

STUDY OF OBESITY IN RELATION TO PCOS (POLYCYSTIC OVARY SYNDROME) AND HYPOTHYROIDISM – AN EPIDEMIOLOGICAL APPROACH

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Abstract

The prevalence of obesity has been on the rise, and it is becoming increasingly evident that obesity is associated with various metabolic disorders and hormonal imbalances. Among these disorders, polycystic ovary syndrome (PCOS) and hypothyroidism have attracted significant attention due to their significant impact on women's reproductive health and overall well-being. This study aimed to investigate the association between obesity and the occurrence of PCOS and hypothyroidism using an epidemiological approach.

A cross-sectional study design was employed, involving a large sample of women from Indian origin, ranging in age from 18 to 55 years. Anthropometric measurements, medical histories, and laboratory investigations were collected to assess body mass index (BMI), PCOS diagnosis, and thyroid function. A structured questionnaire was utilized to collect relevant demographic, lifestyle, and reproductive data in our study.

The results revealed a significant positive correlation between obesity and the prevalence of both PCOS and hypothyroidism. Obese women exhibited a higher incidence of PCOS, characterized by irregular menstrual cycles, hyperandrogenism, and ovarian cysts. Additionally, obesity was associated with a higher likelihood of hypothyroidism, as

indicated by elevated thyroid-stimulating hormone levels and decreased free thyroxine levels.

Subgroup analyses further elucidated the role of various confounding factors, such as age, ethnicity, and lifestyle habits, in the obesity-PCOS-hypothyroidism association. The findings underscored the importance of early detection and intervention strategies to manage obesity-related comorbidities in women with PCOS and hypothyroidism.

This epidemiological investigation contributes insights into the complex interplay between obesity, PCOS, and hypothyroidism. The results emphasize the necessity of comprehensive health screening and management approaches to address these interrelated conditions effectively. Implementing targeted lifestyle modifications and promoting weight loss could potentially alleviate symptoms, improve fertility outcomes, and enhance the overall quality of life for women affected by this intricate triad of disorders. Further prospective studies are warranted to validate these findings and explore potential mechanisms underlying the obesity-PCOS-hypothyroidism nexus. Overall, we conclude that people suffering from PCOS and hypothyroidism are obese, but there is no defined relationship between obesity and hypothyroidism and PCOS.

Keywords

Obesity, hypothyroidism, Polycystic ovary syndrome (PCOS), endocrine disorder, BMR, Anovulation, Hyper- androgenism.

Introduction

Obesity is one of the leading preventable causes of death worldwide and it is the fastest-growing health concern in the world nowadays. One out of every 3 individuals in the world are suffering from obesity. It is common in females compared to males, the cause of which includes lifestyle changes, dietary modification and medical illness. Among various other medical condition, PCOS and Hypothyroidism are a most common causes of obesity in female[1]. WHO overall, reported about 13% of the World's adult population (11% of males and 15% of females) was obese. PCOS and hypothyroid is leading medical condition which causes obesity in female and vice versa

Hypothyroid disorders and polycystic ovary syndrome (PCOS) are two of the most common endocrine disorders in the general population[2]. Anomalies of the thyroid are amongst the most frequent diseases of the endocrine gland. The thyroid gland synthesizes and stores thyroid hormone (TH), which is the body's metabolic hormone. That elevates our basal metabolic rate (BMR) and body heat production. The hormone also helps in sustaining cardiac activity and blood pressure, monitoring cell growth and development of the nervous system. When there is decreased release of TH, the body's metabolic rate decreases, causes nervousness or tiredness, fatigue, weight gain, slow heart rate, constipation, poor memory .irregular menstrual cycle may result in miscarriage and infertility. It may also cause low body temperature, make

dry or itchy skin, thinning of hair or hair loss. It has been estimated that one in eight women develop a thyroid disorder at some time in her life. Women remain at distinctly high risk for developing thyroid disorders following childbirth.

