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The Effect of the Pituitary Gland on the Hormone Prolactin and Its Relationship to Menstrual Irregularity According to Obesity

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ABSTRACT

Background; Thyroid dysfunction has a substantial effect on the functioning of menstruation and the fertility of women. Hypothyroidism often coincides with increased prolactin levels, which worsens the disease.

Research objectives; A cross-sectional study was undertaken in the infertility outpatient department of the University Teaching Hospital in Iraq, specifically examining the medical records of women who had undergone infertility evaluations. The study examined pertinent historical information, clinical observations, and findings from several investigations, such as thyroid function testing and blood prolactin level assessment. Descriptive and inferential statistical techniques were used to ascertain the prevalence and associations between predictors and outcome variables.

Aim of the study; The objective of this study was to evaluate the prevalence of thyroid diseases among infertile women who are seeking treatment at the outpatient department of University Teaching Hospital in Iraq. Furthermore, it sought to examine the correlation between hypothyroidism and hyperprolactinemia with obesity, a subject that has not been thoroughly studied in our population.

Novelty; Out of the 200 participants, the largest group, comprising 90 individuals (42%), were categorized as obese. The mean body mass index (BMI) of the subjects was 24 ± 4 kg/m2. The prevalence of thyroid disorder was 18%, with hypothyroidism representing 13% and hyperthyroidism representing 4%. No significant correlation was observed between BMI and hyperprolactinemia in people diagnosed with thyroid illness. Furthermore, no noteworthy correlation was found between BMI and hyperprolactinemia as an isolated condition. Nevertheless, a notable direct association was observed between thyroid stimulating hormone (TSH) and prolactin levels. Thyroid abnormalities and hyperprolactinemia are common in women who have difficulty getting pregnant. Therefore, it is advisable to regularly screen for these problems during the initial evaluation of infertility. While there was no notable association between BMI and thyroid illness and hyperprolactinemia, it is important to acknowledge the potential influence of weight gain on infertility, especially given that the majority of participants in the research were obese.

Keywords- Hyperprolactinemia, infertility, obesity, thyroid problems.

I. INTRODUCTION

Infertility is the state of being unable to conceive a pregnancy even after consistently having unprotected sexual intercourse for a duration of 12 months.[1] The prevalence of infertility is believed to range from 8% to 12%. Endometriosis, tubal obstruction, and ovulation issues are two prevalent factors that can lead to female infertility. Thyroid dysfunction significantly affects both the functioning of menstruation and female fertility.[2-6] This disorder can cause an absence of ovulation, a malfunction in the luteal phase, increased levels of prolactin in the blood, and irregularities in sex hormones, ultimately resulting in infertility. The range is from 4 to 10. Thus, maintaining a regular thyroid function is essential for achieving and maintaining optimal fertility, ensuring a successful and healthy pregnancy. Increased levels of thyrotropin releasing hormone (TRH) in hypothyroidism are frequently linked to elevated levels of PRL.[7-9] Hyperprolactinemia negatively impacts fertility by disrupting the rhythmic release of gonadotropin-releasing hormone (GnRH), which in turn hinders

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ovulation. The association between obesity and hypothyroidism is generally acknowledged.[10] Nevertheless, a recent study has additionally shown that adipose tissue can secrete prolactin, indicating a correlation between obesity and hyperprolactinemia.[11] This study aims to examine the association between hyperprolactinemia and obesity in individuals with thyroid disorders, as well as the link between obesity and hyperprolactinemia. The relationships between these variables have not been thoroughly investigated in our sample. In addition, the study aims to assess the frequency and categories of thyroid disorders in women who are unable to conceive.

II. METHODOLOGY

This study is a cross-sectional study conducted at the infertility department of University Teaching Hospital between January 2023 and November 2023. The study was based in a hospital setting. The study included women who satisfied the criteria for primary and secondary infertility and were receiving care at the infertility outpatient department. Infertility is categorized as primary when couples are unable to achieve conception for the first time, and secondary when they are unable to achieve conception after a previous pregnancy. The study excluded women with a preexisting diagnosis of thyroid disease, who had undergone thyroid surgery, were presently using thyroid medication, had a history of hyperprolactinemia, had undergone pituitary gland surgery, or were currently using medication for hyperprolactinemia. Patients lacking adequate clinical information or incomplete reports of thyroid function test or prolactin were removed from the study.

