"PREVALENCE OF POLYCYSTIC OVARIAN SYNDROME AMONG FEMALE HEALTH SCIENCE STUDENTS"

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LIST OF ABBREVIATIONS USED

S.No.	Abbreviations	Expansion of the abbreviations
1.	PCOS	Polycystic ovarian syndrome
2.	NIH	National institutes of health
3.	ESHRE	European society for human reproduction and embryology
4.	ASRM	American society for reproductive medicine
5.	AES	Androgen excess criteria
6.	SES	Socioeconomic Status
7.	PUC	Pre-University Course
8.	PG	Post Graduate
9.	CPI	Consumer Price Index
10.	NICU	Neonatal intensive care unit
11.	BMI	Body Mass Index
12.	WHR	Waist hip ratio
13.	FSH	Follicle stimulating hormone
14.	LH	Luteinizing hormone
15.	SHBG	Sex hormone binding globulin
16.	HDL	High density lipoprotein
17.	WC	Waist circumference

18.	HC	Hip circumference
19.	WHO	World Health Organisation
20.	DM	Diabetes Mellitus
21.	HTN	Hypertension
22.	χ 2	Chi – square
23.	AOR	Adjusted Odds rato
24.	SD	Standard deviation
25.	CI	Confidence Interval

ABSTRACT

TITLE – PREVALENCE OF POLYCYSTIC OVARIAN SYNDROME AMONG FEMALE HEALTH SCIENCE STUDENTS

Introduction:

Polycystic ovarian syndrome (PCOS) is the most prevailing endocrinal disorder affecting women in reproductive age group. Globally the prevalence of PCOS ranges from 2.2% to 26 % among reproductive age group women. Prevalence of PCOS in India is highly variable, it ranges from 3.7 to 22.5%. This wide variation in prevalence is due to consideration of different criteria for PCOS which in turn influence the prevalence and incidence rates of PCOS. Risk factors for PCOS such as strong family history, recent weight gain history, also women diagnosed with type 1, type 2 diabetes also have higher chances of developing PCOS later in their life. Also the fact that, PCOS is quite common among the young women, they ignore the symptoms either due to ignorance or lack of knowledge regarding symptoms of PCOS. So, screening of PCOS early in college going women is essential to improve their quality of life and also to stop further progression of the syndrome.

Objectives: To know the prevalence of PCOS and risk factors associated with PCOS

Methodology: A cross-sectional study was done from 1st January 2021 to 31st December 2021 among female health science students. 807 female undergraduate and post-graduate students studying in medical, dental and nursing colleges of KLE Academy of higher education and research, Belagavi were enrolled for the study using proportionate to population size. Female students were screened for PCOS using Rotterdam's criteria. Also, information regarding socio demographic variables,

menstrual history, clinical history, risk factors of PCOS and anthropometric measurements were taken.

Outcomes were assessed and statistical analysis was done using R i386 4.0.3 software. Chi square test ($p < 0.05$), t-test ($p < 0.05$), logistic regression analysis was used.

Results:

Out of 807 study participants, 25.90% of the participants were diagnosed with PCOS.

Majority 60.72% participants belonged to 20-25 age group, 83.02% were Hindus, 41.02% participants fathers were post graduates, 35.69% study participants mothers were post graduates and 84.39% of them were from socioeconomic class I. Majority 43.49% participants knew the information about PCOS from multiple sources, only 13.14% were unaware about PCOS. Almost half 51% had family history of diabetes mellitus, 13.51%, 16.85 % had family history of menstrual irregularities, hypothyroidism and 7.85 % had family history of PCOS.

Among the total participants 8.79% had skin problems, 8.67% had hypothyroidism and 4.08% had multiple comorbidities. Majority 85.50% participants had less than 45 days duration of menstrual cycle, 38.29% had history of passage of clots and 52.29% had history of dysmenorrhea. Literacy status of parents, disturbed sleep in the night, feeling sleepy in the afternoon, hypothyroidism, multiple comorbidities, consumption of pizza and burger, fried foods, difficulty in staying in ideal weight, mood changes, history of acne, clinical hyperandrogenism, body mass index and waist hip ratio were found to be associated with PCOS ($p < 0.05$).

Factors such as source of information about PCOS, family history of menstrual irregularities, family history of hypothyroidism, family history of PCOS, discoloration of skin behind the neck, excessive loss of hair were found associated with PCOS ($p < 0.0001$).

Multivariate logistic regression analysis showed that family history of menstrual irregularities, family history of hypothyroidism, family history of PCOS and having multiple comorbidities are the risk factors for polycystic ovarian disease.

Conclusion: In the present study, the prevalence of PCOS among the study participants was 25.90%. In the present study family history of menstrual irregularities, family history of hypothyroidism, family history of PCOS and having multiple comorbidities were identified as risk factors of PCOS ($p < 0.05$).

Key words: PCOS, Prevalence, Health science students, polycystic ovarian syndrome

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INTRODUCTION

Polycystic ovarian syndrome (PCOS) is the most prevailing endocrinal disorder affecting women in reproductive age group.[1] It is the main cause of anovulatory infertility in women. Exact etiology of the PCOS remains unknown and it is considered to be multifactorial, with familial component and diet / lifestyle factors. Globally the prevalence of PCOS ranges from 2.2% to 26 % among reproductive age group women. Prevalence of PCOS in India is highly variable, it ranges from 3.7 to 22.5%.[2] This wide variation in prevalence is due to consideration of different criteria for PCOS which in turn influence the prevalence and incidence rates of PCOS. PCOS is been identified among 10% of women when National institute of health criteria was used and up to 18% of reproductive women were diagnosed with PCOS using Rotterdam's criteria.[3]

In the year 1935, Poly cystic ovarian syndrome terminology was first introduced by Irving F. Stein and Michael L. Levinthal. PCOS is widely understood as reproductive and metabolic disorder, most commonly affecting women in reproductive age group. Syndrome comprises of amenorrhea, hirsutism/male pattern of body hair distribution and obesity associated with polycystic ovarian morphology.[4] The term PCOS does not justify this condition completely, as the syndrome is responsible for impairment of various systems in our body. Also, this condition may affect female gender during different phases of her lifecycle such as adolescent phase, productive phase(reproductive) and also in post-menopausal phase.[5]

It is polygenic disorder, in which there is involvement of multiple genes such as CYP 11a gene, leading to increased production of enzymes involved in androgen biosynthetic pathology. Also, Insulin receptor gene present on the locus 13.2 of chromosome 19 concerning to insulin sensitivity is also affected.[4] Origin of the PCOS may be familial and associated with complex underlying pathophysiology. In PCOS there is disturbance in the hypothalamic-pituitary-ovarian axis, which results in abnormal gonadotropin hormones release such as rise in luteinizing hormone and fall in Follicle stimulating hormone. Also, Ovarian follicles are less receptive to FSH and anti-Mullerian hormone levels are raised, and also there is higher secretion of androgens, estradiol and dehydroepiandrosterone in the blood circulation.[6]

Anovulatory cycles are responsible for menstrual disturbances, and PCOS women also have higher predilection of acquiring metabolic syndrome, diabetes mellitus, hypertension and cardiovascular disorders. Increased circulation of androgens in the blood are responsible for male pattern of body hair distribution, acne (comedones) and female hair thinning and balding.[7]

Females especially married women suffer from infertility due to anovulatory cycles, which is mainly attributed to PCOS.[8] They face lot of difficulties for conception, in order to conceive during their married life, women with PCOS opt for assisted reproductive technology/induction of ovulation, and this procedure most often results in multiple babies(births).[9]

PCOS females also suffer with insulin resistance, increased predisposition to type -2 diabetes.[7] Central obesity especially abdominal fat is the precursor for the expression of insulin resistance and metabolic features in PCOS females. Insulin resistance in PCOS women of Indian origin is strongly linked to sub cutaneous fat

deposition, when compared to other areas of fat deposition such as visceral fat and total fat.[10]

Initially, there was so much controversy around the diagnosis of PCOS in response to that, different diagnostic criteria came into existence. First criteria was formulated at National institute of child health and human development of the National institutes of health(NIH) in 1990[11], which included clinical or biochemical hyperandrogenism and oligomenorrhoea, and then came Rotterdam's criteria in 2003, with the financial and technical support from European society for human reproduction and embryology (ESHRE) and American society for reproductive medicine (ASRM), which is National institute of health(NIH) criteria plus polycystic ovaries on ultrasound examination, also the criteria specifies that two of the three criteria are enough for PCOS diagnosis.[12] Later came Androgenic excess-PCOS criteria in 2006, which mainly focuses on hyperandrogenism.[13] In 2012, NIH proposed usage of Rotterdam's criteria with more emphasis on classification of 4 phenotypes(oligomenorrhoea + clinical hyperandrogenism; Oligomenorrhoea + Polycystic ovaries; clinical hyperandrogenism + Polycystic ovaries and all three of them oligomenorrhoea + clinical hyperandrogenism + Polycystic ovaries).[14]

Developed countries like United States reported PCOS prevalence as 4% to 6.6%. Surrounding Asian countries like China and Sri Lanka reported prevalence rates of about 2.2% – 11.2% and 6.3% respectively.[15] In terms of PCOS prevalence among adolescents in India, it varies widely about 9.13 - 36%.[15] Study in Mumbai among young girls reported 22.5% prevalence based on Rotterdam's criteria and 10.7% prevalence based on AES criteria.[15] Cross-sectional study conducted in Ahmedabad reported prevalence rate of 13% among young girls based on

Rotterdam's criteria. Cross-sectional study in Lucknow reported prevalence rate of 3.7% based on NIH criteria. Prevalence study in Dehradun, Uttarakhand reported prevalence rate of 41%.[2] Prevalence of 18%, 9.13%, 6% and 11.96% was reported in studies done in various urban and rural parts of Tamil Nadu, Andhra Pradesh, Chennai and Hyderabad respectively using Rotterdam's criteria. Variation in the prevalence rates in different parts of India is mainly due to consideration of different diagnostic criteria.[2]

Risk factors for PCOS such as strong family history, recent weight gain history and usage of valproic acid for epilepsy, also women diagnosed with type 1, type 2 diabetes and gestational diabetes also have higher chances of developing PCOS later in their life. Antenatal factors such as big babies born to overweight mothers, congenital virilization and small babies. premature pubarche, precocious puberty, acanthosis nigricans and metabolic syndrome in later part of the childhood are some of the determinants of PCOS.[16]

Overweight women diagnosed with PCOS are more prone to wide range of health problems such as diabetes, gestational diabetes, cardiovascular disease, hypertension, dyslipidemia, sleep apnea and cerebrovascular stroke and endometrial cancer. Also, PCOS is linked to psychiatric disorder, but the exact causation is not known.[7]Maternal complications such as pregnancy induced hypertension, eclampsia, gestational diabetes mellitus and perinatal mortality in mother and fetal complications such as pre-term babies, low birth weight and higher chances of admission rates to NICU in the baby are the most common complications in PCOS women, when they become pregnant in the later years of life.[8]

PCOS is multi spectrum disorder symptoms varying from menstrual irregularities, hirsutism, excessive acne, alopecia, obesity, sleep apnoea.[17] Women diagnosed with PCOS are more prone to cardiovascular, metabolic and oncogenic manifestations, if left untreated for longer duration.[18] Multiple modifiable risk factors in college going women especially health science students such as stress, consumption of fatty, high calorie foods, sedentary lifestyle and obesity, contribute to insulin resistance, which in turn have a strong association with PCOS.[19] But majority of the PCOS cases still remains undiagnosed.

Although PCOS is quite common among the young women, they ignore the symptoms either due to ignorance or lack of knowledge regarding symptoms of PCOS. So, screening of PCOS early in college going women is essential to improve their quality of life and also to stop further progression of the syndrome. Hence the present study was planned to know the prevalence and risk factors associated with PCOS among health science students.

