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Association between Hypothyroidism and PCOS in Primary Sub-Fertile Women

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Abstract

Introduction: Polycystic Ovary Syndrome (PCOS) is a common endocrine disorder affecting women's reproductive health and fertility. This study aimed to investigate the demographic, clinical, and biochemical characteristics of primary sub-fertile women with and without PCOS. ***Methods:*** This cross-sectional comparative study was conducted at the Fertility Care Centre, Department of Obstetrics & Gynaecology, Dhaka Medical College Hospital, Dhaka, from June 2017 to November 2017. The study included 146 primary sub-fertile women, divided into two groups: Group A (n=73) with PCOS and Group B (n=73) without PCOS. Data on age distribution, educational background, occupation, BMI, hirsutism prevalence, and biochemical findings (TSH, FT3, FT4 levels) were collected and analyzed. ***Result:*** The study found significant differences in BMI and hirsutism prevalence between the two groups. Group A (with PCOS) had a higher mean BMI (26.8±7.2) and a greater prevalence of hirsutism (26%) compared to Group B (without PCOS), which had a mean BMI of 24.4±4.3 and a hirsutism prevalence of 11%. Additionally, Group A exhibited significantly higher mean TSH levels (5.0±2.4 µU/ml) than Group B (2.9±1.3 µU/ml). However, no significant differences were observed in FT3 and FT4 levels between the groups. ***Conclusion:*** The study highlights the association of PCOS with higher BMI, increased prevalence of hirsutism, and altered thyroid function, particularly elevated TSH levels, in primary sub-fertile women. These findings underscore the importance of considering both metabolic and endocrine factors in the management of sub-fertility in women with PCOS. The study contributes to a better understanding of the complex interplay between PCOS, thyroid function, and sub-fertility, suggesting the need for comprehensive evaluation and targeted treatment strategies in this population.

Keywords: Fertility, Infertility, Sub-fertility, PCOS, Hirsutism, Thyroid.

INTRODUCTION

Polycystic Ovary Syndrome (PCOS) and hypothyroidism represent significant concerns in women's health, particularly regarding reproductive capabilities and fertility. PCOS, a prevalent endocrine disorder, affects approximately 4-20% of women in their reproductive years [1,2]. Hypothyroidism, especially Hashimoto's thyroiditis, stands as the most common cause of thyroid-related issues, characterized by an autoimmune response against the thyroid gland [3]. The relationship between these two conditions, especially in the context of sub-fertility, necessitates a deeper understanding due to its complexity and impact on women's health. PCOS is clinically defined by a combination of symptoms, with the Rotterdam criteria being the most widely recognized for diagnosis. This includes the presence of two out of three features: oligo- or anovulation, clinical or biochemical signs of hyperandrogenism, and polycystic ovaries visible via ultrasound [1,2]. The pathophysiology of PCOS is intricate, involving insulin resistance, hyperandrogenism, and chronic inflammation. These contribute to a range of symptoms, including menstrual

irregularities, hirsutism, acne, and obesity [1,4]. The influence of PCOS on fertility is significant, primarily due to its link with anovulatory infertility [5]. Hypothyroidism, particularly in the form of Hashimoto's thyroiditis, involves lymphocytic infiltration into the thyroid gland, impairing thyroid hormone production [3]. This condition affects various metabolic processes, leading to symptoms such as fatigue, weight gain, cold intolerance, and menstrual irregularities [3,6]. The repercussions of hypothyroidism on fertility are notable, often associated with ovulatory disorders and other reproductive dysfunctions [7]. The intersection of PCOS and hypothyroidism in fertility contexts is an emerging area of research. Recent studies have explored oxidative stress markers in PCOS and their exacerbation by hypothyroidism, indicating a potential compounded effect on fertility [8]. However, the literature reveals gaps in fully understanding their interaction, particularly in primary sub-fertile women. This highlights the necessity for more targeted research to clarify the mechanisms linking these conditions [8,9]. Theoretical models that attempt to explain the association between PCOS and hypothyroidism often focus on shared pathophysiological pathways, including hormonal imbalances and autoimmune responses. These models are essential for developing specific therapeutic strategies and enhancing clinical outcomes. The significance of this study lies in its potential to address these knowledge gaps and offer new insights into the complex relationship between PCOS and hypothyroidism in primary sub-fertile women. A deeper understanding of this association is crucial for devising more effective diagnostic and treatment methods, ultimately aiming to improve fertility outcomes and enhance the quality of life for affected individuals. In summary, this study aims to investigate the association between hypothyroidism and PCOS in primary sub-fertile women, focusing on their combined impact on fertility. This exploration is expected to significantly influence clinical practices, patient management, and future research directions in the field of women's reproductive health.

