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Research Article

EXPLORATION OF OVARIAN HORMONES, DIET AND LIFESTYLE OF WOMEN WITH POLYCYSTIC OVARIAN SYNDROME

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A B S T R A C T

Polycystic Ovarian Syndrome (PCOS) is an endocrine disorder made known to affect 4-18% of reproductive women worldwide. It is observed to have associations with metabolic syndromes, psychological mentality and reproductive organs in women. We investigated a case control study to compare the significance of LH, FSH and testosterone among women with and without PCOS. We also compared a simple dietary and lifestyle pattern. A total of 124 Patients were recruited from the Women's Hospital of North Central Regional Health Authority of Trinidad and Tobago. Upon consent women were asked to complete a semi-structured and rating questionnaire. Blood samples were then collected and analysed for LH, FSH and testosterone levels.

Sixty-two women with PCOS were eligible as they met the inclusion criteria and were compared with 62 controls. The mean age of women with PCOS was 27.21 ± 6.538 when compared to 29.64 ± 7.534 without PCOS at p=0.114. There were significant differences among the groups for the levels of LH (p=0.004) and testosterone (p=0.002). The mean ratio of LH/FSH was twicethe level in women with PCOS compared to the normal. Our study showed that women with PCOS consumed significantly more cakes (p=0.036), ice-cream (p=0.029), tea (p=0.006) and fast food (p=0.055) at least twice a week when compared to normal women. Chi-square testing showed that there was a significant difference in abdominal pain experienced by women with and without PCOS. The significance of abdominal pain experienced among the groups showed to be X^2 (2, N=124) = 6.76 p=0. Among the study participants 23% took no medications, 14% on hormonal treatment and 5% were on anticoagulant therapy.

Conclusion: Our findings concluded that LH, FSH and testosterone are good clinical parameters that can be used for diagnostic testing of PCOS. We also conclude that abdominal pain, lack of exercise, and unhealthy diets are some of the characteristic features that women with PCOS may exhibit.

INTRODUCTION

Polycystic Ovarian Syndrome (PCOS) is an endocrine disorder associated with; metabolic syndromes (IR, obesity, hypertension, dyslipidaemia [Tehrani *et al*. 2014, Kitzinger *et al*. 2002], non-metabolic disorders [Castro *et al*. 2014], Cardiovascular Diseases [Velez *et al*. 2014], psychological mentality (anxiety, depression, quality of life) and reproductive dystraction (infertility, hyperandrogenism, hirsutism). This syndrome of ovarian dysfunction [Laven *et al*. 2014] has been shown to affect 4-18% of reproductive women worldwide [Moran *et al* 2011.].

Women diagnosed with PCOS have additionally revealed to exhibit a pattern for pre-obesity [Luque-Ramirez *et al*. 2014.] with links indicating a high progression of 30-40% of them progressing towards havingtype 2 diabetes (T2D). Some may also present with abnormalities in insulin resistance (IR), inflammation, adipose tissue dysfunction, impaired fasting glucose (IGF) and impaired glucose tolerance (IGT) [Trolice.2011, Chaoyang *et al*.2008]. Collectively with these, research has also displayed metabolic abnormalities in lipid metabolism, energy balance regulation, and body fat distribution [Sharpless. 2003].

There also exist biochemical statistics that have shown irregular patterns in the level of ovarian hormones for women diagnosed with PCOS [Cook *et al*. 2002, Rebar *et al*. 1976]. Some women who present with abnormal menstrual cycles would usually present with abnormal levels of LH and FSH. Researchers have shown that women diagnosed with PCOS had higher levels of LH when compared to normal women [Cook *et al*. 2002]. According to the ESHRE/ASRM criteria for identifying women with PCOS [Rotterdam. 2004] and other research conducted [14], it was observed that the hormones LH/FSH had little effect on the diagnosing process of PCOS.