OBJECTIVES:

1. To know the prevalence of PCOS
2. To know the risk factors associated with PCOS

REVIEW OF LITERATURE

A descriptive cross-sectional study was conducted between 2019 to 2020 among 1200 college going girls of Agra city with the mean age of participants being 21.63 ± 3.19 years. Based on Rotterdam's criteria,16.6% female participants were diagnosed with PCOS, of which 5.4% were having both menstrual irregularity and hirsutism. 71% PCOS participants were overweight and obese. Odds of getting PCOS was 3.15 times among snackers, 2.7 times among obese and 4.72 times among participants with family history of PCOS. Good knowledge about PCOS was seen in 50% of participants. Study concluded that healthy lifestyle practices and health education is essential to decrease the incidence of PCOS and its post effects.[20]

An exploratory study conducted in 2020 for students at TWU Denton, Dallas and Houston among 823 individuals showed that mean age of the respondents was 32.9 ± 11.4 years, 61% were Caucasians, also 6% were male participants. Old cases of PCOS was reported in 28.5% of women, 40.5% participants were meeting the Rotterdam's criteria. 17.6% of Hispanics and Latinos were aware about PCOS from family and friends.[21]

In 2019, an observational study was carried out for five weeks among 300 adolescent girls belonging to the age group of 14-18 years at a medical college in Chennai. This study showed lack of awareness concerning the PCOS among 96.3% participants, irregular menses, hirsutism and weight gain was seen among 32%, 26%, 13% respectively. Mild- hirsutism and moderate-severe hirsutism was seen among 18% and 8.3% girls respectively. On screening for PCOS, percentage of participants

diagnosed with PCOS, high risk and low risk adolescents were 12.3%, 10.3% and 23.3% respectively.[22]

In 2019, cross-sectional study conducted on PCOS among 456 medical, dental, physiotherapy students, in the age group of 17 -24 years in Nerul, Navi Mumbai reported that 21% participants were diagnosed with PCOS. Out of 21% participants with PCOS, whose mean age group was 21.18 years, 91% were medical students, 62.5% of them were having higher BMI cut offs. Significant association was observed between BMI > 24.9 kg/m2 and PCOS. Among 360 non-PCOS participants, 22% were categorized as high risk and 77% were categorized as low risk. High risk category and 78% of PCOS participants who were having higher WHR > 0.8 was also significantly associated with PCOS.[23]

A cross-sectional study was conducted in the year 2018-19, to know the prevalence and determinants of PCOS among 150 adolescent girls in Karad. Study showed that, 17.3% participants were diagnosed with PCOS, out of which 84% presented with menstrual irregularities and 19% presented with male pattern of hair. Combination of irregular menses and acne was seen in higher number of participants. PCOS complaints were higher among the individuals belonging to the late adolescence (15-19 years). BMI and WHR values were on higher side for participants with PCOS. Study concluded that adolescent age group is more vulnerable to PCOS and early intervention in the form of changes in the lifestyle is essential to prevent PCOS after effects.[24]

A cross-sectional study on PCOS among adolescent girls was done in the year 2018 in Hyderabad. Prevalence of PCOS in this study was 11.96%. Most of the PCOS diagnosed participants were under the late adolescent age group. Among the PCOS

group, irregular cycles was very common complaint. Other clinical manifestations like acne, hirsutism, alopecia, pigmentation and mood changes were seen in 64%,21%,7%,36%,14% of participants respectively. [25]

In 2018, study conducted on PCOS in Ahmedabad to know the prevalence and its associated risk factors among 881 girl students showed that the mean age of study participants was 15.73 ± 1.28 years. They found that number of girls diagnosed with PCOS were from upper socio-economic status, had family history of Diabetes mellitus and Hypothyroidism. Significant association was found between lifestyle factors and PCOS and also showed association of Leutinizing Harmone and Testosterone levels with PCOS. Quality of life was inadequate in higher number of girls with PCOS compared to non-PCOS.[26]

Cross-sectional study done on PCOS in 2018 among 246 medical and paramedical students in the age group of 17-23 years, in South India showed that 32.11% reported with PCOS based on Rotterdam's criteria, among whom 29% presented with irregular periods, 25% presented with hirsutism and 8.5% participants presented with all the three criteria. Mean and standard deviations of the variables in PCOS such as age, BMI, Modified Ferriman Gallway score showed 18.91 ± 1.69, 23.49 ± 3.89 8.51 ± 0.58 respectively. Close to 61.5% participants suffering with thyroid disorders were also diagnosed with PCOS.[27]

In Jaipur, observational study was conducted in the year 2017-19 among 884 females with the age group ranging in between 15-24 years. Study reported PCOS prevalence by leveraging 3 prevailing different diagnostic criteria such as NIH criteria, Rotterdam criteria and androgen excess criteria. Different criteria showed different prevalence such as NIH -7.5%, Rotterdam's criteria - 18.68% and androgen

excess criteria -11.8% participants reported with PCOS. In terms of phenotype pattern, 40% presented with phenotype D i.e., oligomenorrhea and polycystic ovaries. When compared with participants without PCOS, PCOS participants were suffering more with hirsutism, infertility and acanthosis. Association was seen in between family history of diabetes and PCOS.[28]

Another cross-sectional study conducted in 2017-18 among 125 female students of age group 18-20 years studying in Kolkata, showed that 28% were diagnosed with PCOS. Body Mass Index (30.47 ± 2.72) and Waist Hip Ratio (0.78 ± 0.05) were significantly associated with PCOS when compared to Non PCOS. Among PCOS participants, 40.7% complained about acne and 63% were facing emotional problems.[29]

A cross-sectional study conducted in Bhopal among young women in 2017 to know the prevalence and the risk factors associated with PCOS showed that mean age of study participants was 18.47+0.482 years. Out of 500 studyparticipants,56 of them were suspected cases of PCOS. On further assessment of these suspected cases, 41 were diagnosed with PCOS. Risk factors such as BMI >25 and waist hip ratio > 0.85 were strongly associated with the PCOS. The study concluded that obese women were at higher risk for PCOS and only 21% of the study participants were aware of the PCOS.[18]

A cross-sectional study conducted in 2017 among 170 women showed that participants had a mean age of 24 ± 7 years. Total 41% women were suffering with PCOS, of which 24% of them were unmarried women and 16% were married women. Percentage of females reported with oligomenorrhea, menorrhagia and amenorrhoea was 40%, 12.8% 11% respectively. 68% of women reported with deranged FSH/LH

ratio. Study concluded that higher incidence of PCOS among young women is mainly due to unhealthy lifestyle.[30]

Another cross-sectional study (2016-2017) conducted in Bhopal among 840 young girls from schools and colleges with the mean age group 18.8 years revealed that 9.1% of young girls were suffering with PCOS. Out of 840 participants, 217(25%) presented with menstrual irregularities, 361 presented with dysmenorrhoea and 206(24%) presented with male pattern facial hair. Among the participants whose BMI was more than 25 and WHR was more than 0.96, turned out to have PCOS among 43.2% and 50.8% girls respectively. Study concluded that lack of understanding on PCOS and unhealthy lifestyle choices were the reasons to develop PCOS.[31]

A cross-sectional study conducted in South India among 480 young women in 2016 showed that the mean age of participants was 20.4 + 1.5 years. Among the total 480 participants, 39 were old cases of PCOS. In the remaining 441 study subjects, 9.1% were at high risk and remaining 90.9% were at low risk. Most of the PCOS cases were seen in the age group 23- 25years, in participants with family history of PCOS, in those residing in urban areas and in obese participants. Women diagnosed with PCOS were facing problems regarding weight gain. Significant association between hyper pigmented patches over the skin and PCOS was observed in this study. [32]

A Cross-sectional study on PCOS conducted in 2016 among 100 school going girls in Sambalpur, of age group of 14-17 years showed that clinical PCOS was diagnosed among 12% of participants. 64% girls presented with normal regular cycles, whereas 18% had < 25 days cycle, 15% had longer duration cycles. Acne was

seen in 20% of girls. Regarding the awareness about the PCOS, only 22% girls were aware about it mostly from the sources such as internet, family and friends. Coming to BMI categorization, 28% girls deemed to be overweight, 8% girls deemed to be obese. Study concluded that early diagnosis of PCOS is essential for prompt screening and treatment.[33]

Another cross-sectional study conducted in 2015-2017, among 518 participants in Chennai showed that the mean age group of the PCOS and Non-PCOS participants was 19.7± 4.2 years and 18.4± 4.2 years respectively. Various diagnostic criteria showed varied prevalence rate such as NIH reported 2.1%, AES criteria reported 2.9% and Rotterdam's criteria reported 8.1%. Also, chances of acquiring PCOS was 3.09 times higher in obese, 2.12 times higher in insulin resistance and 4.46 times higher in hypertensive individuals. Study concluded that early screening for PCOS is must to promote healthier lifestyle practices among the individuals.[34]

Cross-sectional study conducted from 2015-2017 in Haryana among 2400 reproductive age group women, reported prevalence of PCOS as 4.21%. Out of total PCOS participants, 78% reported with oligomenorrhea, 65% reported with biochemical hyperandrogenism and 35% reported with polycystic ovarian morphology. 51% of PCOS participants had obesity and 71% of participants had Vit D deficiency. 29.7% female participants with PCOS were categorized as overweight and 9.5% controls without PCOS were categorized as overweight. PCOS participants had increased predisposition to obesity, depression and vitamin D deficiency, when compared to Non PCOS participants. 17% of PCOS females presented with infertility.[35]

A cross sectional study was done in Australia, among 1527 females in 2015. Mean age of the participants was 47.4 ± 19.3 years. PCOS was self-reported by 5.6% of the participants. PCOS females had higher BMI, with the mean BMI being 29.8 ± 8.7. Comorbidities such as diabetes, cardiovascular disease and arthritis were reported higher among PCOS participants. PCOS women had 2.23 times higher risk of getting diabetes and 3.18 times higher risk for acquiring cardiovascular complications.[36]

In 2015, Comparative Study done on PCOS among 18 – 24 years age group urban and rural women in Tamil Nadu showed 8.9% prevalence of in urban and 1% prevalence in rural area based on Rotterdam's criteria. 10.1% of urban females and 15.35% of rural females had oligomenorrhoea. Mean BMI of urban and rural participants was 26.5 ± 0.4 and 21.3 ± 2.34 respectively. Only 8.3% of rural participants were having knowledge regarding PCOS. Odds of acquiring PCOS was 6.7 times higher among female participants with family history of PCOS.[37]

An Observational study carried out in Kancheepuram, Tamil Nadu in 2015 among 207 women in the age group of 18 to 35 years showed that, 32% of participants were diagnosed with PCOS, with the mean age group of PCOS participants being 25 ± 6 years. Of which most of the participants were categorized as overweight and obese patients. Menstrual irregularities such as oligomenorrhoea and amenorrhoea was seen in 57 and 10 participants respectively. Mean and standard deviation of the various parameters/ variables such as BMI, LH: FSH, Serum Testosterone was 28 ± 7, 1.3 ± 0.6, 2.8 ± 0.7 respectively. Study concluded that early diagnosis and treatment of PCOS is paramount to prevent further consequences.[38]

In 2014, in a study conducted in Mumbai to know the prevalence of PCOS among 778 adolescent and young girls, mean age of study participants was 18.5 ± 2.4years. Out of the total 778 study participants, using Rotterdam'criteria and androgen excess society criteria the prevalence of PCOS was 22.5% and 10.5% respectively. Menstrual irregularity was found more in nonobese women. Hirsutism, hypertension, 2 hr post 75gm glucose test, insulin levels and SHBG levels were found to be more in obese women which was found to be statistically significant ($p<0.05$). [15]

An study done in 2015 on PCOS among 275 females visiting Gynecology OPD in Delhi showed that 10.9% participants were diagnosed with PCOS. Complaints like Oligomenorrhoea, obesity, acne, hirsutism were seen 63%, 37%, 57%, 47% respectively.[39]

In 2014, cross-sectional study to screen adolescents with high risk for PCOS conducted among 752 students studying in pre university colleges in the age group of 16-18years in Udupi was done which showed that higher proportion (88%) of participants were from rural area, PCOS risk status assessment showed that 13.4% participants had moderate risk and 86.2% participants had low risk. Significant association was seen with variables such as fathers and mother's educational status and mother's occupation ($p < 0.05$).[40]

In 2014, cross-sectional study was conducted among 259 female medical undergraduate students in Pondicherry. The mean age group of participants was 20.57 years. Prevalence rate found to be 12.18 % using Rotterdam's criteria. of which 42% were old PCOS and 57% were new PCOS cases. Old PCOS cases on treatment were 58%. Hirsutism was seen among 60% of the participants. Hirsutism and

oligomenorrhea phenotype was seen in 32% of the participants. Study concluded that target groups to be screened for PCOS at early ages by using simple evaluation tools.[41]

Hospital based case control study on PCOS was conducted in the year 2013-14, among 25 cases and 25 controls in Jaipur. 96% of the cases and 88% of the controls, belonged to the age group of 15- 30 years. 72% of the cases were from urban area. In respect to residence (urban) and socio-economic status(higher), there was significant association with PCOS. Male phenotype features such as hirsutism, acne, deep voice and atrophied breasts was reported in 96%, 48%, 4%, 4% PCOS subjects respectively. Cases had strong family history of PCOS compared to controls. Mean BMI and WHR of PCOS subjects were (32.28 ± 3.285) and 0.80 ± 0.073 respectively higher compared to controls. Serum biochemical parameters such as fasting blood sugar, Serum. insulin, Serum. testosterone, Serum. triglycerides and Serum. HDL levels were significantly on the higher side among the PCOS subjects.[42]