Similarly, Polycystic ovarian syndrome (PCOS) is the most common reproductive disorder, affecting up to 5- 10 per cent of all women[3]. It is mentioned by Irving F. Stein and Michael L. Leventhal as a symptom due to anovulation. Oligomenorrhea, hirsutism and obesity together with enlarged polycystic ovary (PCO) were the diagnosis standards of PCOS[4]. Among the following criteria, 2 out of 3 conditions is required for a diagnosis of PCOS (as defined by the Rotterdam criteria):

- Anovulation or Irregular Periods
- Hyper- androgenism /elevated male hormone levels OR Clinical hyperandrogenism that result in acne, hirsutism means male-pattern distribution of body or facial hair or hair loss (androgenic alopecia)
- The appearance of polycystic ovaries on ultrasound, containing multiple small follicles

Literature Review

Women with PCOS are at risk of infertility and early pregnancy loss. Most women are Obese, with difficulty in losing weight, and suffer from fatigue, depression and anxiety. Another common phenomenon between obesity and PCOS is insulin resistance[5]. Thyroid disorders are more customary in women with PCOS when compared to the normal population[6]. There's a significant overlap of symptoms like obesity and irregular menstrual cycle between PCOS and Thyroid Disease, even though they are two very different conditions. Generally, women with PCOS have raised TSH levels and are also more

prone to have subclinical hypothyroidism when contrasted to age-matched controls without PCOS. A deficiency in thyroid hormones will lead to androgenic symptoms such as hair loss, acne, and hirsutism similar to PCOS. So, all women with PCOS must have their thyroids evaluated thoroughly (TSH, FT3, FT4, Anti TPO, Anti TG)[7]. Subclinical hypothyroidism also caused insulin resistance in women in all weight categories. It was found that women with PCOS have an increased prevalence of autoimmune thyroiditis, 65% increase in thyroid peroxidase antibodies.

Studies of PCOS probands and their sisters revealed an apparent heritability of metabolic and endocrine characteristics. These findings led researchers to conclude that genetic factors may be involved in the development of PCOS. The most relevant genes involved in steroidogenesis are CYP11a, CYP21, CYP17, and CYP19. PCOS is a complex genetic syndrome. A dysregulation of androgen synthesis contributes significantly to its pathogenesis. Thyroid dysgenesis is the most common type of congenital hypothyroidism. Studies suggest that 2 to 5 per cent of cases are inherited. Two of the genes implicated are PAX8 and TSHR[8]. MC4R, which encodes the melanocortin 4 receptor, is usually implicated in obesity because it controls the growth and development of the thyroid gland. A small percentage (<5%) of obese individuals in various ethnic groups have altered MC4R, affecting its function.

In recent years poor eating habits, lifestyle changes, stress and anxiety have had a devastating impact on women's health and are the key contributors to obesity and endocrinal disorders. Women in cities are prone to health issues including obesity, PCOS/PCOD and hyper/hypothyroidism than their counterparts in rural areas. This keen observation led to the present thought of investigating such differences in

health profiles and consequences of life style and genetics.

Population description

- POPULATION- Asian Population
- LOCATION- India
- COMMUNITY- Indian Women
- PROFESSIONAL STATUS- Out-of-work and working women

Methodology

In our survey, we chose to focus on the Asian population of women, especially those of Indian descent.

We a group of students from St. Ann's College for Women, Hyderabad have conducted a survey to study the correlation between obesity, hypothyroidism and PCOD/PCOS.

This study was carried out over a period of 1 month.

A questionnaire survey was prepared and circulated to 215 women.

INCLUSION CRITERIA:

1. Female concerning the age group of 18 to 55 years.
2. BMI more than 23.0 kg/m²
3. Presented with a clinical history of Obesity, PCOS and Hypothyroidism.

EXCLUSION CRITERIA:

- a) Females not belonging to the age group of 18 to 55 years
- b) Subjects with other gynecological problems.
- c) Females with recent delivery.

Criteria for obesity based on body mass index (BMI) for Indian population considered as Normal BMI: 18.0-22.9 kg/m², Overweight: 23.0-24.9 kg/m² Obesity: >25 kg/m² BMI ≥ 25 was considered as obese.

