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Research Article

Assessing Extended High Frequency Audiometry and Auditory Working Memory in PCOS and Healthy Women

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Abstract

Objective: PCOS, also referred to as hyperandrogenic anovulation, is a heterogeneous endocrine condition that affects 5–10% of women who are of reproductive age [1]. Polycystic ovaries, hyperandrogenism, and oligo-amenorrhea are the hallmarks of the condition. Adolescence is the most common time for this chronic illness to start. We assessed PCOS patients' extended high frequency hearing loss and poor auditory working memory.

Material Methods: 15 women diagnosed as PCOS and 15 healthy controls were in this study. Hearing threshold and auditory working memory of PCOS and healthy group were comparable. Each subjects was tested extended high frequency audiometry (8000-12000 Hz), forward digit task and backward digit task.

Results: In hearing thresholds, a statistically significant difference was noted between the PCOS group and the control group in the 8000–12000 Hz range. Poor score (PCOS) in forward and backward digit task. Conclusion: Hearing loss is common in PCOS patients, particularly at extended high frequencies. Further research is needed to further explain the mechanism of hearing impairment and auditory working memory in conjunction with PCOS.

Keywords: PCOS; Hearing

Introduction

PCOS, also referred to as hyperandrogenic anovulation, is a heterogeneous endocrine condition that affects 5–10% of women who are of reproductive age [1]. Polycystic ovaries, hyperandrogenism, and oligo-amenorrhea are the hallmarks of the condition. Adolescence is the most common time for this chronic illness to start.

PCOS is the predominant endocrinopathy affecting women in their reproductive years. Worldwide, 4% to 20% of women who are of reproductive age are affected (Ritu, 2020).

Working memory processes involve the temporal storage and manipulation of information and require multiple cognitive processes such as language, perceptual speed, verbal and visual memory, and planning. Studies have also shown that E2 levels, which depend on menstrual cycle patterns, are associated with working memory.

According to research, PCOS can negatively affect inner ear blood flow because of alterations in the body's hormonal and metabolic processes. Vascular diseases such as blockages in the arteries and arterioles may result from this. People with PCOS may experience hearing loss as a result of this, but if blood flow returns to normal, hearing in the lower and medium frequencies may be recovered.

Patients with PCOS may experience high frequency hearing loss as a result of vascular pathologies and disorders that affect high frequencies. Insulin resistance, hyperandrogenism, high serum CRP as an inflammatory marker, and dyslipidemia may be the cause of these vascular diseases [1,2]. According to Kucur., *et al*. [1], extended high frequency is especially at risk for the effects of vascular conditions.

Kucur., *et al*. [1] studied hearing sensitivity in normal females and female with PCOS. Study showed that there was a noticeable difference in hearing ability especially at high frequency in PCOS.

There are few studies done on PCOS and their results revealed that the signs and symptoms mentioned in PCOS can affect hearing and working memory. Taking this into consideration, and also there is very less existing literature, and it also helps the PCOS sufferers get aware of their hearing affect and could get bothersome and take precautions. Thus, there is a need for the current study to be done.

Polycystic ovarian syndrome (PCOS) is the most common endocrine disorder affecting 5–10% of women in reproductive age. C Kucur., *et al*. [1] found that PCOS patients have hearing impairment especially in extended high frequencies 8000– 14000 Hz. The prolonged high frequency increases the susceptibility to vascular disorders, resulting in high frequency hearing loss among patients with Polycystic Ovary Syndrome (PCOS).

Aim of the Study

The current study aimed to assess the hearing and auditory working memory in females with polycystic ovarian syndrome using extended high frequency audiometry and digit test.

Objectives

- To Find the Hearing Thresholds among PCOS And Normal Females.
- To Find the Working Memory among PCOS and Normal Females.

Methodology

The study aimed to evaluate Hearing threshold and Auditory working memory in females and females with PCOS. In the below sections the detailed description of the participants, selection criteria, analysis and scoring are discussed.

Participants

The study involved a total of 30 subjects which included 15 females with PCOS and 15 females without PCOS. Age range (18-30 yrs.).

Inclusion criteria

Group-I

- Hyperandrogenism
- Polycystic ovaries (Ultrasound examination)
- Oligo and/or anovulation
- No other neurologic or otologic complaints
- Should be at least 10th-grade qualified.

Group-II

- No evidence of hyperandrogenism
- Healthy women with normal menstrual cycle
- Normal ovarian morphology on ultrasonography
- No other neurologic or otologic complaints

Exclusion criteria

Females had diabetes, Otologic, middle ear pathologies like tympanic membrane perforations, tinnitus, otosclerosis, any other middle ear disease, acoustic trauma, history of otologic surgery, family history of hearing loss, history of alcohol consumption and smoking, thyroid dysfunction, hypertension, exposure to loud noise, ototoxic drugs, autoimmune disorder and pregnant women.