In 2013, cross-sectional study was conducted in Nellore, Andhra Pradesh among 253 girls with mean age of participants being 18.57 ± 0.19 years. 15.4% participants confirmed to have PCOS based on Rotterdam's criteria. Following factors such as higher socio-ecoomic status, presence of wisdom tooth, history of cesearean section, family history of irregular menses, non-vegetarians, presence of central obesity and hypothyroidism showed significant association with PCOS ($p < 0.05$). Odds of having PCOS was higher in individuals, who had history of Cesearean section, wisdom tooth eruption and central obesity with odds ratio being 4.91, 2.61 and 2.57 respectively.[43]

In 2013, cross-sectional study conducted among 120 newly diagnosed PCOS patients showed that, most of the participants were unmarried, with the mean age of 22.05 ± 4.69 years. Mean age of menarche was 13.7 ± 1.398 years. 67% of obese and 60% of non-obese women reported oligomenorrhoea. Infertility was reported among 45% of married PCOS participants. Mean BMI of the participants 27.32 ± 6. Acanthosis nigricans was reported among 44% of PCOS participants, of which 52% obese and 20% non-obese had acanthosis nigricans. Male pattern of hair growth was seen among 12.5% participants. 67% of obese and 60% of non-obese presented with hyperandrogenism. 15% of them were suffering with thyroid disorders.[44]

In Sharjah, a cross-sectional study was conducted in 2012 among 50 female undergraduate students with the mean age of 19.4 years. 20% were diagnosed with PCOS, out of which 16% reported with oligomenorrhea and 4% reported with polymenorrhea. Also 22% reported about PCOS family history. PCOS participants body weight 66.7 kg was on higher side compared to Non-PCOS participants 58.8kg ($p < 0.05$).[45]

A cross sectional analytical study in 2012, among 137 female university students studying in Palastine had a mean age of 20.2 ± 1.4 years. 7.3% participants were diagnosed with PCOS based on NIH criteria. PCOS symptoms such as menstrual irregularities and clinical hyperandrogenism were seen in 35 and 38 cases respectively. Acne was seen in 80% of participants with PCOS, which found to be statistically significant.[46]

Another community-based cross-sectional study done in 2012 among 1520 females of 18-25year old in Lucknow showed that, 11.5% reported irregular menses, 1.83% reported male pattern of hair and 1.6% reported both irregular menses and

male pattern of hair. PCOS prevalence rate was 3.7% based on NIH criteria. Most of the PCOS participants BMI was within the normal range, BMI $\geq$ 27.5 kg/m^2 was observed only in 12% participants. 44% of PCOS participants were having higher cut-off values for WHR.[47]

A study conducted in 2011 among 136 adolescent girls showed that 36% had PCOS based on Rotterdam's criteria. Irregular menses, hirsutism, acne, obesity, polycystic ovaries was found among 59%, 56%, 17%, 17%, 47.8% of participants respectively.[48]

Community based cross-sectional study done in 2011 was done among 1126 women belonging to various geographical regions of Iran with the mean age of 34.4 years. Prevalence rates of PCOS varied due to the various diagnostic criteria used such as study subjects who met Rotterdam's criteria were 14.6%, AES were 11.7% and NIH criteria were 7.1%. 66 of the study subjects presented with all the three components of Rotterdam's criteria. 22.4% of the study subjects presented with Hirsutism.[49]

Comparative study conducted in 2010 among two groups i.e., PCOS group consisted of 30 adolescents and normal group consisted of 71 adolescents to find out the association between PCOS, overweight and metabolic syndrome in Iran showed that higher BMI values and fasting triglycerides were higher among PCOS group compared to normal group. 63% of participants among PCOS group showed polycystic ovaries, where as 7% of participants among non-PCOS participants showed polycystic ovaries.[50]

In 2005-2006, Community- based cross-sectional study was done in Gampaha, Sri Lanka among 3030 women in the age group of 15 to 39 years. Out of 3030 participants, Probable cases of PCOS were seen in 220 (7.5%) women, of which oligo/amenorrhea was seen in 209 females and male pattern of hair distribution was seen in 11 females. Only 6.3% participants were diagnosed with PCOS. 91.4% females presented with oligo/amenorrhoea and polycystic ovaries and 48.3% presented with oligo/amenorrhea and hirsutism. PCOS women were having higher Body Mass Index, Waist Hip Ratio and systolic blood pressure compared to women without PCOS.[51]

DISCUSSION

PCOS is slowly becoming an epidemic among women in reproductive age group, especially college going women. Mainly affecting them during their most productive period of life. Disturbance in the hypothalamic-pituitary-ovarian axis leads to increased circulation of estrogens and androgens, which in turn is responsible for the menstrual irregularities, male pattern of hair distribution on body and polycystic ovarian morphology among PCOS females.[6]

The increase in prevalence of PCOS among health science students could be due to stress, consumption of high calorie foods, sedentary lifestyle and obesity.[19] So more emphasis has to be given for early screening of PCOS among university students in order to improve their quality of life and also to stop further progression of the syndrome.

Table No 1-7: Socio-demographic profile of study participants

In the current study, mean age of the 807 study participants was 22.02 ± 2.9 years. More than half of the study participants were in the age group of 20-25 years. Similar findings were seen in study conducted in Agra (Uttar Pradesh)[20], which showed that mean age of study participants was 21.63 ± 3.19 years. In our study majority (83.02%) of the participants were Hindus and 84.39% of the study participants belonged to socioeconomic class I which was similar to study done in Mangalore (Karnataka).[32]

In our study among the participants, 33.58% of their fathers were graduates, 41% of their fathers were postgraduates, 31.6% of their mothers were graduates,

35.69% of their mothers were postgraduates. Whereas study conducted in Udupi (Karnataka)[40] showed that 46.9% of their fathers completed primary education, 2.8% were graduates and 58.1% of their mothers completed primary education and 1.6% were graduates.

In our study 43.49% study participants knew the information about PCOS from multiple sources, 16.60% knew it from doctors, 13.51% knew it from friends and only 13.14% were unaware about PCOS. Similar findings were seen in study done in Mangalore (Karnataka)[32] which showed that 40% of the participants got the information regarding PCOS from doctors and 19.4% from friends. In this study the increased awareness regarding PCOS among the participants may be because they have access to internet sources to gain information on PCOS and also the fact that our study participants are health science students and PCOS is included in their curriculum.

Table No 8-15: Clinical profile of the study participants

In the present study, 51% study participants had family history of diabetes mellitus, 16.85% had family history of hypothyroidism, 13.51% had family history of menstrual irregularities, 7.81% had family history of PCOS, 7.81% had family history of breast cancer and 1.24% had family history of ovarian cancer. Similar findings were seen in study done in Ahmedabad (Gujarat)[26] which showed that 41.86% had family history of diabetes mellitus, 26.59% had family history of hypothyroidism. Another study done in Mangalore (Karnataka)[32] showed that 5.6% had family history of PCOS, 7.7% had family history of breast cancer and 1.6% had family history of ovarian cancer. Family history can be considered as an important risk factor to determine the risk of PCOS.

In our study, 8.79 % study participants had skin problems, 8.67 % had hypothyroidism, 7.55 % had migraine, 4.08 % had multiple comorbidities. Similar findings were seen in study done in Jaipur (Rajasthan).[28]

In the present study, almost half (49.19%) of them were consuming pizza and burger several times a month, 29.62% were consuming once a week, 30.98% were consuming several times a month, 27.63% were consuming several times a week. Similar findings were seen in study done in Ahmedabad (Gujarat)[26] in which 10.92% consumed junk foods every day, 30.25% consumed once in a week and 27.73% consumed once a month.

In the present study, 14.50% participants had more than 45 days duration of menstrual cycle, 94.05% of them had 3-7 days length of menstrual cycle, 38.29% had history of passage of clots and 52.29% had history of dysmenorrhea. Similar findings were seen in study conducted in Beijing (China)[62] which showed that 18.90% of participants had oligomenorrhoea. Another study done in Hyderabad (Telangana)[25] showed that 16.8% had oligomenorrhoea. Another study done in Dehradun[30] showed that 12.8% had menorrhagia.

In our study, 51.3% study participants had acne, 14.62% had discoloration of skin behind the neck, 39.16% had excessive hair loss. Similar findings were seen in study done in Hyderabad (Telangana)[25] which showed that 64% had acne, 36% had discoloration of skin behind the neck and 7% had excessive hair loss. Discoloration of the skin behind the neck and acne are due to insulin resistance and imbalance in the harmones.[63]

In the present study, 12.76% had mild clinical hyperandrogenism and 3.59% had moderate clinical hyperandrogenism. Similar findings were seen in Chennai [22] which showed that 18.1% had mild type and 8.3% had moderate to severe type. Another study done in Miraj[44] showed that 12.5% had male pattern of hair growth.

The overall prevalence of PCOS in the present study was 25.90%. Whereas the global prevalence of PCOS is estimated to be between 2.2 - 26%[15] and in India about 9.13 – 36%[15]. This wide variation of prevalence of PCOS may be due to different diagnostic criteria used in different studies.

In our study, using Rotterdam's criteria oligomenorrhoea and clinical hyperandrogenism was present among 4.21% of participants oligomenorrhoea and polycystic ovaries was present in 4.09%, clinical hyperandrogenism and polycystic ovaries was present in 4.83% participants. The overall prevalence of PCOS in the present study was 25.90%. Similar findings were seen in study done in Agra (Uttar Pradesh)[20] which showed that using Rotterdam's criteria oligomenorrhoea and clinical hyperandrogenism was seen in 5.40%, oligomenorrhoea and polycystic ovaries was present in 9.30%, clinical hyperandrogenism and polycystic ovaries was present in 1.90% participants.

Table No: 16 Anthropometric profile of study participants

In the current study, 29.12% study participants were obese and 15.24% of them were underweight. Mean BMI, waist circumference, hip circumference and waist hip ratio of 807 participants were 22.92 ± 4.55, 81.55 ± 11.96, 98.2 ± 11 and 0.83 ± 0.06 respectively. Similar findings were seen in study conducted in Mumbai (Maharashtra)[23] which showed that 62.5% participants were obese.

Table No 17-29 Association between sociodemographic factors with PCOS

In our study 28.48% participants who were in the age group of 25-30 years had PCOS. Significant association was not found between age and PCOS ($p > 0.05$) which was similar to study done in Mangalore (Karnataka).[32]

In the present study 29.90% participants fathers were postgraduates had PCOS when compared to 19.80% participants whose fathers completed secondary education. Significant association was found between literacy status of father and PCOS ($p <0.05$). Whereas study done in Udupi (Karnataka) [40] which showed that higher no of participants fathers completed primary education.

In our study 30.56% participants mothers were postgraduates had PCOS when compared to 20 % participants whose mothers were graduates. Significant association was found between literacy status of mothers and PCOS ($p <0.05$). Whereas study done in Udupi (Karnataka) [40] which showed that higher no of participants mothers completed primary education.

In our study 27.46% participants belonging to socio-economic Class I had PCOS when compared to 19.80% belonging class II and 10.72% belonging to class III. Significant association was found between socioeconomic status and PCOS ($p > 0.05$) which was similar to study done in Nellore[43] and Mangalore.[32] Literacy status of parents and socio-economic status play an important role to seek more knowledge on PCOS, bear the cost of early diagnosis and treatment of PCOS.

In our study 40.30% PCOS participants knew about PCOS from doctors when compared to 21.11% knew it from friends, 14.96% of them knew it from family

members. Significant association was found between source of information and PCOS ($p < 0.05$) which was similar to study done in Mangalore (Karnataka).[32]

Table 23. Association between family history of diseases and PCOS

In our study 46.79% participants with family history of menstrual irregularities had PCOS, when compared to 22.64% participants without family history of menstrual irregularities. 41.18% participants with family history of hypothyroidism had PCOS, when compared to 22.69% participants without family history of hypothyroidism. 28.57% participants with family history of PCOS had PCOS, when compared to 25.67% participants without family history of PCOS. Significant association of PCOS was found only with family history of menstrual irregularities, family history of hypothyroidism and family history of PCOS ($p < 0.05$). Similarly, studies done in Nellore [43] and Kolkata[29] also showed association of PCOS with family history of menstrual irregularities and family history of PCOS.

