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EFFECT OF BODY MASS INDEX ON FOLLICLE STIMULATING HORMONE, LUTEINIZING HORMONE, PROLACTIN AND FASTING BLOOD GLUCOSE LEVELS IN WOMEN WITH POLYCYSTIC OVARIAN SYNDROME

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ABSTRACT

Background: Obesity is a modern day scourge which plays havoc on the menstrual life of women in the reproductive age group. Disorders of menstrual cycle affect the women psychologically as well as physically. To estimate the obesity of an individual a cost effective method is to calculate the BMI (Body Mass Index). This is a reliable tool in early detection of Obesity and its associated disorders. In women of the reproductive age group an increased Body Mass Index results in alteration of hormonal levels resulting in altered menstrual cycles. In women with polycystic ovarian syndrome, the hormonal levels are so altered that many cycles are anovulatory. Estimation of Body Mass Index and comparing them with the hormonal levels will provide a fair idea in understanding the disease process.

Materials and Methods: The test subjects were 79 apparently healthy women volunteers. They were divided into two groups based on menstrual history. Nineteen subjects were in control group and sixty were in the test group. BMI was calculated for both the groups. Blood levels of FSH, LH and Fasting Blood Glucose was estimated after obtaining consent and withdrawal of blood was done under aseptic precautions. The resultant measurements were subjected to statistical analysis,

Results: The mean BMI of the test group was 25.48 $Kg/m^2$and the mean BMI of the control group was 23.07Kg/m^2. The Mean FSH levels in test group 7.88 mIU/ml and in the control group it was 8.95mIU/ml. The mean Prolactin levels in the test group were 16.635 ng/ml and in the control group it was 10.35 ng/ml. The mean LH levels in the test group were 6.53mIU/ml and in the control group it was 3.76mIU/ml. The mean fasting blood glucose levels in the test group was 94 mg/dl and in the control group it was 84 mg/dl.

Conclusion: It is evident from the present study that the mean hormonal levels of LH and Prolactin and the fasting blood glucose levels are significantly higher in persons with polycystic ovarian syndrome and the FSH levels are lower in persons with polycystic ovarian syndrome which indicates that there could be always increased number of anovulatory cycles in such individuals.

Keywords: Body mass index, Follicle stimulating hormone, Luteinizing hormone, Prolactin, Glucose, polycystic ovarian syndrome.

INTRODUCTION

Polycystic ovarian syndrome is one of the most common endocrine disorder affecting 5-10% of women in their reproductive age group.[1]Polycystic ovarian syndrome is an ill defined symptom complex, imbalance of different hormonal functions which can affect ovarian homeostasis resulting in anovulation which will manifest as

Polycystic ovarian syndrome.[2]According to National Institute of Health in 1990Polycystic ovarian syndrome is defined based on diagnostic criteria such as presence of hyperandrogenism, chronic oligo-anovulation and exclusion of other diseases like prolactinemia, thyroid disorders and non classical adrenalhyperplasia.[3]

Polycystic ovarian syndrome patients usually over weight, LH: FSH ratio was less than 2 which is significantly higher amongpolycystic ovarian syndrome patients[4]. Fifty percent (50%) of polycystic ovarian syndrome women are overweight / obese. Body mass index is a commonly used measure for excess body weight.Body mass index and mean age of menarche were significantly higher in Chinese women.[5]

The percentage of women affected bypolycystic ovarian syndrome and obesity presenting with glucose intolerance is rather high, ranging from 20 to 49%[1].Dysglycemia is also one of the important factors as most of the polycystic ovarian syndrome cases are prone to Diabetes Mellitus. Obese women with polycystic ovarian syndrome showed insulin resistance and fasting hyper insulinemia.[6] Nowadays physicians check fasting blood glucose levels as a factor when diagnosing polycystic ovarian syndrome. Women with polycystic ovary syndrome should undergo fasting plasma glucose test and Glucose Tolerance Test to rule out diabetes mellitus as a factor for anovulatory cycles. A high glucose level indicates insulin resistance, which in turn contributes to central obesity in polycystic ovarian syndrome.[7]

The present study was performed to correlate Body mass index with LH, FSH, Fasting blood glucose levels and mean age of menarche between apparently normal women and women with polycystic ovarian disease.

MATERIAL AND METHODS

This cross-sectional study was performed on 60 afflicted Polycystic ovarian syndrome women volunteers and 19 control women volunteers from the gynaecology outpatient department of Vinayaka Mission Hospital and J.S.Hospital, Salem, Tamil Nadu, India between March 2013 to March 2014. The ethical clearance was obtained from the Institutional ethics committee of VMKV Medical College for conduct of the study. The control group consisted of apparently normal 19 women and test group consisted of 60 women with polycystic ovarian disease.