Raised BMI is a major risk factor for various non-communicable diseases such as:

- Cardiovascular diseases (mainly heart disease and stroke)
- Diabetes (Type 2 & 1)

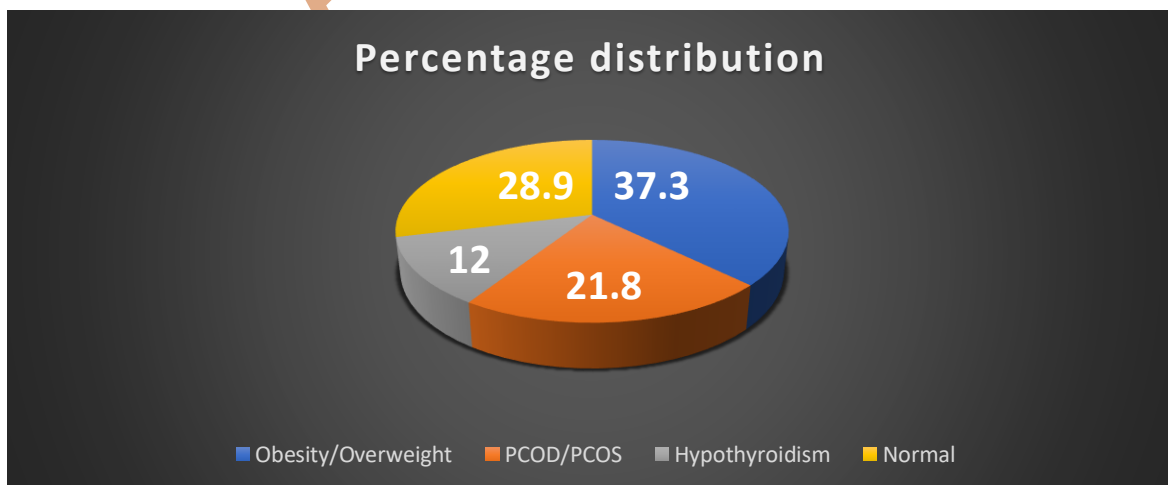
- Musculoskeletal disorders (especially osteoarthritis - a highly disabling degenerative disease of the joints)
- Cancers (endometrial, breast, and colon)

Women presented with irregular menses and (or) infertility and difficulty in reducing weight or sudden change in weight taken as per inclusion and exclusion criteria. We have considered every individual woman survey response to analyze and conclude our research on obesity, PCOS and Hypothyroidism.