Table 24. Association between type of diet and PCOS

Diet plays an important role on the clinical picture and laboratory findings of PCOS. In the present study higher percentage of participants consuming mixed diet had PCOS, however this difference was not found to be statistically significant. Similar findings were also seen in study done in Nellore (Andhra Pradesh).[43]

Table 25. Association between physical exercise and PCOS

In our study 27.37% participants exercising irregularly had PCOS when compared to 21.25% participants who were exercising regularly. Significant association was not found between physical exercise and PCOS ($p > 0.05$) which was similar to study done in Nellore, (Andhra Pradesh).[27] Exercising irregularly increases

the changes of weight gain which in turn leads to insulin resistance affecting glucose transport and metabolism.[64]

Table 26 and Table 27: Association between disturbed sleep in the night and feeling sleepy in the afternoon with PCOS

In this study 33.94% participants with disturbed sleep had PCOS when compared to 22.87% participants without disturbed sleep. Significant association was found between disturbed sleep in the night and PCOS ($p < 0.05$). Similarly sleep disturbances among study participants was seen in study done in Mangalore, Karnataka.[32] In the present study 33.79% participants who felt sleepy always had PCOS, when compared to 23.79% participants who felt sleepy occasionally. Significant association was found between feeling sleepy in the afternoon and PCOS ($p < 0.05$) which was similar to study done in Mangalore, Karnataka.[32] Sleep disturbances among women with PCOS could be due to bidirectional pathways leading to hyperandrogenemia which affects the hypothalamic-pituitary-ovarian-adrenal -pathways.[65]

Table 28. Association between comorbidities and PCOS

In this current study 61.42% participants with hypothyroidism had PCOS, when compared to 22.52% without hypothyroidism. 67.64% participants with multiple comorbidities had PCOS, when compared to 24.06% without multiple comorbidities. Significant association of PCOS was found only with hypothyroidism and multiple comorbidities ($p < 0.05$) which was similar to study done in Nellore (Andhra Pradesh).[43] Association of PCOS and hypothyroidism could be due to hormone changes specially rise in the level of prolactin which prevents ovulation

leading to polycystic ovaries.[66] Hypothyroidism and PCOS share a bidirectional relationship, but the causality is not certain. There is enough evidence to support that prevalence of hypothyroidism is more in PCOS. [67]

Table 29 – 34: Association between consumption of junk foods and PCOS.

In the current study 57.15% participants who consumed pizza and burger every day had PCOS, when compared to 19.28% participants who consumed pizza and burger once a month. Significant association of PCOS was found with consumption of pizza and burger ($p < 0.05$). It signifies that with increased consumption of junk foods it leads to obesity and obesity is very much linked to PCOS, which was similar to study done in Navi Mumbai (Maharashtra).[23] and Kolkata (West Bengal).[29] Junk food is refined carbohydrate which leads to risk of insulin resistance and imbalance in the hormones due to increased glucose- fats ingredients in the junk foods leading to PCOS.[68]

Table 35. Association between difficulty in staying in ideal weight and PCOS.

In this study 40.62% participants with difficulty in staying in ideal weight had PCOS, when compared to 17.51% who did not face difficulty in staying in ideal weight. Significant association was found between difficulty in staying in ideal weight and PCOS ($p < 0.05$) which was similar to study done in Mangalore (Karnataka).[32] The hormonal imbalances, insulin resistance makes it difficult for women with PCOS to shed the extra weight.[69]

Table 36. Association between mood changes and PCOS.

In the current study 29.03% participants with mood changes had PCOS, when compared to 18.60% without mood changes. This difference was found to be

statistically significant between mood changes and PCOS ($p < 0.05$) which was similar to study done in Mangalore (Karnataka).[32]

Table 37. Association between menstrual history and PCOS

Menstrual cycle more than 45 days, length of menstrual cycle of less than two days and more than seven days, history of passage of clots and dysmenorrhea were found to be associated with PCOS ($p < 0.05$) which was similar to study conducted at Hyderabad, Telangana[25].

Table 38. Association between history of acne and PCOS.

PCOS is one of the endocrine disorders associated with acne.[70] In this study 30.68% participants with acne had PCOS, when compared to 20.8% participants without acne. This difference was found to be statistically significant ($p < 0.05$) which was similar to study done in Kerala.[48]

Table 39. Association between dis-coloration of skin behind the neck and PCOS.

In the present study 55.94% participants with discoloration of skin behind the neck had PCOS, when compared to 20.76% participants without discoloration. Significant association was found between discoloration of skin behind the neck and PCOS ($p < 0.05$) which was similar to study done in Mangalore (Karnataka).[32]

Table 40. Association between excessive loss of hair and PCOS.

In our study 35.13% participants with excessive hair loss had PCOS, when compared to 19.96% participants without excessive hair loss. Significant association was found between history of excessive loss of hair and PCOS ($p < 0.05$) which was similar to study done in Agra, Uttar Pradesh.[20]

Table 42. Association between clinical hyperandrogenism (Modified Ferriman Gallway Scale) and PCOS.

In the current study 87.38% with mild clinical hyperandrogenism and 100% with moderate clinical hyperandrogenism had PCOS, when compared to 13.33% with no clinical hyperandrogenism. Significant association was found between clinical hyperandrogenism and PCOS ($p < 0.05$) which was similar to study done in Chennai, Tamilnadu[22], which showed that

18% with mild hirsutism, 8.3% with moderate hirsutism. Clinical hyperandrogenism among PCOS participants is due to increased circulation of androgens in the blood.[71]

Table 43. Association between body mass index and PCOS.

In our study 40% participants were obese had PCOS, when compared to 22.50% participants who were of normal weight. Significant association was found between body mass index and PCOS ($p < 0.05$) which was similar to study done in Jaipur (Rajasthan).[28]

Table 44. Association between waist hip ratio and PCOS.

In our study, mean value of waist circumference of participants with PCOS was 86.48±13.54, when compared to participants without PCOS was 79.82±10.85 and mean value of Hip circumference of participants with PCOS was 102.45±12.64, when compared to participants without PCOS was 96.71±9.96 Significant association of PCOS was found with waist and hip circumference ($p < 0.05$) which was similar to study done in Jaipur (Rajasthan).[28]

Table 45: Multivariate regression analysis.

In the present study it was seen that family history of menstrual irregularities, family history of hypothyroidism, family history of PCOS and having multiple comorbidities were risk factors for polycystic ovarian disease. Similar results were also seen in various studies done in Agra[20], Jaipur[28], Tamil Nadu[37], Lucknow[47] and Kancheepuram[38]

METHODOLOGY

Source of Data

Female undergraduate and post-graduate students studying in medical, dental and nursing colleges of KLE Academy of higher education and research, Belagavi

Study design

Cross sectional study

Study period

January 2021 – December 2021

Study area

Medical, dental and nursing colleges of KAHER Belagavi

Sample size

810 female students by using proportionate to population size.

Sample size was calculated for a finite population of 1700 female students using the prevalence of 10%, based on the findings of a study conducted in South India.[32]

$n = Ny /[(N-1)] E^2+y]$

$y = Z^2_{1-\alpha /2}\ p\ (100 – p)$ or $Z^2_{1 – \alpha/2}\ p\ (1- p)$

where N is the population size

P is the proportion you are interested in

E is the marginal error

$Z^2_{1-\alpha/2}$ is the critical value for the confidence level

For $\alpha = 5\ \%$, E = 15% of p = 0.15 x 0.1 = 0.015

N = 1700, $\alpha = 5\%$, $Z^2_{1-\alpha/2} = 1.96$

$Y = (1.96)^2\ (0.1)\ (0.9) = 0.345$

$n = Ny/\ [(N-1)\ E^2 + y]$

$= 1700\ X\ 0.345/\ [\ 1699\ X\ (0.015)^2 + 0.345]$

$= 586.5\ /\ [\ 0.3822 + 0.345]$

$= 806.518 = 807 = 810$

So, 810 female students were chosen as study participants using proportionate to population size

Course	**No. of students**	**Proportion to size**	**Proportionate to undergraduate and postgraduate students**
Medical			
Undergraduate	550	382	263
Postgraduate	250		119
Total	800	382	**382**
Dental			
Undergraduate	400	214	190
Postgraduate	50		24
Total	450	214	214
Nursing			
Undergraduate	400	214	190
Postgraduate	50		24
Total	450	214	214
TOTAL	1700	810	810

Method of collection of data:

Before commencement of data collection, the list of medical, dental & nursing undergraduate and postgraduate students studying in each year was obtained from the respective college authorities.

Study tool:

Pre-tested and pre-designed questionnaire was used.

1) Information regarding socio demographic variables, menstrual history, clinical history, risk factors of PCOS was assessed.
2) Participants were assessed for the PCOS with the help of **Rotterdam's criteria**[12]

Presence of at least 2 criteria out of the 3 criteria was diagnosed as PCOS.

Modified Ferriman and Gallway [mFG] scale

Oligo/ Amenorrhea	Clinical Hyperandrogenism	Polycystic ovaries
Absence of menstruation for 45 days or more and/or less than 8 menses per year.	Modified Ferriman and Gallway[mFG] score of 8 or higher.	Presence of more than 10 cysts,2-8 mm in diameter, with increased ovarian volume of more than 10 cm^3, and an echo dense stroma in pelvic ultrasound scan.

Was used to assess clinical hyperandrogenism [Hirsutism over 9 body parts – upper lip, chin, chest, arm, upper abdomen, upper back, lower back and thigh]

Grading of 0 – 4 was used to assess hirsutism [minimum 0 and maximum 36]

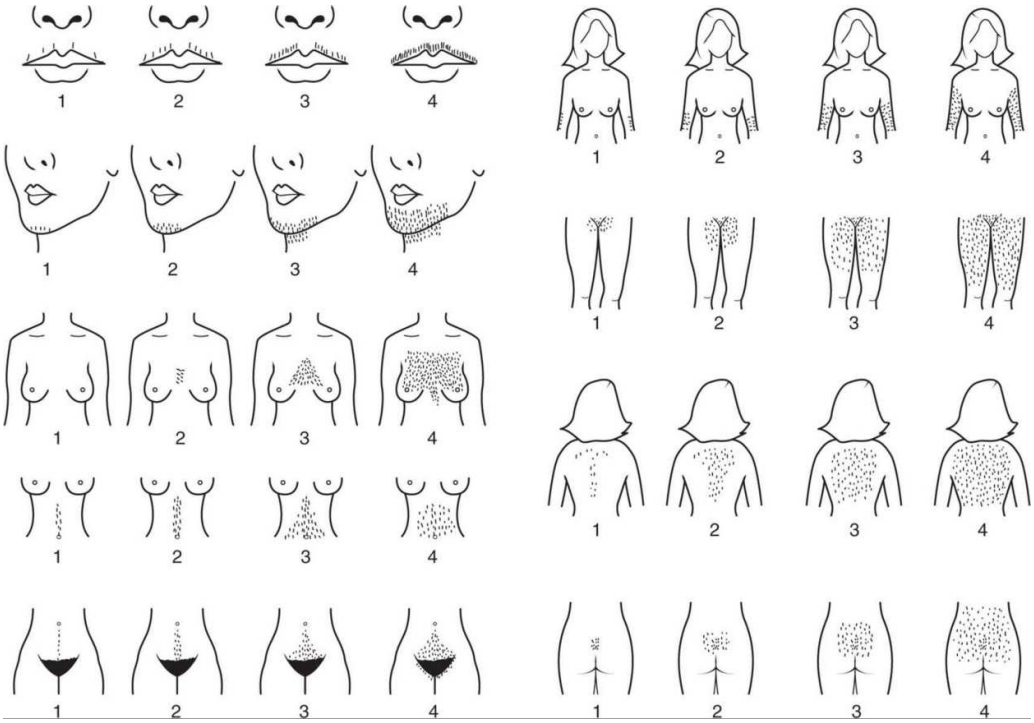
0 – complete lack of terminal hairs

1 – minimal presence of terminal hair

2 – more than minimal terminal hairs

3 – not too large hairs

4 – presence of terminal hairs.



Students who were not willing for examination of body hair distribution were assessed with the help of pictorial images of hirsutism. They were graded based on the following images showed to them.[53]

USG abdomen: Study participants were subjected to USG abdomen to check for polycystic ovaries on or before 5th day of last menstrual period to check for the presence of Polycystic ovaries.

***Ultrasound abdomen to detect polycystic ovaries was done by obstetrician and gynecologist.**

3) Anthropometric measurements: Height was measured using measuring tape.
Weight was measured using weighing machine.
Waist circumference and hip circumference was measured using measuring tape.