The following parameters were studied

1. Age of menarche
2. Body Mass Index
3. Follicle stimulating hormone levels
4. Luteinizing hormone levels
5. Prolactin levels
6. Fasting Blood Glucose

The Body mass index was calculated using the formula: weight in Kilograms/Height in meters[2.] According to the Asia–Pacific criteria of Body mass index for obesity subjects were divided into four groups.[8]

Group 1: Less than 18.0kg/m^2
Group 2: Between 18.1 and 22.9kg/m^2
Group 3: Between 23.0 and 24.9 kg/m^2
Group 4: Greater than 25 kg/m^2

Body mass index (BMI) with body fat as Standard Consensus Statement for Indian population was considered, Normal BMI: 18.0 -22.9kg/m^2, Over weight: 23.0-24.9 kg/m^2,
Obesity: ≥25kg/m^2 as cut off for BMI.[9]
Based on above classification of BMI Group 1 is less than normal weight, Group 2 is normal weight, Group 3 is overweight, Group 4 is obese.

To analyze FSH, LH, Prolactin and Fasting blood glucose levels around 5ml of blood sample was collected under aseptic conditions. FSH, LH, Prolactin levels were analyzed with the help of"Tosoh AIA360 Analyzer Kit" with fully automated analyzer equipment, Fasting blood glucose levels were analyzed with "BioSystem

Kit" with Bio system A-15 fully automated analyzer in both test and control groups.

To determine the follicular status of the test and control groups, ultrasonography was performed.

Based on the following criteria, the EuropeanSociety of Human Reproduction and Embryology/American Society for Reproductive Medicine in 2003 (Rotterdam PCOS ConsensusWorkshop Group, 2004[10] the test subjects were selected.

Inclusion Criteria for Test subjects

1. Age:17years to 40 years
2. Oligomenorrhoea or Anovulation (Less than eight menstrual cycles in a year).[9]
3. Clinical and biochemical signs of hyperandrogenism.
4. Polycystic ovaries (presence of 12 or more folliclesin each ovary measuring 2–9 mm in diameter and/or increased ovarian volume of 10 ml)

Exclusion Criteria for Test subjects

1. Women below 17 years and above 40 years.
2. Pregnant and Lactating mothers
3. Other etiologies (e.g. congenital adrenal hyperplasia, androgen-secreting tumors and Cushing's syndrome)
4. Patients using drugs affecting sex hormones and blood glucose levels.

Inclusion Criteria for control group

1. Women aged between 17-40 Years
2. Regular menstrual cycles between 21 to 35 days.
3. Normal ovaries

Exclusion Criteria for control group

1. Women below 17 years and above 40 years
2. Pregnant and Lactating mothers.

Statistical Analysis

The resultant parametrical measurements were subjected to statistical analysis to validate the significance of the study using SPSS version 16.

RESULTS

The mean age of menarche in both the test group and control group was 13 years. The mean BMI of the test group was 25.48 Kg/m^2. The mean BMI of the control group was 23.07Kg/m^2. The Mean FSH levels in test group 7.88 mIU/ml. The mean FSH levels in the control group was 8.95mIU/ml. The mean Prolactin levels in the test group were 16.635 ng/ml. The mean Prolactin levels in the control group were 10.35 ng/ml. The mean LH levels in the test group were 6.53mIU/ml. The mean LH levels in the control group were 3.76mIU/ml. The mean fasting blood glucose levels in the test group was 94 mg/dl. The mean fasting blood glucose levels in the control group was 84 mg/dl. The cumulative mean of all these parameters is depicted in Table-1. The FSH to LH ratio was in the test group was 1.46 and in the control group it was 3.56 (Table-4). Paired samples "t" test was performed to validate the study and its significance (Table-2). Also comparison of the parameters of test and control groups is depicted in (Table-3).

DISCUSSION

Polycystic ovarian disease can cause either primary or secondary infertility if the primary cause like dyslipidemia, insulin resistance and hyper androgenemic causes remain untreated. [11] In the present study the fasting blood glucose levels in the test group was having marginal increase than the control group which is indicative of a rising insulin resistance. Categorization of obesity should be ethno centric as the body fat percentage varies in ethnic populations and treatment modalities also will change accordingly[5]. In our study obese women with polycystic ovaries were more than in the control group. However in a study with a small sample size, the prevalence of polycystic ovaries can be moderate.[12] and concomitant presence of obesity will worsen the outcome of a metabolic disorder.[13] Luteinizing hormone effect in polycystic ovarian syndrome in patients with an increased body mass index, this

mediation of hormonal control is done in the pituitary gland and not in the hypothalamus.[14]

In the present study, the luteinizing hormone levels were higher than the control group which could be contributing to polycystic ovarian disease. Low levels of follicular stimulating hormone were found in women with polycystic ovaries which suggest that there is anovulation in these women.[15] It is evident from the present study that the levels of follicular stimulating hormone are lower in women with polycystic ovarian syndrome than in the control group. In most of the studies hyperprolactinemia was an exclusion criterion for polycystic ovarian disease and in the present study where Prolactin levels were also measured and the Prolactin levels were significantly higher in the test group than the control group which indicates that Prolactin levels will be elevated in women with polycystic ovarian disease. In a study conducted in Bangladesh, it has been concluded that a there is a definitive link between body mass index, insulin resistance with the fertility levels.[4]In the present study the authors agree with the findings of the study as the parameters measured and the results obtained from the present study were also similar.