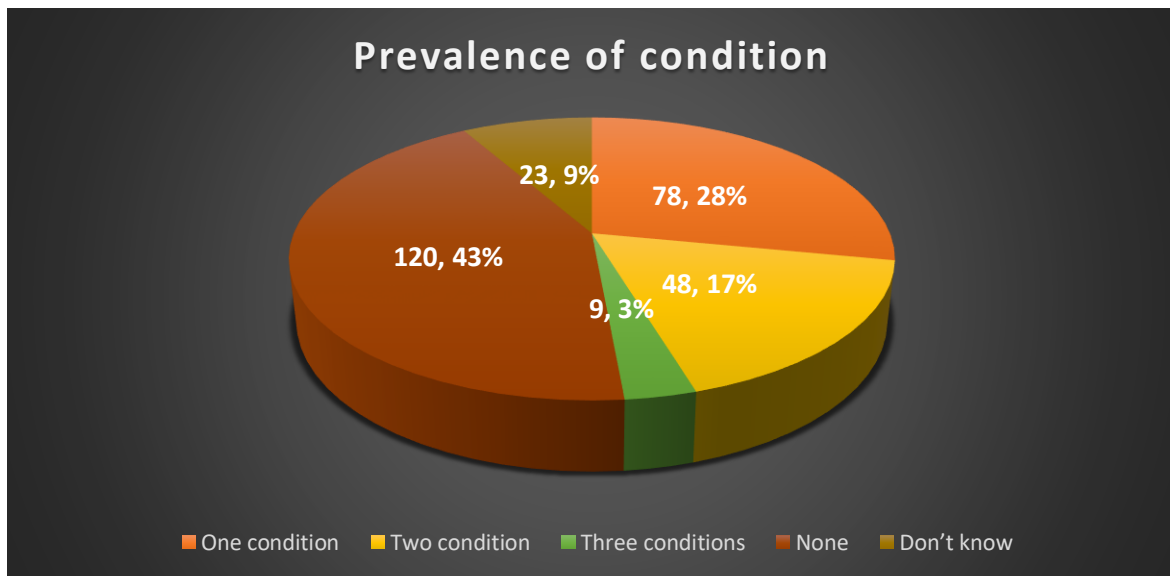
Results of our survey

In an online survey conducted during May of 2020, in India about PCOD/PCOS, hypothyroidism/ hyperthyroidism, and obesity in age groups from 18-45 with more than 80% of them being in the range of 18-25 age group females. It is observed that around

- 37.3% are obese or overweight,
- 21.7% suffer from PCOS/PCOD,
- 12% suffer from hypothyroidism/hyperthyroidism,
- 2.6% suffer from both PCOD/PCOS and hypo/hyperthyroid,
- 86% of people who have PCOS/PCOD have obesity,
- 57.1% of people who have hypo/hyperthyroid suffer from obesity.
- 83.3% of people who have both PCOD/PCOS and hypo/hyperthyroid suffer from obesity.



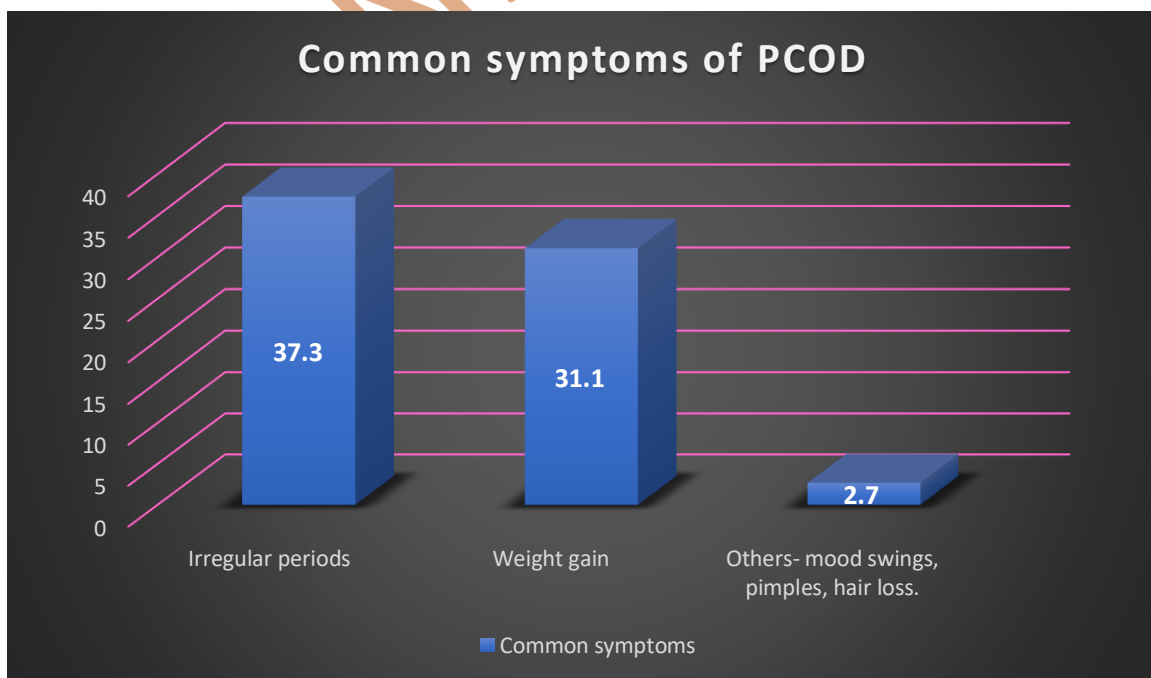
It means around 2.2% are obese/overweight and have both PCOD and thyroid.8% of people don't know as they are not diagnosed. 92% of all people have relatives who suffer from any 3 of the following conditions.