Additionally women with PCOS have been identified as having higher levels of testosterone [Balen *et al*. 1995, Chang *et al*. 2005]thus resulting in hyperandrogenism which would usually manifest itself as hirsutism and acne. Nevertheless those who present with PCOS can sometimes present with malfunctions in both their reproductive and endocrine system.

Since no cure has been found, women are therefore recommended a variety of medications depending on the status of their laboratory findings and physical symptoms. The most common medication includes oral contraceptive (OCP's), antiandrogens, tropical medications, gonadotropins [Archer. 2004], change in their diet and high levels of exercise.

Few studies have demonstrated the effect of diet on hormones, however high fat diets have been observed to cause obesity and infertility in female mice with PCOS [Lai *et al*.2014] In conjunction to this, hypo-caloric diet for women with PCOS has shown a 5% IR, hyperandrogenism, menstrual function and fertility increase with a relatively small weight loss[Rondanelli *et al*. 2014]. To add dash diets have also shown to assist in the reduction of IR, triglycerides and VLDL [Zatollah *et al*. 2014].

Overall there are insufficient research on the diet of women with PCOS, their lifestyle activities and most of all, there are conflicting literature on whether LH, FSH and testosterone are effective for clinical diagnosis. This study therefore seeks to investigate the effectiveness of previous literature on the usefulness of testing LH, FSH and testosterone for diagnostic consideration for women with PCOS. It also aims to give a concise account of the lifestyle patterns of those with PCOS when compared to those without.

MATERIALS AND METHODS

This was a case control studyconducted at the Mount Hope Women's Hospital and North West Regional Health Authority of Trinidad and Tobago from the period of January 2015 to May 2016. Ethical approval was obtained from the Ethics Committee at the University of the West Indies and from both the hospitals.The inclusion criteria were women who presented on the day for their medical check-up and consisted of women with and without PCOS between the ages of 18-35 years, women within their early follicular stage, pre-diabetics and T2D. The exclusion criteria consisted of women under the age of 18 years, pregnant women and those with medical conditions that could affect the results. A population of 200 women (sample size calculated with confidence interval 7) participated in which only 124 fit into our inclusion criteria. Sixty-two women had PCOS and 62 were presented without. The women without PCOS were used as our control group and therefore considered to be normal.

The women were asked to give written consent before participating in the research. They were then issued a semi-structured questionnaire with some rating questions designed by the investigators as seen in Table 1.0.The questionnaire as seen in Table 1.0 comprised of the person age, ethnicity, chronic/medical conditions, how patients considered their health, how often they exercised, the level of bodily pain they experienced daily and the symptoms experienced daily such as abdominal pain, frequent urination, increased thirst and decreased appetite. These patients were also asked about their diet such as ice-cream, cakes, preservative fruits, fast food (restaurant style and not homemade) tea and coloured soft drink consumed at least 3 times a week as seen in Table 1. They were also asked if they remembered the medications they were taking and the reason.

Table 1 displaying the questionnaire issued to patients

Ethnicity	**East Indian, African, Mixed**
Chronic/ Medical Conditions	T2D, PCOS, Lung infection, Heart Disease, Other chronic condition
General Health	Excellent(1) Very good(2) Good(3) Fair(4) Poor(5)
Are you affected by any bodily pain?	1-10 1(no pain) 10(a lot of pain)
Do you have any of the following symptoms?	Increase thirst, decreased appetite, abdominal pain, frequent urination
How often do you exercise?	1-10 1(never) 10(strenuous, all the time)
Are you on medications? Reasson	
Do you eat the following at least 3 time a week?	Preservatives, cakes, ice-cream, snacks, fast food at least twice a week
Do you drink any of the following at least 3 times a week?	Black soft drink, coloured soft drink, tea, alcohol
Age	

Blood samples were then taken from the patients by a certified phlebotomist present at the hospitals. The samples were then sent to the hospital laboratory to be centrifuged, separated and analysed where the levels of LH, FSH and testosterone were obtained from the use of the Vitros 4600 Biochemistry ECI analyser, by Johnson and Johnson. This machine is used in the hospital and have been used for the testing of countless of other biochemical test. The reagents used were the J and J ECI testosterone reagent pack, J and J ECI FSH reagent pack and J and J ECI testosterone reagent pack.