METHODS

This cross-sectional comparative study was conducted at the Fertility Care Centre, Department of Obstetrics & Gynaecology, Dhaka Medical College Hospital, Dhaka, from June 2017 to November 2017. The study aimed to compare primary sub-fertile women with and without Polycystic Ovary Syndrome (PCOS) to understand the association between PCOS and hypothyroidism in this population. The study population comprised primary sub-fertile women aged 18 years and above, attending the Fertility Care Centre of Dhaka Medical College Hospital during the study period. A total of 146 primary sub-fertile women were selected for the study, divided into two groups: Group A (73 women with PCOS) and Group B (73 women without PCOS). Inclusion criteria for Group A (PCOS group) were primary sub-fertile women aged 18 years and above, diagnosed with PCOS based on the Rotterdam Criteria, and who provided informed consent to participate in the study. For Group B (non-PCOS group), the inclusion criteria were primary sub-fertile women aged 18 years and above, without a diagnosis of PCOS, and who also provided informed consent. The study excluded severely ill patients, primary sub-fertile women unwilling to participate, patients with diabetes mellitus (DM), hypertension, or other serious co-morbidities. This exclusion was to ensure the homogeneity of the study groups and the reliability of the results, focusing solely on the impact of PCOS on sub-fertility without the confounding effects of other significant health conditions. Data collection involved a detailed review of medical histories, clinical examinations, and laboratory investigations to confirm the diagnosis of PCOS as per the Rotterdam Criteria and to assess the presence of hypothyroidism. The Rotterdam Criteria for PCOS diagnosis include at least two of the following three features: oligo- or anovulation, clinical or biochemical signs of hyperandrogenism, and polycystic ovaries visible on ultrasound. Hypothyroidism was diagnosed based on thyroid function tests, including serum levels of Thyroid Stimulating Hormone (TSH) and Free Thyroxine (FT4). Statistical analysis was performed using appropriate statistical software. The primary outcome measures included the prevalence of hypothyroidism in primary sub-fertile women with and without PCOS. Comparative analyses between the two groups were conducted to assess any significant differences in the prevalence and characteristics of hypothyroidism. The study also aimed to identify any potential correlations between PCOS and hypothyroidism in the context of primary sub-fertility. Ethical considerations were strictly adhered to throughout the study. All participants provided informed consent, and the study protocol was approved by the relevant ethical review board. Confidentiality and privacy of the participants were maintained, and the study was conducted in accordance with the Declaration of Helsinki.

RESULTS

Table 1: Distribution of baseline characteristics among the participants (N=146)

Variables	Group A (n=73)		Group B (n=73)	
	n	%	n	%
Age				
≤30	29	39.7	34	46.6
31-35	31	42.5	20	27.4
>35	13	17.8	19	26
Mean ±SD	32.7±7.9			33.1±9.2
Range (min-max)	20-47		20-50	
Education				
Primary	32	43.8	29	39.7
Secondary	27	37	25	34.2
Graduate	8	11	9	12.3
Illiterate	6	8.2	10	13.7
Occupation				
House wife	69	94.5	65	89
Service	4	5.5	8	11

In the study comprising 146 primary sub-fertile women, the distribution of baseline characteristics between the two groups, Group A (with PCOS, n=73) and Group B (without PCOS, n=73), revealed notable differences and similarities. In terms of age, Group A had a younger demographic with 39.7% (n=29) of its participants aged 30 years or below, compared to 46.6% (n=34) in Group B. The majority of participants in Group A fell within the 31-35 age range (42.5%, n=31), while in Group B, this age group constituted 27.4% (n=20). Participants above 35 years comprised 17.8% (n=13) in Group A and 26% (n=19) in Group B. The mean age was slightly higher in Group B (33.1±9.2 years) compared to Group A (32.7±7.9 years). Educational levels were similar across both groups. In Group A, 43.8% (n=32) had primary education, 37% (n=27) secondary education, 11% (n=8) were graduates, and 8.2% (n=6) were illiterate. Group B showed a comparable pattern with 39.7% (n=29) having primary education, 34.2% (n=25) secondary education, 12.3% (n=9) being graduates, and a slightly higher illiteracy rate at 13.7% (n=10). Occupationally, the majority of participants in both groups were housewives, with 94.5% (n=69) in Group A and 89% (n=65) in Group B. A small proportion of participants in both groups were engaged in services, accounting for 5.5% (n=4) in Group A and 11% (n=8) in Group B.