Nearly 78% of people who have these also have a close family member such as grandparents, parents/aunts or siblings with the same condition. Many got diagnosed with PCOS/PCOD and hypo/hyperthyroid group at the age group of 17-22 some at an early age of 10 and some at later age of 40 and remaining in their mid-30s. Many got diagnosed by gynecologists for PCOD and endocrinologists for thyroiditis.

Most people with PCOS/PCOD have the following symptoms:

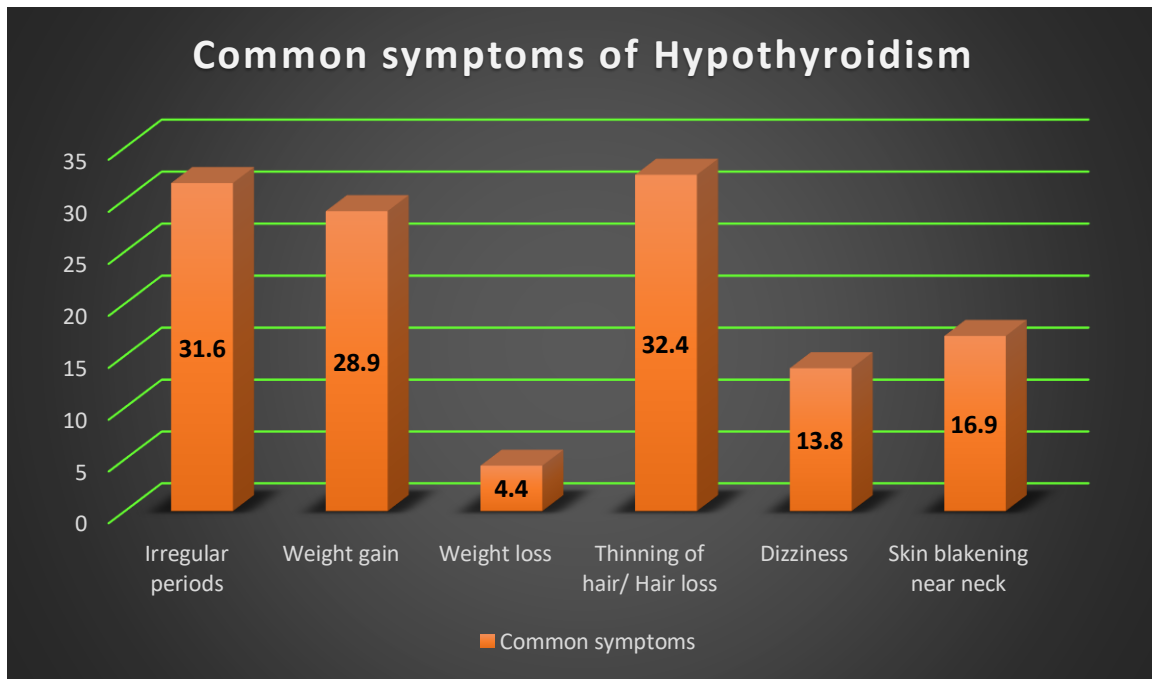
- Irregular periods, hair loss, weight gain, acne/pimples.



Most people with hypo/hyperthyroid have the following symptoms:

- Irregular periods, hair loss/thinning of hair, skin darkening/blackening around the neck region, weight gain

People with thyroid mostly use thyroid tablets such as Thyronorm, Eltroxin.



Interestingly people nearly 50% suffering from PCOD / PCOS do not use any medication since they do not want it, recommended by doctors to not take medication or stop using them. So, they exercise and maintain a diet. Some others use ayurvedic, allopathy or homoeopathy medicines. The remaining use metformin, letrozole with other combinations. The point to be noted is that 50% of people who have any one or two or all three are also suffering from physiological diseases like anxiety/depression or both.