Inclusion criteria

Female students studying in medical, dental and nursing colleges of KAHER, Belagavi.

Females who have attained menarche more than 2 years before the study.

Female students who gave written informed consent.

Exclusion criteria

Cushing's syndrome and hyperprolactinemia.

Pregnant women.

Ethical clearance

The study was approved from Institutional Ethics Committee for Human Subject's Research, Jawaharlal Nehru Medical College, Belagavi, Letter No. MDC/DOME/79/25/01/2021

Informed consent

Written, informed consent and assent were taken from the study participants.

Statistical analysis

Data was analysed using R i386 4.0.3 software. Shapiro wilk's test was used to check the normality of variables. Categorical data is represented by frequency table and continuous data is represented by mean ± SD /median (range).

Chi-square test was done to see the association between categorical variables.

t-test was done to see the association between the continuous variables.

Logistic regression model was used to check the potential risk factors of PCOS.

$p < 0.05$ was considered as statistically significant.

DEFINITIONS OF STUDY VARIABLES

1. **Age:** Calendar age in years was considered for the study (nearest completed years).
2. **Religion**: "An organized system of beliefs, ceremonies, and rules used to worship a God or groups or Gods. For example: Hindu, Muslims and Christian".[54]
3. **Education status**:

Primary school: "A person who had studied from first to seventh standard".[55]

High school: "A person who had studied 8th standard to 12th standard".[55]

PUC or diploma: "Person who had studied up to PUC 2nd year or a Diploma course".[55]

Graduation: "A person who had a bachelor's degree in any field".[55]

Post -graduation: "A person who had a master's degree in any field".[55]

4. **Socio economic status[56]**

Modified B.G. Prasad's classification was used

The B.G. Prasad's scale was introduced in 1961 considering the base of Consumer Price Index Consumer price index (CPI) for 1960 as 100.

Consumer price Index for May 2021 (CPI-IW) 119.6

Multiplying factor = current index value for March 2021 (=119.6)/Base index value in 2016 (=100) =1.196

The new income value is calculated using the following equation:

= multiplication factor × old income value × 4.63 × 4.93.

Here 4.63 and 4.93 are the linking factors given by the Labour bureau of India.

So, after substituting the values, the new scale is,

Modified BG Prasad Socio-economic Classification

Socio-economic status: class	B. G. Prasad's classification of 1961 (monthly income in rupees)	Revised B.G. Prasad's classification for 2021(Monthly income in rupees)
I	100 and above	7863 and above
II	50-99	3931-7862
III	30-49	2359-3930
IV	15-29	1179-2358
V	Below 15	1179 and below

5. **Physical exercise**[57]

   Regular: "at least 5 days in a week"

   Irregular: "less than 5 days in a week"

6. **Menarche:** "Onset of first menstruation in life"

   It may happen in the age group 10-16 years, the peak time of onset 13 years.[4]

7. **Menorrhagia: "**Cyclic bleeding at normal intervals; the bleeding is either excessive in amount (> 80ml) or duration (>7 days) or both".[4]

8. **Oligomenorrhea:** "Menstrual bleeding occurring more than 45 days apart and which remains constant at that frequency".[12]

9. **Dysmenorrhea:** Painful menstruation of sufficient magnitude so as to incapacitate day to day activities.[4]

10. **Acanthosis nigricans**: represented by particular skin changes due to insulin resistance.

    Skin is thickened(hypertrophied) and pigmented.

    Frequently seen in sites like nape of the neck, inner thighs, groin and axilla.[4]

11. Clinical hyperandrogenism[58]:

    Hirsutism over 9 body parts – upper lip, chin, chest, arm, upper abdomen, upper back, lower back and thigh.

    No clinical hyperandrogenism – score less than 8

    Mild clinical hyperandrogenism – score 8 to 15

    Moderate clinical hyperandrogenism – score 16 to 26

    Severe clinical hyperandrogenism – score more than 26

Height measurement[59] **- "**The subject stood straight without footwear, with heels, buttocks and back touching the wall and arms hanging by side. The height was

measured from heal to heal. The coinciding reading was measured to the nearest 0.1 cm using a measuring tape".

Weight measurement[59] – "Body weight was measured without any foot wear and minimal clothing to the nearest 0.1 kilogram using a standard portable weighing machine, which was standardized periodically during the study. The scale was adjusted to zero before each session and weight was recorded in kilogram".

12. Waist circumference[60]

Waist circumference was measured by using flexible measuring tape to the nearest 0.1 cm with the student standing, and at the end of normal expiration at a point midway between the inferior margin of the lowest rib and the iliac crest.

Waist circumference ≥ 88 cm indicates increased risk of metabolic complications.

13. Hip circumference[60]

Hip circumference was measured at the maximum circumference around the buttocks

WHR > 0.85 in women reflects abdominal fat accumulation.

Waist-To-Hip Ratio (WHR) was calculated by dividing WC by HC.

14. Body Mass Index (BMI)[61]– According to the guidelines recommended by WHO, persons with BMI values of less than 18.5 were classified as "underweight", 18.5 to 24.9 were classified as "Normal Weight", 25 to 29.99 were classified as "over-weight" and 30 and above were classified as "Obese".

Body Mass Index was calculated as;

$$BMI = \frac{\text{Weight in Kgs}}{(\text{Height in Meter})^2}$$

Classification	**Body Mass Index**
Normal range	18.5 – 24.99
Overweight	≥25.00
Pre-obese	25.00-29.99
Obese class I	30.00-34.99
Obese class II	35.00-39.99
Obese class III	≥40.00

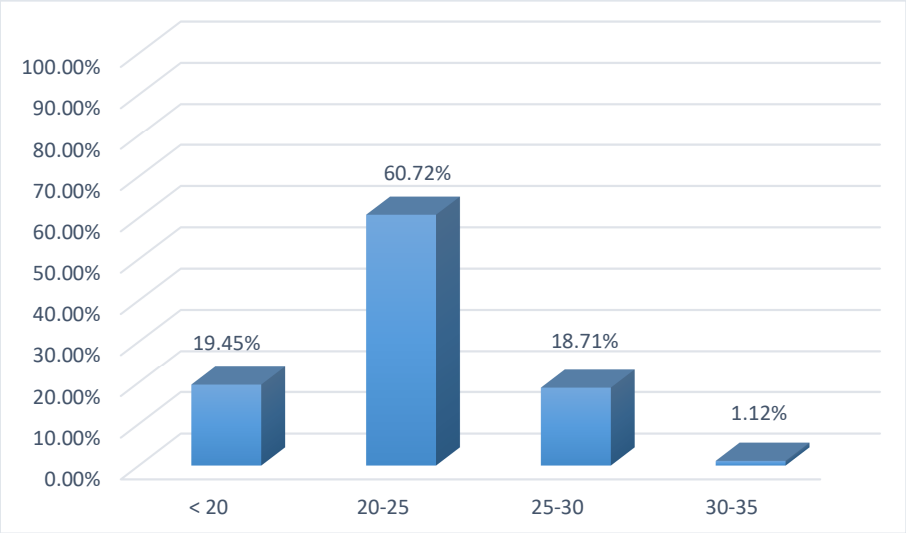
RESULTS

I. Socio-demographic profile of study participants

Table 1: Age distribution of study participants.

Age in years	Number	Percentage (%)
< 20	157	19.45
20-25	490	60.72
25-30	151	18.71
30-35	9	1.12
Total	807	100

Graph 1 (Table No 1). Age distribution of study participants

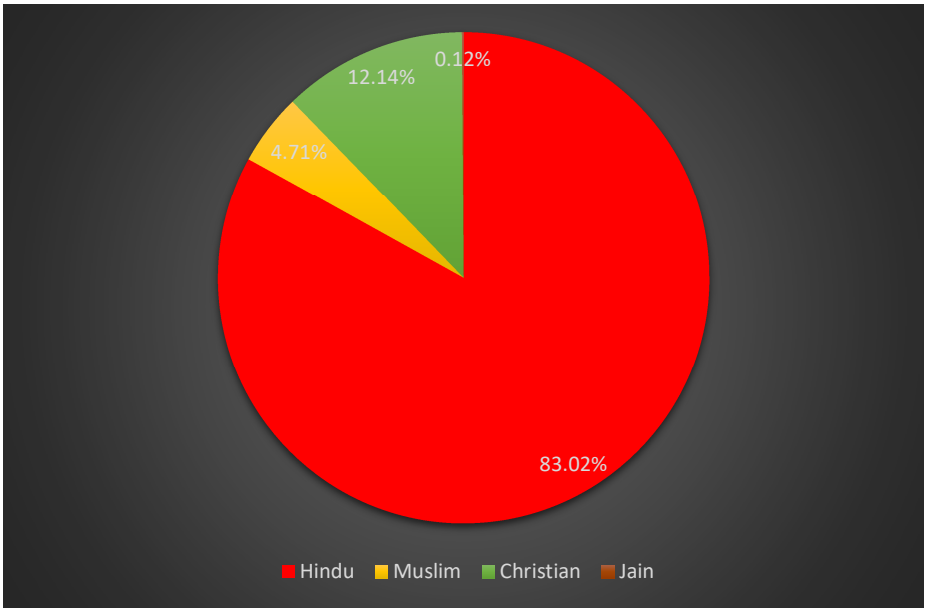


In the present study, out of 807 participants 157(19.45%) were aged 20 years or less, 490 (60.72%) were aged in between 20 to 25 years, 151 (18.71%) were aged between 25 to 30 years and nine (1.12%) were aged between 30 to 35 years. The mean age of the study participants was 22.02 ± 2.9 years. The median age of study participants is 21 years with range being 14 to 35 years.

Table 2: Distribution of study participants according to religion.

Religion	Number	Percentage (%)
Hindu	670	83.02
Muslim	38	4.71
Christian	98	12.14
Jain	01	0.12
Total	807	100

Graph 2 (Table No 2). Distribution of study participants according to religion

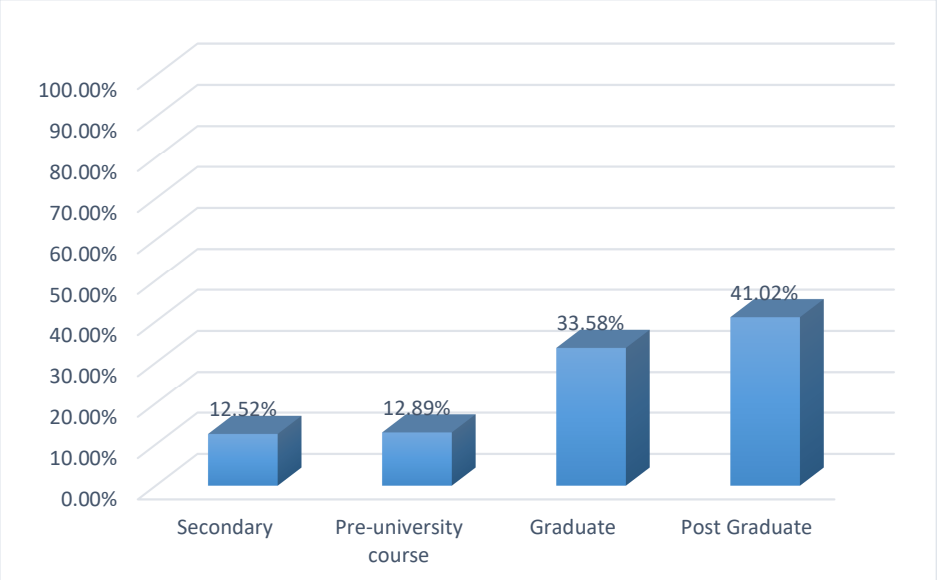


Out of 807 participants 670 (83.02%) belonged to Hindu religion, 38 (4.71%) belonged to Muslim religion, 98 (12.14%) belonged to Christian religion and only one (0.12%) belonged to Jain religion.

Table 3: Distribution of the study participants according to the literacy status of father.

Literacy status of father	Number	Percentage (%)
Secondary	101	12.52
Pre-university course	104	12.89
Graduate	271	33.58
Post Graduate	331	41.02
Total	807	100

Graph 3 (Table No 3). Distribution of the study participants according to the literacy status of father.