Statistical Analysis

All data collected were grouped according to women with and without PCOS in relation to the information submitted in the questionnaire. Both groups were compared with each other. The means of the data were then compared using Paired Sample T-test and Chi-square testing from the IBM SPSS Statistics Data Editor Version 21. Categorical data were expressed as percentages and continuous data were expressed as their mean and standard deviation. All data were analyzed at the 95% confidence interval.

RESULTS

Among the 124 women who participated in the study, 62 (39 Indians, 6 African, 17 mixed) were diagnosed with PCOS and 62 (34 Indians, 12 African, 16 mixed) without according to their gynaecologist at the clinics. Our study consisted of more East Indian participants when compared with the other ethnicities. However this was insignificant as we were not comparing an equal amount of all ethnicities in relation to PCOS. We compared women with and without PCOS. The mean age of women with PCOS was 27.21 ± 6.538 when compared to the mean age of women without PCOS which was 29.64 ± 7.534 with a p=0.114 which was good for comparison as it presented no statistical significant difference as seen in Table 2.

Table 2 showing the demographic characteristics of women with and without PCOS

	PCOS (n=62)	Control (n-62)
Ethnicity		
East Indian	39	34
African	6	12
Mixed	17	16
Age (mean ± SE)	27.2 ± 6.5	29.64 ± 7.5

The mean average level of LH was 10.03±10.566 for women with PCOS and 5.41±7.531 for women without with a significance of p=0.004 at the 95%confidence level. Additionally the mean average level of testosterone was 1.60±1.088 and 1.05±0.838 for women with and without PCOS respectively of significance difference at p=0.002 (Table 3).

Table 3 showing the mean characteristics of women with PCOS compared to controlled

Hormone	PCOS (n=62) Mean± SD	Control(n=62) Mean± SD	p
FSH/ mIu/mL	4.26 ± 2.283	3.91±2.362	0.409
LH/ mIu/mL	10.30±10.566	5.41±7.531	0.004*
Testosteronenmol/L	1.60±1.088	1.05±0.838	0.002*
	Lifestyle		
Health	2.85 ± 0.963	2.69 ± 1.080	0.283
Bodily Pain	4.05 ± 2.375	2.90 ± 2.280	0.004*
Level of Exercise	4.83 ± 2.792	5.11 ± 0.523	0.523

*****Significant at the 95% confidence level

Our data showed that women with PCOS consumed significantly more cakes (p=0.036), ice-cream (p=0.029), tea (p=0.006) and fast food (p=0.055) at least three times a week when compared to normal women (Table 4).

Table 4 showing thefoods consumed by PCOS and control group at least twice a week

Foods consumed ≥ twice a week	PCOS Mean± SD	Control Mean± SD	p
Preservative fruits	0.63 ± 0.500	0.44 ± 0.512	0.333
Cakes	0.81 ± 0.403	0.50 ± 0.516	0.036*
Ice-cream	0.94 ± 0.250	0.56 ± 0.512	0.029*
Snacks	0.81 ± 0.403	0.50 ± 0.516	0.136
Tea	0.82 ± 0.405	0.27 ± 0.467	0.006*
Soft drinks (coloured)	0.58 ± 0.515	0.50 ± 0.522	0.339
Fast food	0.80 ± 0.414	0.47 ± 0.516	0.055*

Results of our study demonstrated that women with PCOS experienced significantly higher levels of bodily pain up to 4 (p=0.004) on a scale of 1-10 with 1 being the lowest and 10 being the highest on a daily basis (Figure 1). The scoring methodology for body pain was on a scale of 1-10. A person with a scale of value 1, meant that they experience no unusual body pain while a person with a scale 10 experienced body pain daily which is why they considered their health low. The PCOS women also exercised less frequently weekly and considered their health status to be lower when compared to the normal women as shown in Table 3.0. The level of exercise was also on a scale of 1-10. A scale of 1 meant the person did not exercise at all but a person with a scale 10 meant they exercised a lot weekly.