A sample size of 200 was selected based on a 95% confidence level, a 5% margin of error, and a 10% nonresponse rate. This computation considered the prior study conducted at the same institute, which determined a 7% prevalence of thyroid issues among infertile women. Precise clinical information, such as the patient's age, menstrual cycles, type and duration of subfertility, history of thyroid disease, hyperprolactinemia, and any drug usage, were documented. Anthropometric measurements were used to record weight, height, and BMI. Quantitative analysis was performed on morning samples to evaluate the levels of serum free T3 (FT3), free T4 (FT4), TSH, and PRL. The serum levels of FT3, FT4, TSH, and PRL were also documented. The laboratory has established the reference ranges for the following parameters: FT3: 4.26-8.1 pmol/L, FT4: 10.2-28.2 pmol/L, TSH: 0.46-4.68 µIU/ml, and Prolactin in non-pregnant females: 2-29 ng/mL. The women were classified according to their thyroid levels.

Subclinical hyperthyroidism is characterized by a low level of TSH (<0.46mIU/ml) and normal levels of FT4/FT3.

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Overt hyperthyroidism is characterized by a low level of TSH (<0.46mIU/ml) and a high level of FT4/FT3.

A diagnosis of hyperprolactinemia is established when the level of prolactin in the blood exceeds the normal range of >30 ng/mL.

The measurement of obesity, as defined by BMI, was computed by dividing weight in kilograms by the square of height in meters.

- The normal range for BMI is 18 to 22.9 kg/m^2.
- Overweight - BMI between 23 and 25 kg/m^2
- Obese - BMI greater than 25 kg/m^2

Statistical Analysis

The data was entered into a Microsoft Excel spreadsheet and subsequently imported into SPSS version 20.0 for statistical analysis. The descriptive findings were presented utilizing statistical variables such as mean, standard deviation, frequency, and percentage for data that adhered to a normal distribution. The data that deviated from a normal distribution were presented using the median and interquartile range. The Fisher exact test was employed to assess categorical data, whilst the independent sample t-test was performed for parametric testing. The statistical significance was assessed by applying a p-value threshold of less than 0.05 and a 95% confidence interval (CI).

Inclusion criteria

The inclusion criteria for this study as follows: all patients regularly visit the hospital.

Patients freely agree to participate in the study and demonstrate the ability to make an informed decision.

Exclusion criteria

All patients miss some visits the hospital.

Patients don’t agree to participate in the study.

III. RESULTS

Among the 200 participants, the study group was primarily composed of individuals with primary infertility (154; 72%), followed by those with secondary infertility (28%). Around two-thirds (66%) of the participants fell between the age range of 30 to 40 years. The majority of the individuals had a BMI indicating obesity (90; 42%), followed by those with a normal BMI (37%) and those who were overweight (18%) (Table 1).

Table 1. Characteristics of the study participants (n=200)

Age (years)	37.7±4.0
Duration of infertility	2.0±2.0

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Type of infertilityPrimary	
Primary	154 (72%)
Secondary	59 (28%)
Menstruation irregularity	
Present	78 (36%)
Absent	135 (64%)
BMI (kg/m^2)	24.1±2.5
BMI category	
Underweight	9 (3%)
Normal	75 (37%)
Overweight	39 (18%)
Obese	90 (42%)
Hormone levels	
Prolactin (ng/mL)	5±1.0
FT_3 (pmol/L)	13±2.0
FT_4 (pmol/L)	3±2.0
TSH (µIU/ml)	19±8.0

The study found that the prevalence of thyroid problem was 18% (40 out of 200 participants), with 13% (30 out of 200) having hypothyroidism and 4% (11 out of 200) having hyperthyroidism. The prevalence of subclinical hypothyroidism was 10% (21/200), making it the most often observed illness among the cases (Table 2). The incidence of hyperprolactinemia was 17%, with 34 out of 213 individuals affected.

Table 2. Thyroid and prolactin hormone problems distribution (n=200)

Thyroid hormone	
Euthyroid	174 (81.6%)
Subclinical hypothyroidism	21 (10%)
Overt hypothyroidism	7 (3%)
Subclinical hyperthyroidism	5 (2%)
Overt hyperthyroidism	5 (2%)
Prolactin hormone	
Hyperprolactinemia	34 (17%)

The average age of the participants was 37.7±4.0years, ranging from 30 to 40 years (Table 1). When examining the average distribution based on the type of infertility, it was found that the average age in cases of secondary infertility (28) was significantly greater than in cases of primary infertility (72). The average BMI was 24.1±2.5 kg/m^2, indicating obesity. The present study found that the highest occurrence of hypothyroidism was observed in obese women, accounting for 37% of cases. Conversely, hyperthyroidism was more commonly found in women with a normal BMI, representing 60% of cases. When examining the relationship between BMI and hyperprolactinemia, no statistically significant link was found between the two variables (Table 4). The thyroid-stimulating hormone (TSH) exhibits a strong positive association with prolactin, as indicated by p-value of less than 0.01.

Table 3. The correlation between BMI and hyperprolactinemia and thyroid disease.