CONCLUSION

Polycystic ovarian syndrome affected women who are obese will have elevated and abnormal hormonal levels as evident from the present study. The Body Mass Index causes disturbances in the menstrual cycle of women with polycystic ovarian syndrome. Anovulatory cycles of women affected by polycystic ovarian disease will reduce fertility levels. Obese women in the reproductive age group with menstrual cyclic disturbances should undergo hormonal profiling and fasting blood glucose to rule out insulin resistance. Since the sampling size of the present study is modest a larger sample size is being done to categorically validate the above findings. However the results of the study can be taken as guideline when investigating obese women with polycystic ovarian disease.

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Table 1: Comparison of Mean and Standard deviation between test and control groups

Parameter	Mean(Test) N=60	S.D(Test) N=60	Mean(Control) N=19	S.D(Control) N=19
Age at menarche(year)	13.7	1.3	13.37	0.83
BMI(kg/m$^{2)}$	25.48	3.35	23.07	2.70
LH	6.54	3.71	3.76	2.31
FSH	7.89	2.66	8.96	4.10
Prolactin	16.64	9.53	10.36	4.01
FG	94.59	14.07	87.74	5.29
FSH:LH	1.46	0.79	3.56	3.22

AM: Age at menarche; BMI: Body mass index; LH: Luteinizing hormone; FSH: Follicle stimulating hormone; FG: Fasting glucose; S.D: Standard deviation, N: Sample size.

Table 2: Results of Paired samples t test between test and control group

Paired Samples Test								
Parameters	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
AM	-.52632	1.54087	.35350	-1.26899	.21636	-1.489	18	.154
BMI	.73263	4.80427	1.10218	-1.58295	3.04822	.665	18	.515
LH	2.66789	3.70320	.84957	.88301	4.45278	3.140	18	.006
FSH	-1.18632	4.68399	1.07458	-3.44393	1.07130	-1.104	18	.284
Prolactin	5.77158	7.74727	1.77735	2.03751	9.50564	3.247	18	.004
FG	7.31579	12.58329	2.88680	1.25084	13.38074	2.534	18	.021

AM: Age at menarche; BMI: Body mass index; LH: Luteinizing hormone; FSH: Follicle stimulating hormone; FG: Fasting glucose; S.D: Standard deviation

