Research article

A comparative study of simple reaction time in PCOS and non-PCOS patients and its relation with BMI

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ABSTRACT

Introduction and Aim: Polycystic ovarian syndrome (PCOS) is a hormonal disorder of the female reproductive system causing infertility, an irregular menstrual cycle, and hormonal imbalance characterized by hyperandrogenism. Reaction to any stimulus is a voluntary response that measures the speed of response of a person. There is gender variation in reaction time, hence there is a need for evaluation of reaction time in PCOS. Thus, auditory and visual reaction time may be affected in the women with polycystic ovaries. The aim of the study was to compare ART and VRT in PCOS and non-PCOS Individuals and to correlate ART and VRT with BMI in PCOS individuals.

Materials and Methods: Age-matched 25 normal and 25 PCOS were subjected to ART and VRT and recordings were obtained. The anthropological parameters like height, weight, and BMI were computed. The results were analyzed using a t-test and Pearson's correlation test using SPSS software.

Results: The auditory reaction time showed significant ($p<0.001$) increase in PCOS 0.318±0.0388 than non-PCOS individuals 0.239±0.0629. There was positive correlation ($r=0.491$, $p<0.05$) of BMI with visual reaction time in PCOS individuals.

Conclusion: Since there is an increase in reaction time and a positive relation with BMI we can say that there is a decline in cognition in PCOS individuals probably due to hormonal changes and obesity.

Keywords: Auditory reaction time; BMI; hyperandrogenism; PCOS; visual reaction time.

INTRODUCTION

Polycystic ovarian syndrome (PCOS)affects an estimated 8-13% of women of reproductive age and is primarily characterized by ovulatory menstrual irregularity and hyperandrogenism. The syndrome is heterogeneous (clinical and biochemical). It encompasses a spectrum of variably associated clinical features that include: Cutaneous signs of hyperandrogenism (eg., hirsutism, moderate-severe acne), a menstrual irregularity that may include oligo or amenorrhea or irregular bleeding, polycystic ovaries, and metabolic changes like obesity and insulin resistance (1). The ovarian dysfunction is unique, it appears to be intrinsic and is characterized by abnormal ovarian steroidogenesis and folliculogenesis that are manifested clinically by hyperandrogenism and anovulation. Over the past 25 years, internationally accepted diagnostic criteria have been developed for adults based on various combinations of otherwise unexplained hyper-androgenism, and a polycystic ovary, which are all encompassed by the Rotterdam consensus criteria (2).

Obesity is present in approximately one-half of the patients with PCOS. Cushingoid obesity seen in them is due to severe insulin resistance that enhances the development of PCOS. The insulin resistance in the case of PCOS is more related to central obesity. In the case of type 2 diabetes mellitus individuals, pancreatic beta cell dysfunction occurs and it can also be seen in PCOS individuals as they are at high risk of insulin resistance (3). An increase in androgen concentration than usual exerts a minor effect on the insulin resistance of PCOS, hyperandrogenism is contributed directly and indirectly through hyperinsulinemia (4). Both insulin resistance and hyperandrogenism harm the cognition. Studies have shown that there is a cognitive decline in obese individuals owing to the inflammatory changes with obesity (5) and there is brain atrophy noticed in obesity (6,7). So there exists a connection between obesity and diabetes with cognitive decline. There are several studies done on the Psychological effects of PCOS (8,9), but paucity of literature on cognitive response in PCOS. Since PCOS is associated with Obesity and insulin resistance which might affect cognition, we intend to look into the cognitive response in the form of simple reaction time in PCOS patients and its association with BMI.

MATERIALS AND METHODS

This is an observational cross-sectional study which is an analytical type. The study population includes two groups. Group 1 consisted of the control and Group 2, the subject group. Two groups were differentiated based on the condition of PCOS. Rotterdam criteria

were used as a reference for differentiation. Convenient sampling was done i.e., the study consisted of a total of 25 between the age group of 18-28 years. After obtaining institutional ethical clearance, the study protocol was briefed to the subjects in their language.

Exclusion criteria were subjects with auditory problems, injury or inflammation of eyes, and ear and subjects were devoid of color blindness. Informed consent from each subject was taken and the following anthropometric parameters were recorded-age (years), height (centimeters), and weight (in kilograms). All the tests were conducted during morning time in the Department of Physiology of the institution. Reaction time was recorded using the INCO time test apparatus (Model number:651MP S.No.: TT-013). Simple reaction time was measured i.e., the reaction time has a single stimulus and a single predefined response. Measurement of visual reaction time (VRT) and auditory reaction time (ART) in milliseconds(ms)was done. Time taken in a simple reaction after receiving optical or aural stimulus was measured. Red color optical signals and buzzer sound were given and the subjects were asked to respond with their dominant hand to press on hand keys as soon as they noticed the optical stimulus and heard the sound signal. The lesser the time taken the faster the reaction time.

BMI was calculated using two anthropometric parameters i.e., weight (kg) and height (m). with Quetlet Index. BMI= weight in Kg/Height in meter square

RESULTS

The descriptive statistic of the study is as follows:
The mean ages of control and PCOS patients were 18±4 and 20±3 respectively.

Table1: Comparison of BMI between control subjects and PCOS patients

Parameter	Control subjects (mean ± SD)	PCOS patients (mean ± SD)	P value
BMI	19.531±4.438	32.3442±6.499	<0.0000

N= 25 in each group,* p<0.05 is significant.