Variables	Euthyroid n=175 (87.5%)	Hypothyroidism n =30 (15%)	Hyperthyroidism n=11 (5.5%)	p-value*
BMI category				
Underweight	9 (4)	-	-	0.01
Normal	58 (36)	12 (4)	6 (60)	

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Overweight	30 (16)	6 (20)	3 (30)	
Obese	78 (44)	12 (37)	2 (10)	
Prolactin				
Normal	149 (85)	23 (75)	1 (10)	0.01
Hyperprolactinemia	26 (15)	7 (25)	10 (100)	
Menstruation irregularity				
Yes	66 (37)	10 (30)	5 (40)	0.8
No	109 (63)	20 (70)	6 (60)	

IV. DISCUSSION

The participants in the current study had a mean age of 30 years, which aligns with findings from previous studies. The mean age in secondary infertility was much higher compared to primary infertility, which is to be expected given its selection criteria, and was similar to other studies.[11] The study population consisted primarily of individuals with primary infertility (72%) compared to those with secondary infertility (28%), a result consistent with previous research. [3,7]. The study found that both hyperthyroidism and hypothyroidism can cause menstrual disruptions. Specifically, 31% of women with hypothyroidism and 40% of women with hyperthyroidism experienced menstrual irregularity. However, it is important to note that the observed link between thyroid disorders and menstrual irregularity was not statistically significant.

Obesity can cause disruptions in the hypothalamo-pituitary-gonadal axis, leading to monthly irregularities and reduced fertility.[11] Obese and overweight women continue to experience unfavorable outcomes even after undergoing reproductive treatment.[11] Therefore, it is recommended that overweight or obese infertile women undergo weight loss in addition to receiving definitive treatment. This will help alleviate their hormonal imbalance and ultimately enhance the effectiveness of the treatment. The study clearly revealed that a significant proportion of infertile women had a high BMI. Specifically, 60% of the participants were either overweight (18%) or obese (42%). Additionally, the average BMI of the participants was within the overweight category, measuring at 24 ± 4.kg/m^2. The elevated BMI observed in the secondary infertility group may be attributed to weight gain during prior pregnancies or to advanced age, as indicated by a previous study.[11] The incidence of thyroid dysfunction in infertile women ranges from 4% to 25% in various research, while in the present study it was found to be 18%.[2-10]

The prevalence of hypothyroidism, the most prevalent thyroid condition, was 13%, which is comparable to the findings of Sharma et al's study (17%).[14] However, other investigations have demonstrated both greater and lower prevalence rates.[3] Subclinical hypothyroidism exhibited a higher prevalence compared to overt hypothyroidism, aligning with findings from previous research.[6-9] The condition of hypothyroidism is commonly linked to an increase in body weight and obesity, however there are limited research that demonstrate a substantial correlation.[12] The present study found that the highest occurrence of hypothyroidism was observed in obese women, accounting for 37% of cases. Furthermore, 58% of individuals with hypothyroidism were either overweight or obese, which is consistent with a previous study where 52% of cases were classified as overweight or obese.[14] The study found a prevalence of 4% for hyperthyroidism. However, other investigations have indicated lower (1%) and higher (5%) prevalence rates. [10-14]

Hyperprolactinemia has a detrimental effect on fertility by interfering with the normal secretion of GnRH, hence impeding ovulation.[11] The present investigation revealed a 15% frequency of hyperprolactinemia. Prior research has demonstrated elevated prevalence rates of 18%, 24%, 41%, and 46%. Consistent with other research, the present study observed a higher incidence of hyperprolactinemia in instances of primary infertility as opposed to secondary infertility. Sharma et al. found that the average prolactin level was significantly higher in cases of primary infertility compared to secondary infertility.[14] However, unlike this inquiry, the study conducted by Sheth et al. did not yield any statistically significant difference.[11]

Hypothyroidism, accompanied by a raised TSH level, results in high prolactin levels, leading to hyperprolactinemia. Hence, there exists a direct link between prolactin and TSH, with prolactin levels rising in direct proportion to rises in TSH levels.[4] This study also discovered a significant positive correlation between TSH and prolactin. When there is a situation characterized by abnormally high amounts of prolactin in the bloodstream
Upon evaluation of hypothyroidism, it was discovered that 24% (7 out of 22 patients) of women with hypothyroidism had hyperprolactinemia, which aligns with the findings of a separate study.[9] Elevated levels of prolactin in women with hypothyroidism exacerbate the illness and hinder the efficiency of treatment. Therefore, in infertile women with hypothyroidism and hyperprolactinemia, the initial focus of treatment should be on correcting the hypothyroidism. This should be done