Table 2: Distribution of BMI characteristics among the participants (N=146)

Variables	Group A (n=73)		Group B (n=73)		P value
	n	%	n	%	
<18.5 (Underweight)	2	2.74	0	0	-
Normal (18.5-24.9)	41	65.75	47	63.01	
Over weight (25.0-29.9)	23	31.51	27	36.99	
Mean	26.8±7.2		24.4±4.3		**0.001s**
Range (min-max)	18.0-29.1		18.6-29.0		

In Group A, only a small fraction of participants, 2.74% (n=2), were categorized as underweight (BMI <18.5), while none in Group B fell into this category. The majority of participants in both groups had a BMI within the normal range (18.5-24.9), with 65.75% (n=41) in Group A and 63.01% (n=47) in Group B. However, a notable proportion of participants were classified as overweight (BMI 25.0-29.9), with 31.51% (n=23) in Group A and 36.99% (n=27) in Group B. The mean BMI was higher in Group A at 26.8±7.2 compared to Group B, which had a mean BMI of 24.4±4.3. The BMI range for Group A was 18.0-29.1, and for Group B, it was 18.6-29.0. There was a significant difference in mean BMI distributions between the two groups.

Table 3: Distribution of Hirsutism among the participants (N=146)

Hirsutism	Group A (n=73)		Group B (n=73)		P value
	n	%	n	%	
Present	19	26	8	11	**0.019s**
Absent	54	74	65	89	

In Group A, hirsutism was present in 26% (n=19) of the participants, while in Group B, a notably lower percentage of 11% (n=8) exhibited hirsutism. The majority of participants in both groups did not have hirsutism, with 74% (n=54) in Group A and a higher percentage of 89% (n=65) in Group B. The distribution of hirsutism among the groups showed a statistically significant difference, as indicated by a P value of 0.019.

Table 4: Distribution of the study patients according to biochemical findings (N=146)

Biochemical Findings	Group A (n=73)	Group B (n=73)	P value
	Mean±SD	Mean±SD	
TSH (µU/ml)	5.0±2.4	2.9±1.3	**0.001**
Range (min-max)	0.7-9.0	0.6-5.1	
FT3 (nmol/L)	1.59±0.31	1.52±0.25	0.134
Range (min-max)	1.1-2.1	1.1-2.0	
FT4 (nmol/L)	9.1±2.2	8.8±2.0	0.391
Range (min-max)	5.6-12.4	5.2-12.0	

The mean TSH level in Group A was notably higher at 5.0±2.4 µU/ml compared to Group B, which had a mean TSH level of 2.9±1.3 µU/ml. This difference was statistically significant with a P value of 0.001. The range of TSH levels in Group A was 0.7-9.0 µU/ml, while in Group B, it was 0.6-5.1 µU/ml. This finding suggests a higher prevalence of elevated TSH levels, indicative of hypothyroidism, in the PCOS group (Group A). In contrast, the mean FT3 levels were similar between the two groups, with Group A having a mean of 1.59±0.31 nmol/L and Group B having a mean of 1.52±0.25 nmol/L, resulting in a P value of 0.134. The range of FT3 levels was 1.1-2.1 nmol/L in Group A and 1.1-2.0 nmol/L in Group B. Similarly, the mean FT4 levels were comparable between the groups, with Group A showing a mean of 9.1±2.2 nmol/L and Group B having a mean of 8.8±2.0 nmol/L. The P value for this comparison was 0.391. The range for FT4 levels was 5.6-12.4 nmol/L in Group A and 5.2-12.0 nmol/L in Group B. The study's analysis of biochemical findings among both groups revealed significant differences in thyroid-stimulating hormone (TSH) levels, while findings for Free Triiodothyronine (FT3) and Free Thyroxine (FT4) levels showed no statistically significant differences.