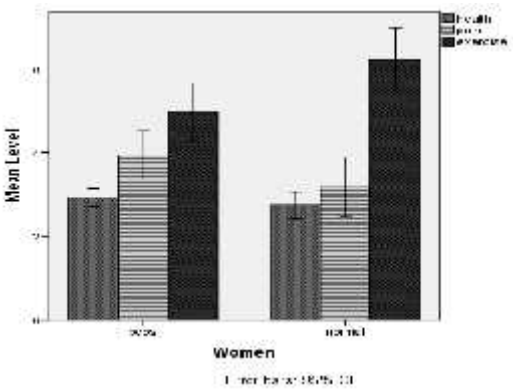

Figure 1 showing thelifestyle of women with and without PCOS

Additionally using Chi-square testing on SPSS, a relationship showed that there is a significant difference in abdominal pain experienced by women with and without PCOS. The abdominal pain experienced among both groups of women were higher in women with PCOS as X^2 (2, N=124) = 6.76 p=0.

The mean ratio of LH/FSH was observed to be higher in women with PCOS compared to the normal at the 95% confidence interval (Figure 2). Figure 3.0 presented the reasons for taking medications. The major reasons showed 23% took no medications, 14% hormonal treatment and 5% as anticoagulant.

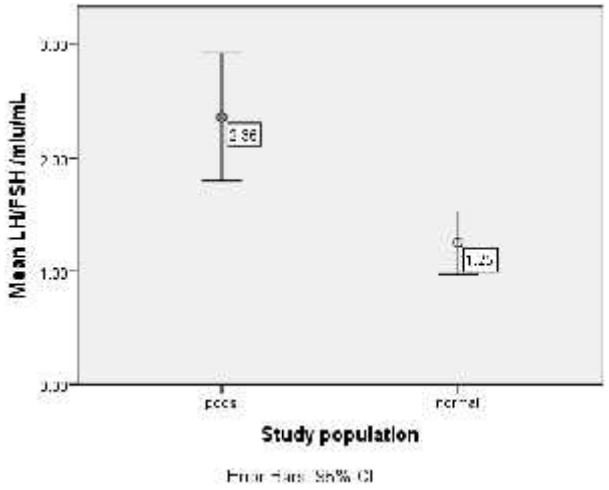

Figure 2 showingerror bars for the LH/FSH of both PCOS and Normal women (control)

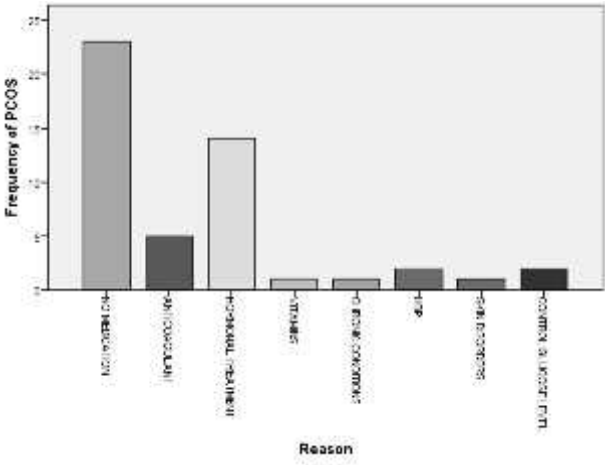

Figure 3 showing medications women with PCOS were taking

DISCUSSION

In this study we examined two ovarian hormones LH and FSH, the androgen testosterone, the diet and the lifestyle of women living with PCOS among different ethnic backgrounds. We also looked at the reasons why women with PCOS believed they were taking medications as they did not remember the names of their medications.

The major finding from our study revealed that women with PCOS were observed to have higher levels of LH, FSH and testosterone in their early follicular stage. Studies have shown that women with PCOS differed in their LH concentrations [Polson *et al*. 1988] and it can also peak to three times the levels of their FSH values [Cool *et al*. 2002] and in some cases twice [Alili *et al*. 2014].