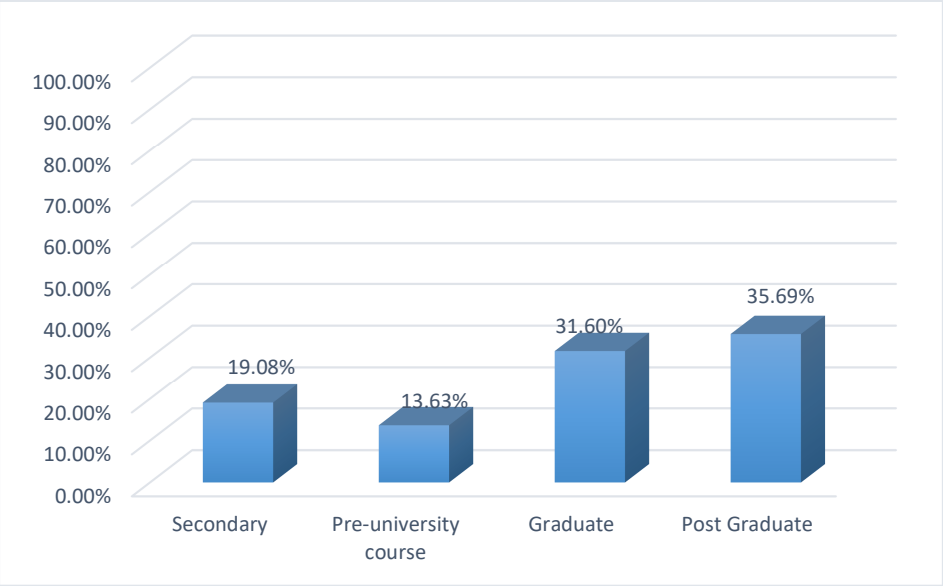


In this study, out of 807 participants, 101 (12.52%) of study participants fathers had completed secondary education, 104 (12.89%) of their fathers had completed pre-university course, 271 (33.58%) of their fathers were graduates and 331 (41.02%) of their fathers were postgraduates.

Table 4: Distribution of the study participants according to the Literacy status of mother.

Literacy status of mother	Number	Percentage (%)
Secondary	154	19.08
Pre-university course	110	13.63
Graduate	255	31.6
Post Graduate	288	35.69
Total	807	100

Graph 4 (Table No 4). Distribution of the study participants according to the Literacy status of mother.

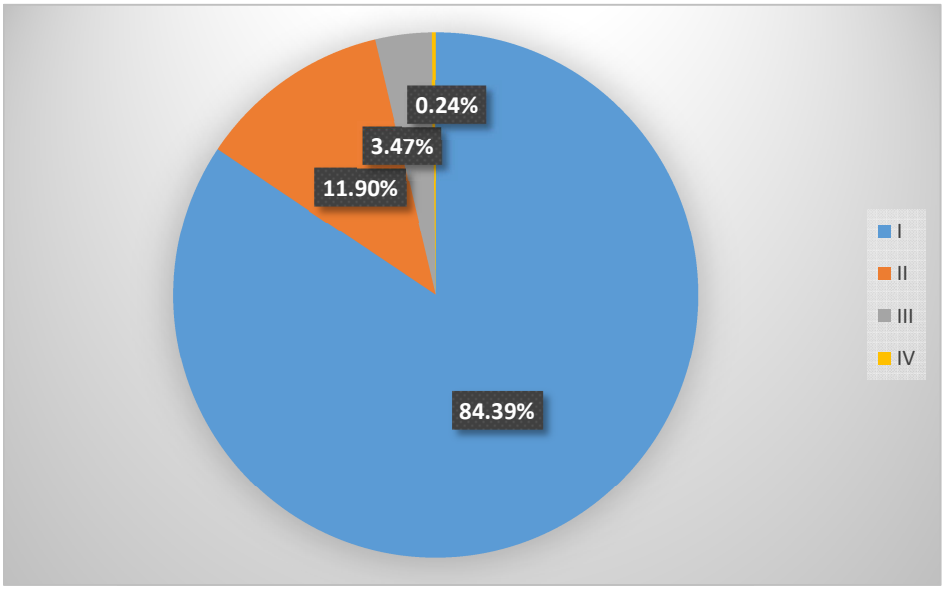


In the current study, out of 807 participants, 154 (19.08%) of study participants mothers had completed secondary education, 110 (13.63%) of their mothers had completed pre-university course, 255 (31.6%) of their mothers were graduates and 288 (35.69%) of their mothers were postgraduates.

Table 5: Distribution of study participants according to socio-economic status.

Socio economic status	Number	Percentage (%)
I	681	84.39
II	96	11.90
III	28	3.47
IV	02	0.24
Total	807	100

Graph 5 (Table No 5). Distribution of study participants according to socio-economic status.



In the current study, according to modified B.G. Prasad's classification majority 681 (84.39%) of the study participants belonged to socioeconomic class I, 96 (11.9%) belonged class II, 28 (3.47%) belonged to class III and only two (0.24%) belonged to class IV.

Table 6: Distribution of the study participants according to marital status.

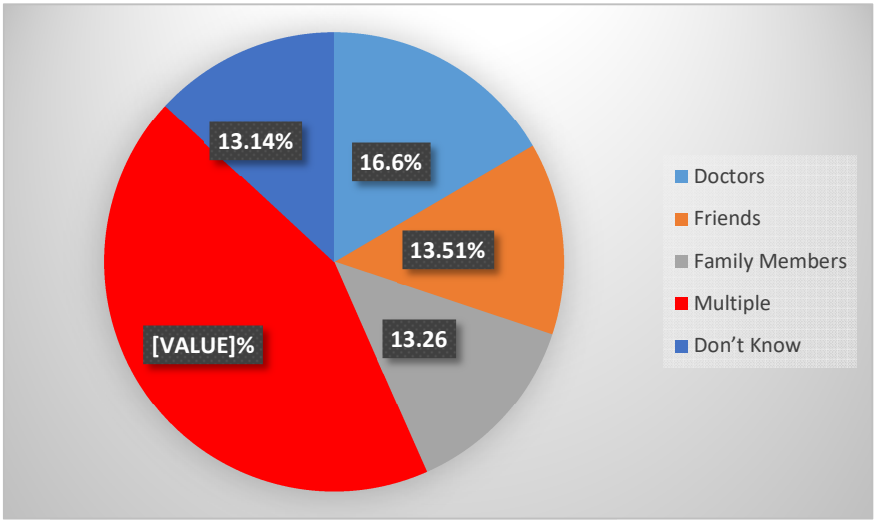
Marital status	Number	Percentage (%)
Unmarried	782	96.90
Married	25	3.10
Total	807	100

Out of 807 study participants, majority 782 (96.90%) of them were unmarried and only 25 (3.10%) of them were married.

Table 7: Distribution of study participants according to source of information about PCOS.

Source of information about PCOS	Number	Percentage (%)
Doctors	134	16.6
Friends	109	13.51
Family Members	107	13.26
Internet	351	43.49
Don't Know	106	13.14
Total	807	100

Graph 6 (Table no 7): Distribution of study participants according to source of information about PCOS.



Out of 807 study participants, 351 (43.49%) of them knew the information about PCOS from internet, 134 (16.6%) knew from doctors, 109 (13.51%) knew from friends, 107 (13.26%) knew about PCOS from family members, and 106 (13.14%) were unaware about PCOS.

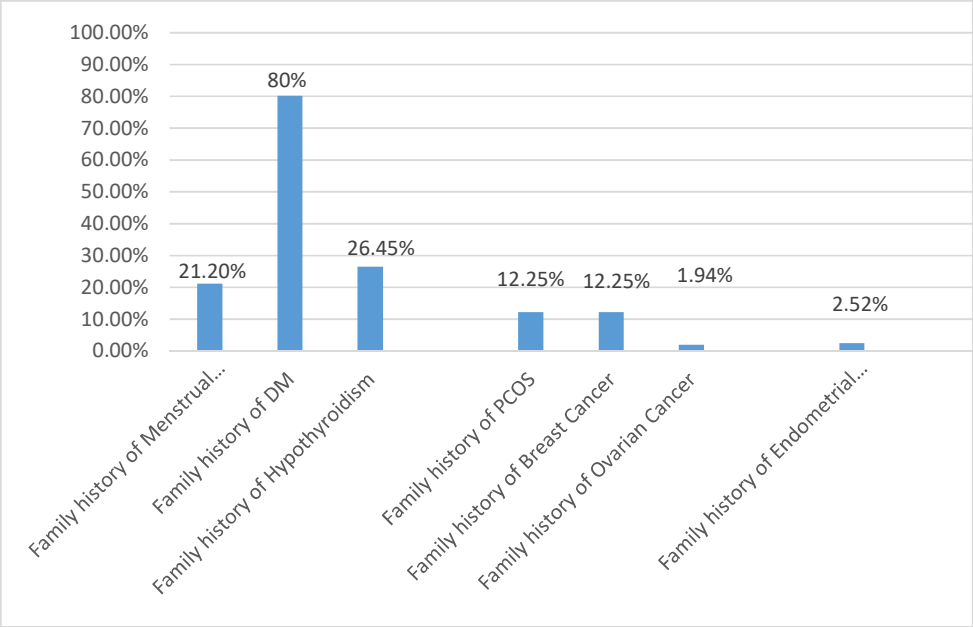
CLINICAL PROFILE OF THE STUDY PARTICIPANTS

Table 8: Distribution of study participants according to family history of diseases (n = 514)

Family history	Number	Percentage (%)
Family history of Menstrual irregularities	109	21.20%
Family history of Diabetes mellitus	412	80.15%
Family history of Hypothyroidism	136	26.45%
Family history of PCOS	63	12.25%
Family history of Breast Cancer	63	12.25%
Family history of Ovarian Cancer	10	1.94%
Family history of Endometrial Cancer	13	2.52%

***293 participants had no family history of any diseases.**

Graph 7 (Table no 8). Distribution of study participants according to family history of diseases.

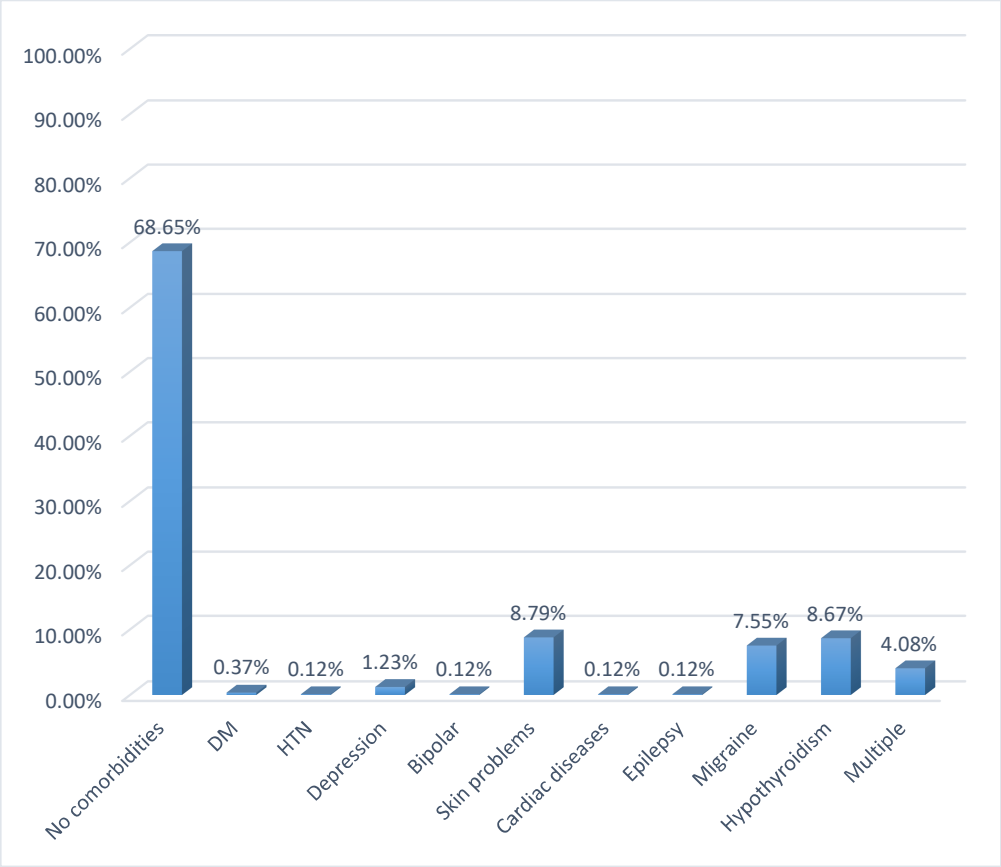


In our current study, out of 807 study participants, 109 (21.20%) of them had family history of menstrual irregularities, 412 (80.1%) had family history of diabetes mellitus, 136 (26.45%) of them had family history of hypothyroidism, 63 (12.25%) of them had family history of PCOS, 63 (12.25%) of them had family history of breast cancer, 10 (1.94%) of them had family history of ovarian cancer and 13 (2.52%) of them had family history of endometrial cancer.