Gender wise awareness on disease

Following are interesting findings out of chi square analysis using SPSS to explore differences between males and females ;inference for each table is given as foot note.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	303.325 ^a	186	.000
Likelihood Ratio	55.970	186	1.000
N of Valid Cases	224		

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Pearson Chi-Square	303.325 ^a	186	.000
Likelihood Ratio	55.970	186	1.000
N of Valid Cases	224		

a. 276 cells (97.9%) have expected count less than 5. The minimum expected count is .00.

Awareness on type of medicine for PCOD shows significant difference ; reason being males are not particular or cautious about it , they feel it is not their concern

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	70.468 ^a	158	1.000
Likelihood Ratio	40.113	158	1.000
N of Valid Cases	224		

a. 235 cells (97.9%) have expected count less than 5. The minimum expected count is .00.

Thyroidism is a general concern for both the sexes ,that is why no significant gender difference

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.660 ^a	2	.000
Likelihood Ratio	17.667	2	.000
N of Valid Cases	224		

a. 3 cells (50.0%) have expected count less than 5. The minimum expected count is .31.

It is concern of females only so difference significant

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	97.937 ^a	256	1.000
Likelihood Ratio	54.174	256	1.000
N of Valid Cases	224		

a. 382 cells (98.7%) have expected count less than 5. The minimum expected count is .00.

This becomes known fact after diagnosis so both males and females be aware of it equally.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.616 ^a	4	.047
Likelihood Ratio	7.938	4	.094
N of Valid Cases	224		

a. 5 cells (55.6%) have expected count less than 5. The minimum expected count is .13.

There is significant difference in the awareness on this question of hirsutism (unusual hair growth) VS gender as females represent 94 percent of the sample studied ,hence justified.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.479 ^a	6	.372
Likelihood Ratio	5.707	6	.457
N of Valid Cases	224		

a. 7 cells (58.3%) have expected count less than 5. The minimum expected count is .03.

Exercise level same no difference

Discussion

This brief communication explores the nature of the relationship between PCOS, hypothyroidism and obesity. It reviews data obtained from the survey conducted and interprets them to present a unified pathophysiological basis, incorporating these complex relationships.

A study from a survey shows the prevalence of lean PCOS as 40%. It has been identified that insulin resistance, which plays a central role in the development of PCOS and genetic susceptibility, is responsible for developing PCOS. Obese patients are vulnerable to deranged lipid profile and increased insulin resistance. Hence, this insulin resistance in PCOS patients, which leads to atherosclerosis of the vessels because of raised triglycerides and decreased levels of high-density lipoproteins (HDLs), at times, contributes to hypertension. Hence, although insulin resistance is a common finding in PCOS, it is independent of obesity. PCOS-associated defects in insulin sensitivity and secretions are further worsened by obesity.

Although the association of hypothyroidism and obesity is not fully teased out, most of the researchers have shown that TSH is higher in people with a high BMI (Body mass index). The elevated TSH levels are associated with the rapid production of fat cells either by inflammatory mediators or via another hormone called leptin, thereby leading to obesity. But, in our survey, we did not find any significant difference in the thyroid status when we compared lean and obese PCOS patients. Hence, this survey indicates that BMI is not affected by the thyroid or PCOS status of the patient's body.

Conclusion

As the prevalence of endocrine dysfunctions increases, the association of polycystic ovary syndrome (PCOS) and autoimmune thyroid disease is increasingly being recognized along with obesity. While the causality of this association is still uncertain, as the two conditions (PCOS/PCOD and thyroids) share a bidirectional relationship. The exact nature of this link has not been elucidated yet. Both syndromes share certain common characteristics, risk factors, and pathophysiological abnormalities. Simultaneously, certain etiopathogenetic factors that operate to create these dysfunctions are dissimilar.