Result and Discussion

The present study aimed to evaluate the Hearing threshold and Auditory working memory in normal females and females with PCOS.

The result is discussed under the following sections:

- To Find the Hearing Thresholds Among PCOS And Normal Females.
- To Find the Working Memory Among PCOS and Normal Females.

To Find the Hearing Thresholds Among PCOS And Normal Females.

The mean, SD and statistical result are given below in the table 1 and 2.

Table 1: The mean, SD and statistical result of hearing thresholds in normal group.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
AGE	15	19.00	29.00	23.5333	3.39888
8KHz	15	10.00	15.00	12.6667	2.58199
10KHz	15	10.00	15.00	13.0000	2.53546
12KHz	15	10.00	20.00	13.6667	2.96808
Valid N (listwise)	15				

Table 1 represents the mean, standard deviation, minimum hearing threshold, maximum hearing thresholds and age of normal females. The mean at 8 KHz is 12.66 (SD = 2.5), 10 KHz is 13 (SD = 2.5) and at 12 KHz is 13.6 (SD = 2.9).Minimum age is 19 years and maximum age is 29 years. Total number of participants are 15.

Table 2 represents the mean, standard deviation, minimum hearing threshold, maximum hearing thresholds and age of female with PCOS. The mean at 8 KHz is 22.3 (SD = 7.2), 10 KHz is 27.6 (SD = 7.2) and at 12 KHz is 37 (SD = 4.9). Minimum age is 19 years and maximum age is 29 years. Total number of participants are 15.

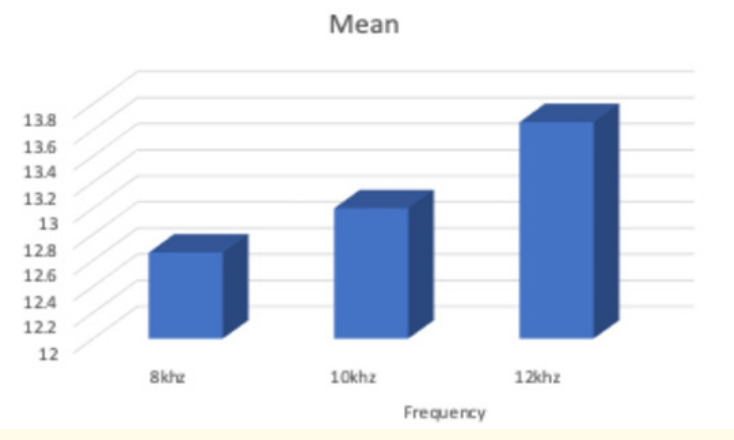

Figure 1: Mean of Hearing thresholds (8 KHz, 9 KHz, 10 KHz), in normal females.

Table 2: The mean, SD and statistical result of hearing thresholds in PCOS group.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
AGE	15	19.00	29.00	23.8667	3.48193
8KHz	15	15.00	40.00	22.3333	7.28665
10KHz	15	20.00	40.00	27.6667	7.28665
12KHz	15	30.00	45.00	37.0000	4.92805
Valid N (listwise)	15				

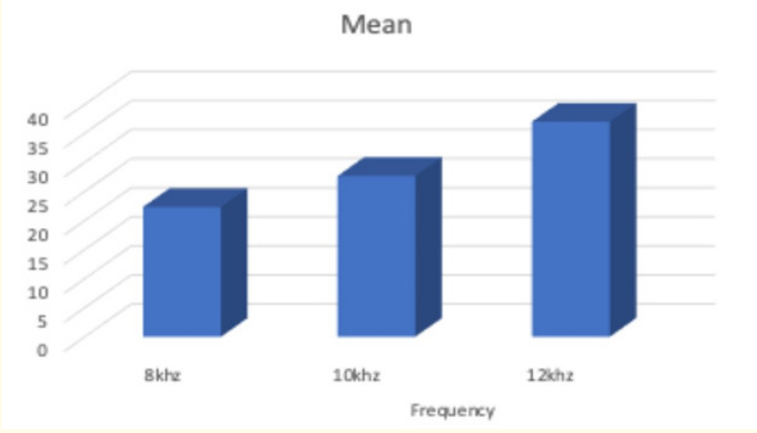

Figure 2: Mean of Hearing thresholds (8KHz, 9KHz, 10KHz), in PCOS.