We also observed in our findings that the LH/FSH levels were significantly different when compared among both groups. Contrary to this, according to the 2003 Rotterdam ESHRE/ASRM criteria, it was stated clearly that LH/FSH should not be recommended as an identifier for women having PCOS [Rotterdam 2004] in which a study later proved them correct by showing that the LH/FSH ratio had little effect in diagnosing PCOS [Wei *et al*. 2006].

Additionally the levels of testosterone were significantly higher as expected and did agree with the ESHRE/ASRM criteria. The levels of testosterone was observed to be higher in60-80% of women with PCOS [Balen *et al*. 1995] and many other research have shown the significance of testosterone as being a criteria to test for based on conditions such as hirsutism and acne [Balen *et al*. 1995, Chang *et al*. 2005, Alili *et al*. 2014.],

In our study women also highlighted the reason they were taking medications which was as hormonal treatments, treatment for pre-diabetes, anticonvulsants, vitamins and anti androgens. These medications may have affected the results obtained.

Our study also sought to understand the quality of life experienced by women with PCOS. Our findings showed that women with PCOS regardless of ethnic background experienced both bodily and abdominal or pelvic pain other than during their menstrual cycles. They were also observed to exercise less frequently and considered their health to be around average or less than average when compared to other women.

It has been presented in research that the quality of life is affected [Jone *et al*. 2002] by women who experience pelvic pain which has been tied to the emotional changes of depression and anxiety [Beard *et al* 1986] also known as psychosocial problems, and has been shown to have links with infertility [Ramezanzadeh *et al*. 2004]. Additionally studies have shown that high levels in LH >10 1U/1 together with high levels of testosterone and increase obesity also increased the chances of infertility in women with PCOS [Balen *et al*. 1995] Since PCOS is the leading cause of female infertility, it is therefore recommended that women who experience these symptoms seek their gynaecologist for advice.

Another important finding obtained in our study disclosed that women with PCOS ate more preservative fruits, cakes, ice-cream, snacks, and drank more tea regularly when compared to normal women. However a major statistical difference was shown for women with PCOS consuming more cakes, ice-cream and tea regardless of ethnicity.

Research has shown that women exhibit a dietary pattern for foods with high GI [Douglas *et al*. 2006] in which cakes, ice-cream, tea and the dairy being consumed at least twice a week are of medium (56-69) and high (70) or greater GI [Foster-Powell *et al*. 2002].

This is a significant finding as the foods craved for and consumed daily by women have attached metabolic signals, psychological distress, and menstrual disturbances as studies have shown the possible link of dairy foods affecting ovulatory functions [Chavarro *et al*. 2007].

The effect of reproduction has been amplified compared to ancient times where there were more hunter gathered communities as in ancient times there were less food supply and therefore more physical activity thus less obesity [ACAM WJ].

Physicians must continue to highlight the importance of grains, vegetables and fruits as prevention to chronic disease [ACAM WJ Leaders.]. Diet and lifestyle of women must therefore be looked at from all angles and their development to PCOS, especially the micro scale so that we can obtain a proper pathology.

As research calls it, “this thief of womanhood” [Kitzinger *et al*. 2002] is affecting our women daily and more emphasis should be placed on women living with PCOS. Even though we live in a “gender-polarized” [Braun *et al*. 2005] and advanced technological world, a young woman without a menstrual cycle, psychological discomfort and infertility problems can soon be sadly outnumbered with our future children being computers, machines and robots.

Limitations of Study

More detailed information on women marital status, time period of having PCOS, menstrual irregularities, number of kids and pregnancy complications would have added more impact on this manuscript.

CONCLUSION

Our findings conclude that LH, FSH and testosterone are good clinical parameters that can be used for diagnostic testing of PCOS. We also conclude that abdominal pain, lack of exercise, and unhealthy diets are some of the characteristic features that these women may experience.

Disclosure

Authors agree that this work is original and there are no conflicts of interest.

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