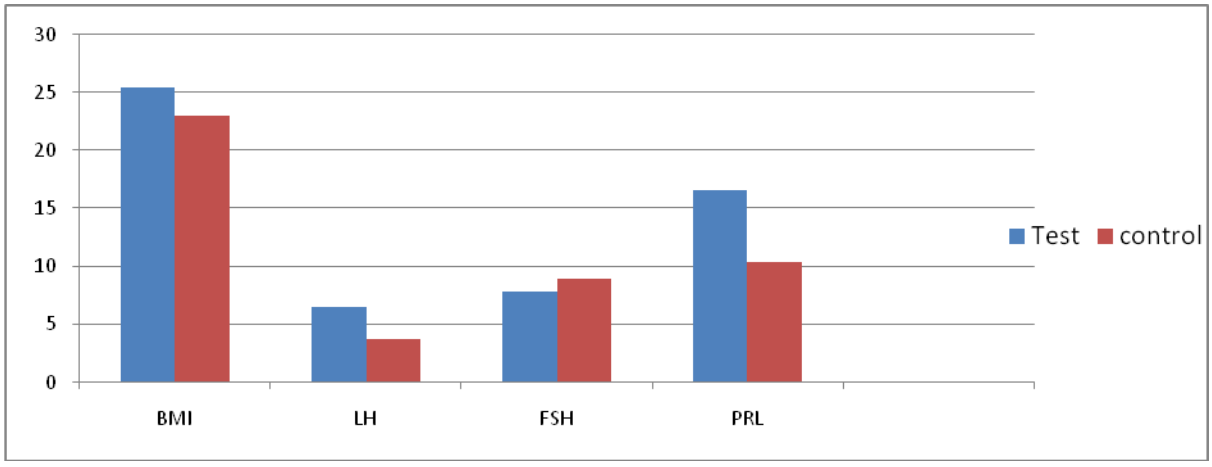

Figure-1: Comparison of means of parameters between test and control groups

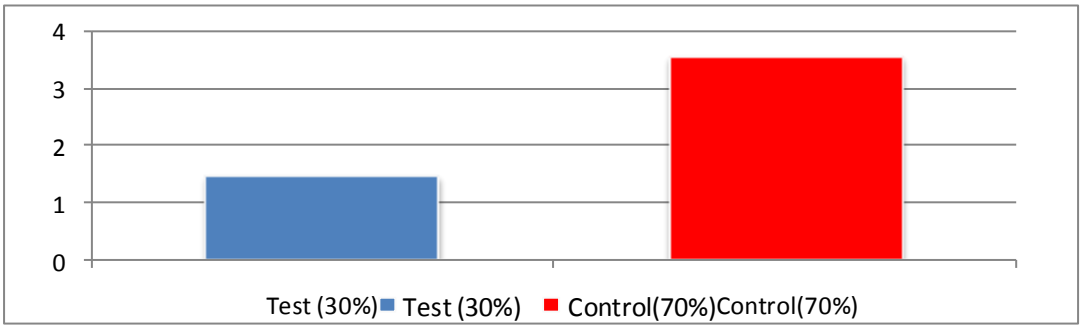

Figure-2: FSH: LH ratio between Test and control groups

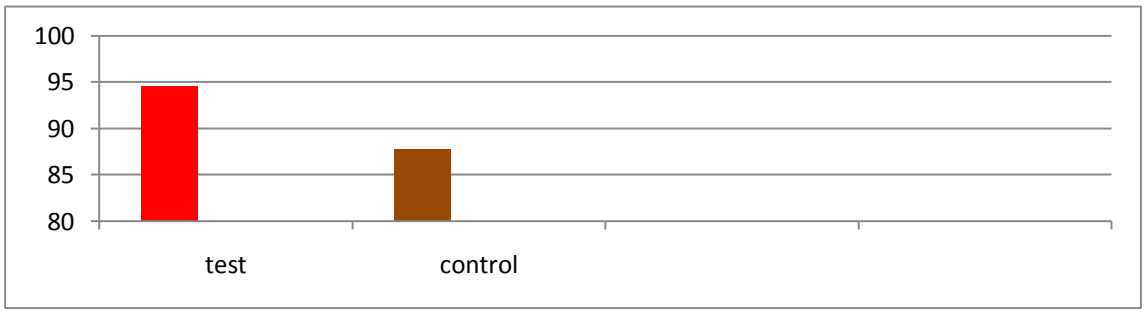

Figure-3: Bar chart showing the comparison of fasting blood glucose levels between test and control groups

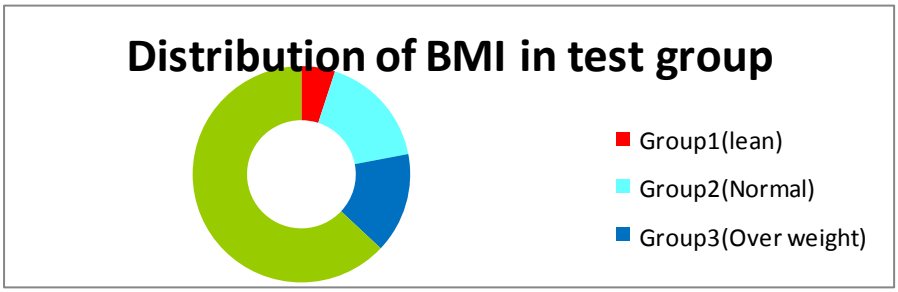

Figure-4

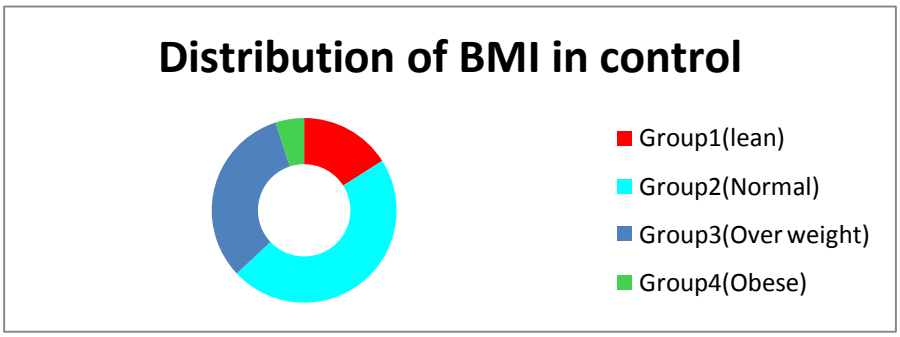

Figure-5