To Find the Working Memory Among PCOS and Normal Females.

Table 3: The mean, SD of working memory in normal group.

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Forward digit Normal	**15**	4.00	5.00	4.6000	.50709
Backward digit Normal	**15**	4.00	5.00	4.5333	.51640

Table 3 represents the mean and standard deviation values of the forward and backward digit test in normal group. The mean score of forward digits is 4.6 (SD = 0.5) and backward digit is 4.5 (SD = 0.5).

Table 4 represents the mean and standard deviation values of the forward and backward digit test in PCOS group. The mean score of forward digit test is 3.6 (SD = 0.5) and backward digit test is 3.0 (SD = 0.3).

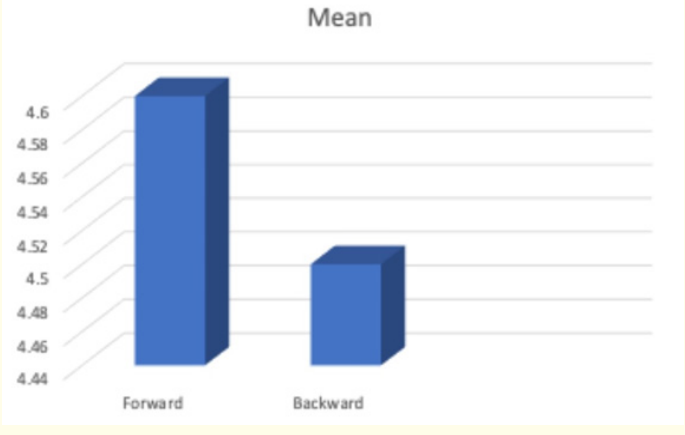

Figure 3: Mean of forward and backward digit in normal females.

Table 4: Mean, SD of digit test in PCOS group.

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Forward digit PCOS	**15**	3.00	4.00	3.6000	.50709
Forward Digit PCOS	**15**	2.00	4.00	3.0000	. 37796

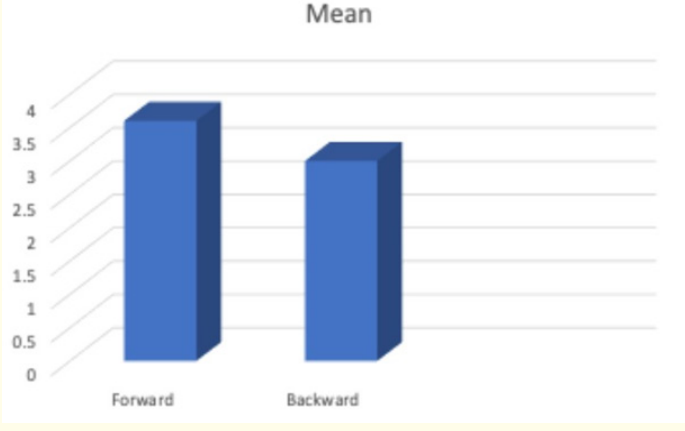

Figure 4: Mean of forward and backward digit test in PCOS group.

Summary and Conclusion

A female with polycystic ovarian syndrome (PCOS) will have tiny ovaries, irregular menstrual cycles, and elevated amounts of male hormones. This chronic illness typically first manifests in adolescence. It is possible for PCOS to impair hearing. This is due to a few characteristics of PCOS, including blood vessel damage, cardiac issues, and hormonal and biochemical alterations, such as elevated amounts of male hormones, which can impact blood flow. In the early stages of PCOS, disorders that damage the endothelium, or blood vessel lining, also impair hearing high frequency noises. As a result, evaluation of the hearing capacities of female PCOS patients is required [3-16].

The present study aimed to evaluate the Hearing Threshold and Auditory working memory in Females with PCOS. The following summary can be drawn from the result of the present study

- The PCOS group hearing threshold is poorer than normal group. The mean rank test is indicating that the PCOS group threshold is more as compared to the normal group.
- PTA score is statistically significantly higher in PCOS than control group. ($p< 0.0001$ for 8khz, 10khz & 12khz).
- The PCOS group performed poor in digit forward and digit backward task as compared to the normal group.

Implications of the Study

- This research shows that the androgen hormone is very important for our ability to hear.
- This study shows that it is very important to find hearing loss early in people with PCOS. They can do this by doing extra tests to check for problems with higher frequency sounds.

Future Directions

- The findings of the study can be viewed as initial results. These results can be used to plan a future study that involves a larger group of people.
- We need to study how hearing loss happens in people with PCOS to find out if the loss of EHFA (extended high frequency audiometry) gets worse over time.

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