DISCUSSION

The comprehensive analysis of our study sheds light on the intricate relationship between PCOS and various demographic, clinical, and biochemical factors in primary sub-fertile women. The age distribution in our study reveals a younger demographic in the non-PCOS group (Group B), with 46.6% of participants aged ≤30 years, compared to 39.7% in the PCOS group (Group A). This suggests that fertility concerns or diagnosis may occur earlier in women without PCOS. In contrast, the higher percentage of women aged 31-35 years in the PCOS group (42.5% vs. 27.4% in Group B) might indicate a delayed presentation or diagnosis in women with PCOS, aligning with global trends of delayed childbearing [10,11]. The educational background shows a similar distribution in both groups, with a slightly higher percentage of graduates in Group B (12.3% vs. 11% in Group A). This similarity across educational levels suggests that PCOS and sub-fertility issues are not confined to any particular educational stratum, emphasizing the need for widespread fertility education and awareness [12]. Occupationally, a majority of participants in both groups were housewives, with a slightly higher percentage in the PCOS group (94.5% vs. 89% in Group B). This finding might reflect the societal and cultural contexts of the study population and does not directly correlate with PCOS or fertility issues [13]. A critical finding of our study is the BMI characteristics, where a significant difference in mean BMI was observed between the groups. The PCOS group had a higher mean BMI of 26.8±7.2, with 31.51% being overweight, compared to a mean BMI of 24.4±4.3 in Group B, where 36.99% were overweight. This significant difference (P value: 0.001) aligns with existing literature that associates PCOS with a higher prevalence of overweight and obesity, impacting fertility and exacerbating PCOS symptoms [14,15]. The prevalence of hirsutism, a hallmark of hyperandrogenism in PCOS, was notably higher in the PCOS group, with 26% of women exhibiting this symptom compared to only 11% in the non-PCOS group. This significant difference (P value: 0.019) not only supports the diagnostic criteria of PCOS but also emphasizes the clinical and psychological burden of hirsutism in affected women [16]. Biochemically, the study highlights a significant difference in TSH levels between the groups, with the PCOS group showing a higher mean TSH level of 5.0±2.4 µU/ml compared to 2.9±1.3 µU/ml in the non-PCOS group (P value: 0.001). This finding suggests a potential link between thyroid function and PCOS, as also observed other studies [13,17,18]. The elevated TSH levels in the PCOS group could indicate a higher prevalence of thyroid dysfunction, which has been associated with menstrual irregularities and fertility issues. However, the FT3 and FT4 levels did not show significant differences between the groups, indicating that while thyroid function may be altered in PCOS, it does not uniformly affect all thyroid hormones. In conclusion, our study provides a nuanced understanding of the demographic, clinical, and biochemical profiles of primary sub-fertile women with

and without PCOS. The findings underscore the multifaceted nature of PCOS, highlighting the importance of considering factors such as age, BMI, hirsutism, and thyroid function in the management of PCOS-related sub-fertility. These insights are crucial for developing targeted interventions and comprehensive management strategies for women with PCOS seeking fertility treatment.

Limitations of The Study: The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

In conclusion, our study provides valuable insights into the demographic, clinical, and biochemical characteristics of primary sub-fertile women with and without Polycystic Ovary Syndrome (PCOS). The findings reveal notable differences in age distribution, Body Mass Index (BMI), and the prevalence of hirsutism between the two groups, underscoring the multifaceted nature of PCOS. Particularly, the higher mean BMI and prevalence of hirsutism in the PCOS group highlight the clinical burden of these symptoms. Additionally, the significant difference in Thyroid Stimulating Hormone (TSH) levels between the groups suggests a potential link between thyroid function and PCOS, which could have implications for the management of sub-fertility in women with PCOS. These results emphasize the need for a comprehensive approach in the evaluation and treatment of sub-fertility in women, particularly those affected by PCOS, considering both reproductive and metabolic aspects. This study contributes to the growing body of evidence on the complex interplay between PCOS, thyroid function, and sub-fertility, paving the way for future research and targeted therapeutic strategies.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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