Table 9: Distribution of study participants based on co-morbidities

Comorbidities	Number	Percentage (%)
No comorbidities	554	68.65
DM	03	0.37
HTN	01	0.12
Depression	10	1.23
Bipolar	01	0.12
Skin problems	71	8.79
Cardiac diseases	01	0.12
Epilepsy	01	0.12
Migraine	61	7.55
Hypothyroidism	70	8.67
Multiple	33	4.08
Total	807	100

Graph 8 (Table No 9). Distribution of study participants based on co-morbidities

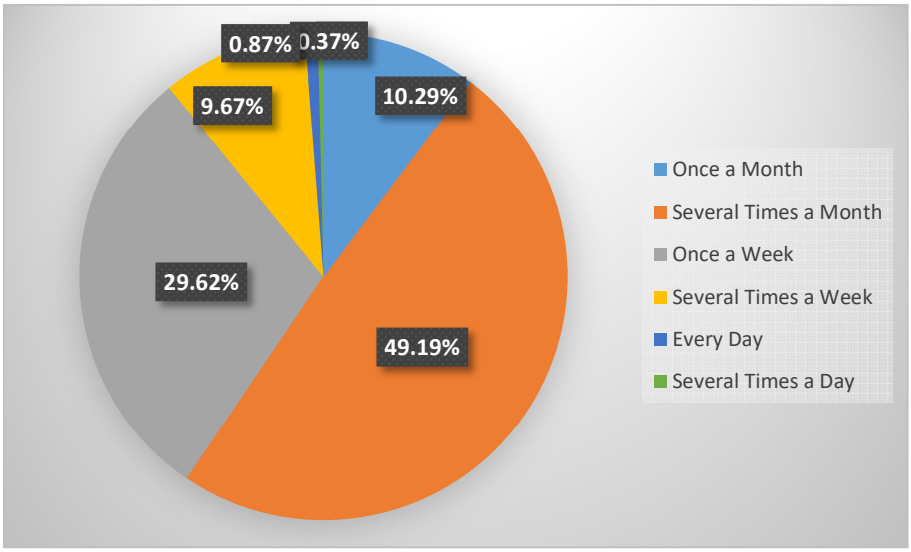


Out of 807 study participants, 554 (68.65%) of them had no comorbidities, 71(8.79%) had skin problems, 70 (8.67%) had hypothyroidism, 61 (7.55%) had migraine, 33 (4.08%) had multiple comorbidities, 10 (1.23%) had depression, three (0.37%) had diabetes, and one each (0.12%) had hypertension, cardiac diseases and epilepsy and bipolar disease respectively.

Table 10: Distribution of study participants based on consumption of pizza and burger.

Pizza and burger	Number	Percentage (%)
Once a Month	83	10.29
Several Times a Month	397	49.19
Once a Week	239	29.62
Several Times a Week	78	9.67
Every Day	7	0.87
Several Times a Day	3	0.37
Total	807	100

Graph 9 (Table 10). Distribution of study participants based on consumption of pizza and burger.

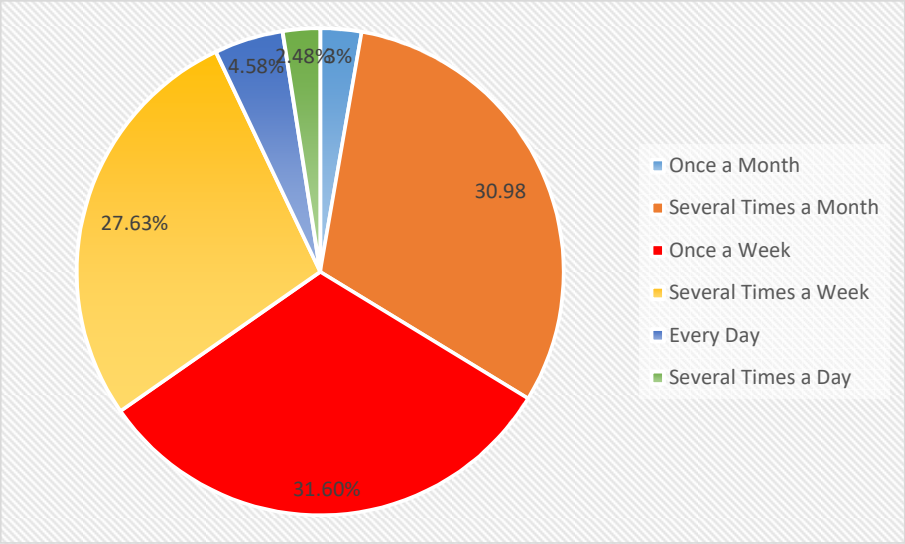


Out of 807 study participants, almost half 397 (49.19%) of them were consuming pizza and burger several times a month, 239 (29.62%) of them were consuming once a week, 83 (10.29 %) of them were consuming once a month, 78 (9.67%) of them were consuming several times a week, seven (0.87%) of them were consuming every day and only three (0.37%) of them were consuming pizza and burger several times a day.

Table 11: Distribution of study participants based on consumption of fried foods.

Fried foods	Number	Percentage (%)
Once a Month	22	2.73
Several Times a Month	250	30.98
Once a Week	255	31.60
Several Times a Week	223	27.63
Every Day	37	4.58
Several Times a Day	20	2.48
Total	807	100

Graph 10 (Table 11). Distribution of study participants based on consumption of fried foods.



Out of 807 study participants, 255 (31.6%) of them were consuming fried foods once a week, 250 (30.98%) of them were consuming several times a month, 223 (27.63%) of them were consuming several times a week, 37 (4.58%) of them were consuming every day, 22 (2.73%) of them were consuming once a month and 20 (2.48%) of them were consuming fried foods several times a day.

Table 12: Distribution of study participants based on menstrual history

Menstrual history		Number	Percentage (%)
Duration of menstrual cycle	< 45 Days	690	85.50
	> 45 Days	117	14.50
	Total	**807**	**100 %**
Length of menstrual cycle	< 2 days	11	1.36
	3-7 Days	759	94.05
	>7 days	37	4.58
	Total	**807**	**100 %**
History of passage of clots	Yes	309	38.29
	No	497	61.59
	Total	**807**	**100 %**
Dysmenorrhoea	Yes	422	52.29
	No	385	47.71
	Total	**807**	**100 %**

Out of 807 study participants, majority 690 (85.5%) had less than 45 days duration of menstrual cycle, 759 (94.05%) of them had 3-7 days length of menstrual cycle, 309 (38.29%) of them had history of passage of clots and almost half 422 (52.29%) of them had history of dysmenorrhea.

Table 13: Distribution of study participants based on clinical history of PCOS

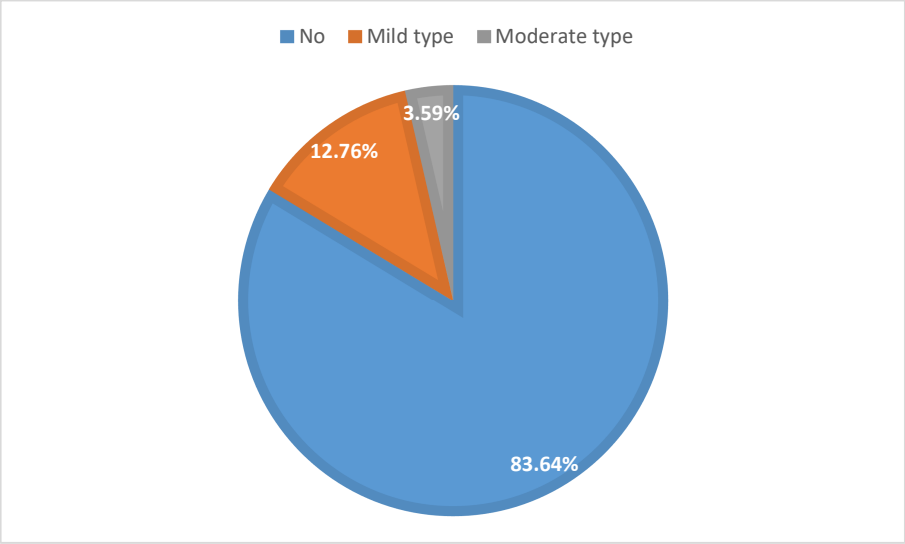
Clinical history of PCOS		Number	Percentage (%)
History of acne	Yes	414	51.3
	No	393	48.7
	Total	**807**	**100%**
Discoloration of skin behind the neck	Yes	118	14.62
	No	689	85.38
	Total	**807**	**100%**
History of excessive loss of hair	Yes	316	39.16
	No	491	60.84
	Total	**807**	**100%**
History of skin tags	Yes	58	7.19
	No	749	92.81
	Total	**807**	**100%**

Out of 807 study participants, almost half 414 (51.3%) of them had acne, 118 (14.62%) of them had discoloration of skin behind the neck, 316 (39.16%) of them had history of excessive hair loss and 58 (7.19 %) of them had skin tags.

Table 14: Distribution of study participants based on Clinical hyperandrogenism (Modified Ferriman Gallwey Scale)

Clinical hyperandrogenism	Number	Percentage (%)
No clinical hyperandrogenism	675	83.64
Mild type	103	12.76
Moderate type	29	3.59
Total	807	100

Graph 11 (Table 14). Distribution of study participants based on Clinical hyperandrogenism)



Out of 807 study participants, 675 (83.64%) of them had no clinical hyperandrogenism, 103 (12.76%) of them had mild type of clinical hyperandrogenism, 29 (3.59%) of them had moderate type of clinical hyperandrogenism. The overall mean score of clinical hyperandrogenism was 6.38 ± 3.44.

Table 15. Distribution of study participants according to PCOS status (n = 807)

PCOS Status	Number	Percentage (%)
Participants without polycystic ovarian syndrome	598	74.10%
Participants with polycystic ovarian syndrome (old cases)	103	12.76%
Rotterdams's criteria (New cases)		
Participants with oligomenorrhoea and clinical hyperandrogenism	34	4.21%
Participants with oligomenorrhoea and polycystic ovaries	33	4.09%
Participants with clinical hyperandrogenism and polycystic ovaries	39	4.83%
Total	**807**	**100%**

*Old cases = 103 (12.76%)

* New cases = 106 (13.13%)

* Overall prevalence = 209 (25.90%)

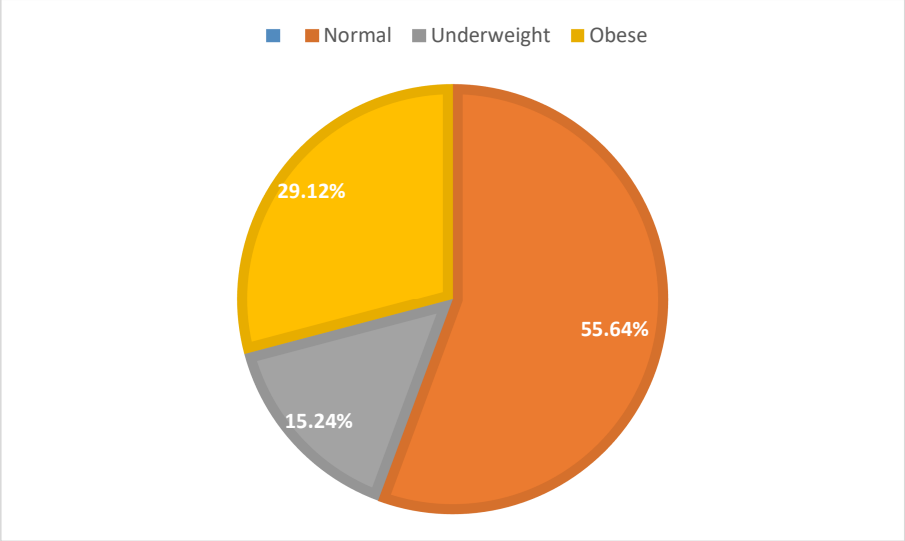
In the present study out of 807 study participants, 103(12.76%) of the study participants were known cases of PCOS. Using Rotterdam's criteria, 106 (13.13%) new cases were identified during this study. Out of 106 new cases, oligomenorrhoea and clinical hyperandrogenism was present among 34 (4.21%), oligomenorrhoea and polycystic ovaries was present in 33 (4.09%), clinical hyperandrogenism and polycystic ovaries was present in 39 (4.83%) participants. The overall prevalence of PCOS in the present study was 209 (25.90%).