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before investigating other potential causes of elevated prolactin levels, as proper thyroid supplementation can restore prolactin levels and normalize ovulatory function.[10]

According to a recent study, it has been found that adipose tissue has the ability to release prolactin. The study discovered a robust positive association between body weight and BMI, as well as blood prolactin levels, in people experiencing secondary infertility. There appears to be a correlation between obesity and hyperprolactinemia.[11] However, the present investigation did not find a substantial correlation between BMI and hyperprolactinemia. It is important to mention that almost 50% of women diagnosed with hyperprolactinemia had a body weight that classified them as either overweight or obese. This aligns with the results of another study, which reported a similar percentage of 43%.[14-16]

V. CONCLUSION

Infertile women frequently experience endocrinological problems such as thyroid condition and hyperprolactinemia. Due to their correlation with monthly abnormalities and infertility, it is essential to do regular screening for thyroid function and PRL levels as part of the initial examination for infertility. There was no notable correlation between BMI and thyroid disease or hyperprolactinemia. The study population included mostly of individuals who were obese, indicating that the impact of weight growth on infertility should not be disregarded.

REFERENCES

[1] Richard OB, Daniel JS, Myelene WY. Berek and Novak's gynecology. 14th ed. Philadelphia: Lippincot Williams and Wilkins; 2007. Chapter 30, Infertility; 1185-275.

[2] Inhorn MC. Global infertility and the globalization of new reproductive technologies: Illustrations from Egypt. Soc Sci Med. 2003 May; 56(9): 1837–51.

[3] Elahi S, Tasneem A , Nazir I, Nagra SA, Hyder SW. Thyroid dysfunction in infertile women J Coll Physicians Surg Pak. 2007 April; 17 (4): 191-94

[4] Orazulike NC, Odum EP. Evaluation of thyroid function in infertile female patients in port harcourt, Nigeria. Trop J Obstet Gynecol. 2018;35(1): 38-43.

[5] Hivre MD, Bhale DV, Mahat RK, Bujurge AA. Study of Serum TSH and Prolactin Levels in Patients of Female Infertility International Journal of Recent Trends in Science And Technology. 2013; 9(1):144-45

[6] Priya DM, Akhtar N, Ahmad J. Prevalence of hypothyroidism in infertile women and evaluation of response of treatment for hypothyroidism on infertility. Indian J Endocrinol Metab. 2015 Jul;19(4):504–6.

[7] Verma I, Sood R, Juneja S, Kaur S. Prevalence of hypothyroidism in infertile women and evaluation of response of treatment for hypothyroidism on infertility. Int J Appl Basic Med Res 2012;2:17-9.

[8] Manandhar R, Manandhar BL, Sharma J. Thyroid Profile in Infertile Women. Nepal Med J. 2018;1(01):19–24.

[9] Pushpagiri N, Gracelyn L, Nagalingam S. Prevalence of subclinical and overt hypothyroidism in infertile women. Int J Reprod Contraception, Obstet Gynecol. 2015;1733–8.

[10] Rijal B, Shrestha R, Jha B. Association of thyroid dysfunction among infertile women visiting infertility center of Om Hospital, Kathmandu, Nepal. Nepal Med Coll J 2011; 13(4): 247-49.

[11] Seth B, Arora S, Singh R. Association of obesity with hormonal imbalance in infertility: A cross-sectional study in North Indian Women. Indian J Clin Biochem. 2013;28(4):342–7.

[12] Ratnaparkhe V, Shah H, Upadhyay K. Link between Infertility, Overweight and Subclinical Hypothyroidism. Int J Health Sci Res. 2020 February; 10(2): 10-17

[13] Misra A, Chowbey P, Makkar BM, Vikram NK, Wasir JS, Chadha D, Joshi SR, Sadikot S, Gupta R, Gulati S, Munjal YP, Concensus Group. Consensus statement for diagnosis of obesity, abdominal obesity and the metabolic syndrome for Asian Indians and recommendatiions for physical activity, medical and surgical management. J Assoc Physicians India. 2009 Feb;57:163–70.

[14] Sharma P, Pal A, Sood R, Jaswal S, Thakur S, Sharma A. Correlation of prolactin and thyroid disorders in infertile women. Int J Reprod Contracept Obstet Gynecol. 2017 Feb;6(2):649-653

[15] Akhter N, Hassan S. Sub-clinical hypothyroidism and hyperprolactinemia in infertile women: Bangladesh perspective after universal salt iodination. The Internet Journal of Endocrinology.2008; Vol. 5 (1)

[16] Gupta MK, Singh A. Study on Thyroid Hormone, FSH, LH and Prolactin Levels in Patients with Primary Infertility: A Hospital Based study. J Med Sci Clin Res. 2016 Jul; 4(7): 11435-11439