproductive Hormones (FSH and LH) in infertile females in the local population.

Contribution of authors:
Mahwash Mengal: Principal investigator/researcher.
Muhammad Alam Mengal: Added his worthy contribution in drafting of the manuscript, statistical analysis and critical analysis and review of data.

Sobia Humera: contributed significantly towards collection and assembly of data and as expert advisor of the manuscript for important intellectual content.

REFERENCES