Table 2: Comparison of simple auditory reaction time between PCOS and non-PCOS

Parameter	Control subjects (mean ± SD)	PCOS patients (mean ± SD)	P value
Auditory reaction time (ms)	0.239±0.0629	0.318±0.0388	<0.001

N= 25 in each group,* p<0.05 is significant.

Table 3: Comparison of simple visual reaction time between PCOS and non-PCOS

Parameter	Control subjects (mean ± SD)	PCOS patients (mean ± SD)	P value
Visual reaction time (ms)	0.282±0.110	0.3162±0.034	0.146

On applying 't' test there was statistically significant difference noticed for BMI (Table 1), auditory reaction time (Table 2) and Visual reaction time (Table 3) among PCOS and non-PCOS individuals.

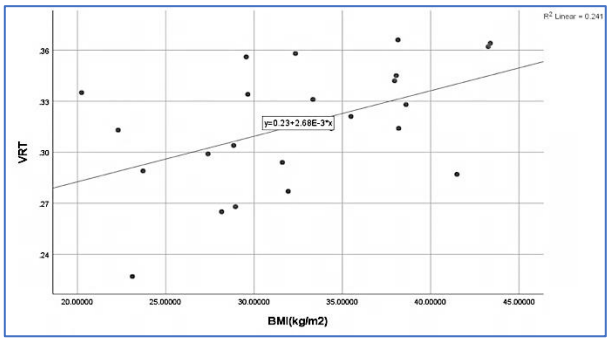

Fig.1: The correlation between visual reaction time and BMI

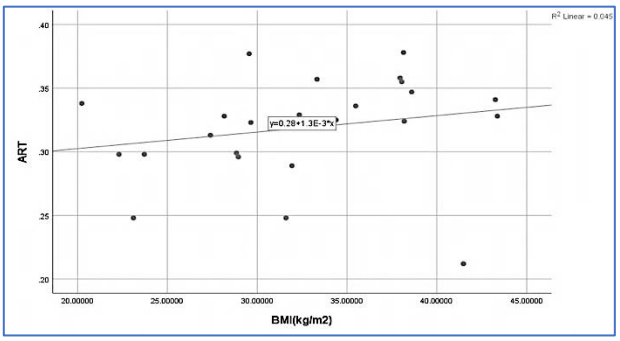

Fig.2: The correlation between auditory reaction time and BMI

On applying Pearson correlation coefficient there was a significant(r=0.0491,p<0.05) positive correlation between visual reaction time and BMI (Fig. 1), whereas, though there was positive correlation between auditory reaction time and BMI, it was not statistically significant(r= 0.211, p= 0.31) (Fig. 2).

DISCUSSION

In our study, the body mass of PCOS patients was significantly higher than the controls. This is by various literature showing higher body mass index in PCOS (10,11). There is a close link between obesity and PCOS, with multiple pathogenesis. The insulin resistance noticed in PCOS largely plays an important role in the development of obesity (12,13). However, lipid metabolism as a consequence of androgen excess in PCOS can probably lead to abnormal visceral fat deposition(14). Our study showed a decline in cognitive function in both visual and auditory reaction time, with auditory reaction time showing significant change. There is a statistically significant difference in ART levels between PCOS and Non-PCOS groups. The PCOS group had comparatively longer ART values. The reaction time is a measure of information processing and speed of response. Since the reaction time in our study showed prolongation of reaction time both in ART and VRT in PCOS patients, it probably suggests that there is the possibility of cognitive decline in them. There is a scarcity of literature showing PCOS's effect on cognition. Few

studies showed decreased performance in psychomotor speed, reaction time, word recognition, and visuospatial learning in PCOS ladies, which they attributed to higher free testosterone levels(15,16). Generally, there is gender variation in reaction time with males outperforming females in visual and auditory reaction time (17,18). With the above result, the decreased performance in auditory and visual reaction time in PCOS becomes contended as PCOS is a condition of high testosterone level. However, it has been shown that large doses of exogenous testosterone impair visuospatial performance while improving verbal performance and also very high or very low levels of testosterone impair performance with moderate levels being optimal for performance(19). Since our study showed decreased performance in reaction time, we can attribute it to hyperandrogenism in PCOS.

Our study also showed a positive correlation of reaction time with body mass index in PCOS suggesting even the role of obesity in impaired cognitive performance. PCOS is a state of insulin resistance and obesity may be a result of this. Obesity may cause inflammatory changes and insulin resistance which eventually may cause metabolic disturbance leading to diabetes-induced cognitive impairment. It is well documented that Diabetes Mellitus declines cognitive performance (20,21). Hence the results of our study showing cognitive decline in PCOS individuals could be an interplay between Hormonal derangement and obesity. The correlation of cognition with other obesity parameters like waist-hip ratio, and body fat could be evaluated in further studies.

CONCLUSION

The present study emphasizes the fact that PCOS individuals might suffer from cognitive deficits by assessing cognition with simple reaction time and comparing it with normal. The auditory reaction time was increased in PCOS individuals and there was a positive correlation of reaction with body mass index indicating that obesity could lead to insulin resistance and cause cognitive decline. Thus, suggesting a probable interplay between hormonal dysregulation and insulin resistance for the cognitive decline in PCOS individuals.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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