Generally, it is suggesting that PCOS and thyroid patients are usually obese and probably obesity is the cause of clinical manifestations of PCOS and hypothyroidism, even in our study we found that 23.5% of our patients suffering from hypothyroidism/hyperthyroidism and PCOS/PCOD were lean and 76.5% of them were overweight. Hence, our survey result shows that PCOS and hypothyroid; as well as its clinical manifestations are seen across overweight and normal BMI patients. This means all the PCOS patients, irrespective of their BMI, have irregular cycles, hair loss, skin darkening and weight gain.

Hence, we have seen that the majority of the PCOS and hypothyroidism patients are overweight but there is no defined relationship between obesity and hypothyroidism in PCOS patients. The presence of obesity possesses risk of future cardiovascular and metabolic disorders among all PCOS patients, but the presence of obesity in hypothyroid patients makes them more susceptible to such kinds of risks in the future. There is enough

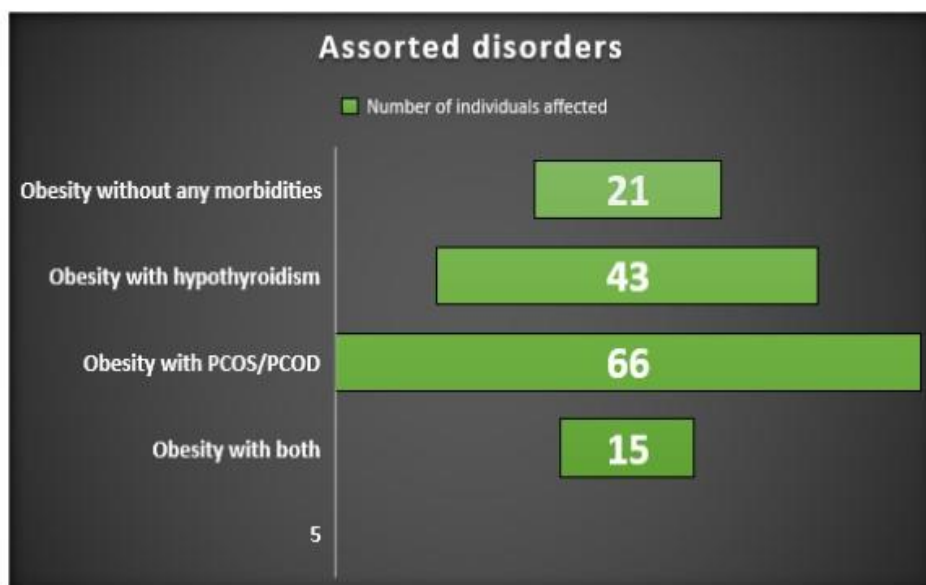
literature support to argue that prevalence of obesity is increased in individual with subclinical hypothyroidism/thyroid autoimmunity and PCOS patients. The pathophysiological pathway and contributing factors behind this association are yet to be elucidated. Long-term studies are required to assess the significance of obesity in patients with PCOS and thyroid dysfunction.

We were surprised to find that menstrual abnormalities in women with PCOS was the strongest predictor for mental health issues, particularly when there are so many other symptoms—like beard growth and infertility—that can make a woman feel unfeminine,” says senior author Nancy Reame, the Mary Dickey Lindsay Professor of Disease Prevention and Health Promotion at Columbia Nursing. “The study findings suggest that we can’t treat PCOS effectively unless we pay close attention to any signs of mental distress.”

A person’s values and the culture they live in will impact which characteristics they

may find distressing. These same characteristics can also impact the emotional well-being of people without PCOS. People with PCOS still have an increased risk for depression and anxiety regardless of their weight, age, socioeconomic factors, facial and body hair, and fertility. Obesity impacts individuals' quality of life, with many sufferers experiencing increased stigma and discrimination because of their weight. Thyroid disease can affect individual’s mood — primarily causing either anxiety or depression. Generally, the more severe the thyroid disease, the more severe the mood changes.

Many people consider these diseases as a taboo and feel ashamed to talk about them publicly leading to mental health issues such as depression and anxiety. There should be more awareness about these in public and be taught in educational institutions. General public need to be empathetic towards them and if needed the patients should be provided with mental health counselling.



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