II. ANTHROPOMETRIC PROFILE

Table 16: Distribution of study participants based on body mass index

Body mass index (kg/m^2)	Number	Percentage (%)
Normal weight	449	55.64
Underweight	123	15.24
Obese	235	29.12
Total	807	100

Graph 12 (Table 16). Distribution of study participants based on body mass index)



In the current study, out of 807 study participants, 449 (55.64%) of them had normal weight, 123 (15.24%) of them were underweight and 235 (29.12%) of them were obese.

Mean BMI, waist circumference, hip circumference and waist hip ratio of 807 participants was 22.92 ± 4.55, 81.55 ± 11.96, 98.2 ± 11 and 0.83 ± 0.06 respectively.

IV. Association between sociodemographic factors and PCOS

Table 17: Association between age and PCOS.

Age in years	PCOS		Total
	Absent	Present	
< 20	124 (78.98%)	33 (21.02%)	157 (100%)
20-25	358 (73.06%)	132 (26.94%)	490 (100%)
25-30	108 (71.52%)	43 (28.48%)	151 (100%)
30-35	08 (88.89%)	01 (11.11%)	09 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
$\chi^2 = 3.7726$	df = 3	p=0.2984 ^{MC}	

Abbreviations: MC: Monte-Carlo's simulation used in Chi-square test

In the current study, 33 (21.02 %) participants in the age group of 20 years or less had PCOS 132 (26.94%) participants in the age group of 20-25 years had PCOS, 43 (28.48%) participants in the age group of 25-30 years had PCOS, and one (11.11%) participant in the age group of 30-35 years had PCOS. Significant association was not found between age and PCOS ($p > 0.05$). Mean age of participants with PCOS was 22.08±2.74yrs and the mean age of participants without PCOS was 22.01±2.96yrs.

Table 18: Association between religion and PCOS

Religion	PCOS		Total
	Absent	Present	
Hindu	500 (74.62%)	170 (25.38%)	670 (100%)
Muslim	26 (68.42%)	12 (31.58%)	38 (100%)
Christian	71 (72.44%)	27 (27.56%)	98 (100%)
Jain	01 (100%)	0 (0%)	01 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
$\chi^2 = 1.2242$	df = 3		$p = 0.7261^{MC}$

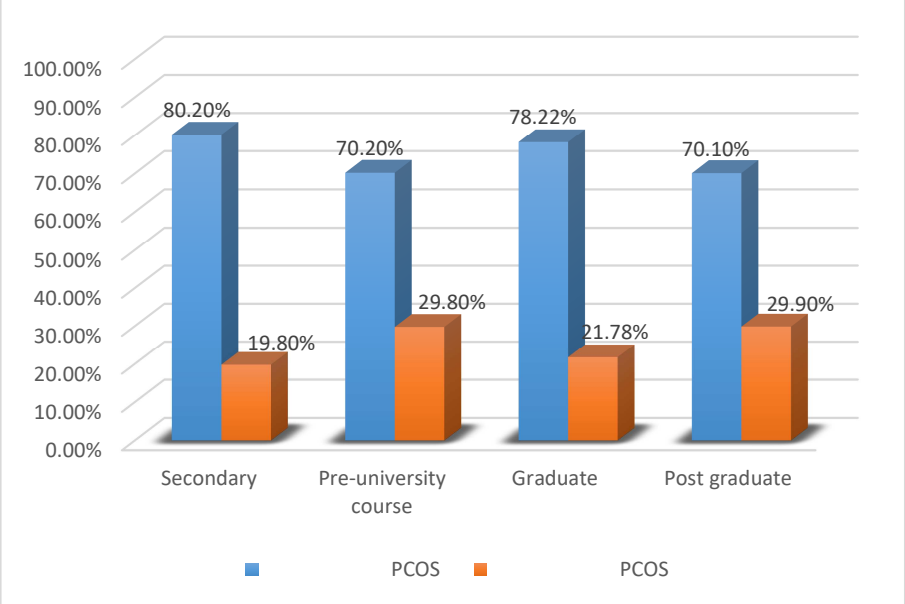
Abbreviations: MC: Monte-Carlo's simulation used in Chi-square test

In our study, out of 670 Hindu participants, 170 (25.38%) of them had PCOS. Out of 38 Muslim participants, 12 (31.58%) of them had PCOS. Out of 98 Christian participants, 27 (27.56%) of them had PCOS. Significant association was not found between religion and PCOS ($p > 0.05$).

Table 19: Association between literacy status of father and PCOS

Literacy status of father	PCOS		Total
	Absent	Present	
Secondary	81 (80.20%)	20 (19.80%)	101 (100%)
Pre-university course	73 (70.20%)	31 (29.80%)	104 (100%)
Graduate	212 (78.22%)	59 (21.78%)	271 (100%)
Post graduate	232 (70.10%)	99 (29.90%)	331 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
$\chi^2 = 7.9643$	df = 3		p = 0.04676

Graph 13 (Table 19). Association between literacy status of father and PCOS

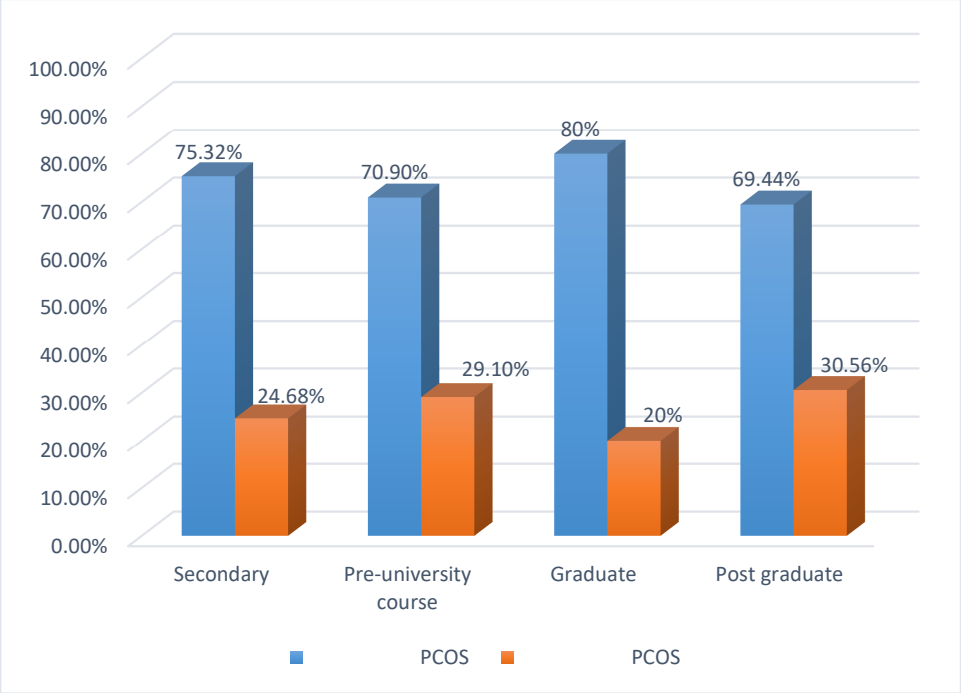


In our study, out of 331 participants, 99 (29.90%) of them had PCOS whose fathers were postgraduates. Out of 271 participants, 59 (21.78%) of them had PCOS whose fathers were graduates. Out of 104 participants, 31 (29.80%) of them had PCOS, whose fathers had pre- university education and out of 101 participants, 20 (19.80%) of them had PCOS, whose fathers had completed secondary education. Higher percentage of PCOS was found among the participants with increasing literacy status of their father. Significant association was found between literacy status of father and PCOS ($p < 0.05$).

Table 20: Association between literacy status of mother and PCOS

Literacy status of mother	PCOS		Total
	Absent	Present	
Secondary	116 (75.32%)	38 (24.68%)	154 (100%)
Pre-university course	78 (70.90%)	32 (29.10%)	110 (100%)
Graduate	204 (80%)	51 (20%)	255 (100%)
Post graduate	200 (69.44%)	88 (30.56%)	288 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
$\chi^2 = 8.5819$	df = 3	p = 0.0354	

Graph 14 (Table 20). Association between literacy status of mother and PCOS.



In our study out of 154 participants, whose mothers had completed secondary education 38 (24.68%) of them had PCOS. Out of 110 participants, whose mothers had completed pre-university education 32 (29.10%) of them had PCOS. Among 255 participants, whose mothers were graduates 51 (20%) of them had PCOS. Among 288 participants, whose mothers were post graduates 88 (30.56%) of them had PCOS. Higher percentage of PCOS was found among the participants with increasing literacy status of their mother. Significant association was found between literacy status of mother and PCOS ($p < 0.05$).

Table 21: Association between socioeconomic status and PCOS.

Socioeconomic status	PCOS		Total
	Absent	Present	
Class I	494 (72.54%)	187 (27.46%)	681 (100%)
Class II	77 (80.20%)	19 (19.80%)	96 (100%)
Class III	25 (89.28%)	3 (10.72%)	28 (100%)
Class IV	02 (100%)	0 (0%)	02 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
$\chi^2 = 6.7932$	df= 3	$p = 0.08596^{MC}$	

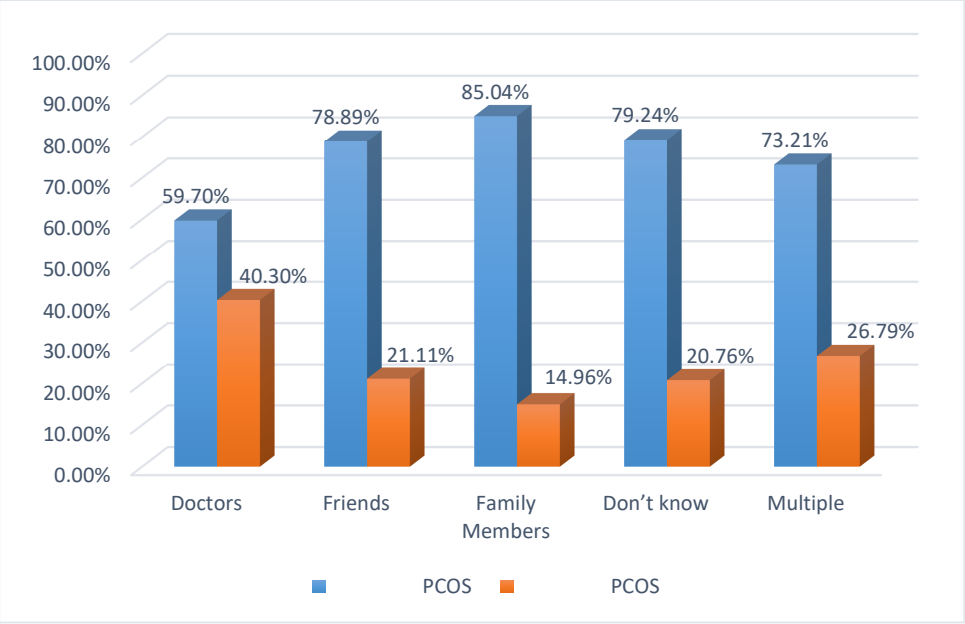
Abbreviations: MC: Monte-Carlo's simulation used in Chi-square test

In the current study 187 (27.46%), 19 (19.80%), three (10.72%) participants belonging to socio-economic class I, class II, class III respectively had PCOS. Higher percentage of PCOS was found among the participants belonging to socio-economic class I. However, significant association was not found between socio economic status and PCOS ($p > 0.05$).

Table 22: Association between source of information and PCOS.

Source of Information about PCOS	PCOS		Total
	Absent	Present	
Doctors	80 (59.70%)	54 (40.30%)	134 (100%)
Friends	86 (78.89%)	23 (21.11%)	109 (100%)
Family Members	91 (85.04%)	16 (14.96%)	107 (100%)
Don't know	84 (79.24%)	22 (20.76%)	106 (100%)
Internet	257 (73.21%)	94 (26.79%)	351 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
$\chi^2 = 24.069$	df = 4		$p < 0.0001$

Graph 15 (Table 22). Association between source of information and PCOS.



In our study out of 209 participants with PCOS, 54 (40.30%) of them knew about PCOS from doctors, 23 (21.11%) knew it from friends, 16 (14.96%) of them knew it from family members, 22 (20.76%) had no knowledge on PCOS and 94 (26.79%) of them knew it from internet. Significant association was found between source of information and PCOS ($p < 0.05$).

Table 23: Association between family history of diseases and PCOS

Family History		PCOS		Total	X^2	df	p
		Absent	Present				
Family history of menstrual irregularities	Yes	58 (53.21%)	51 (46.79%)	109 (100%)	28.658	1	< 0.0001
	No	540 (77.36%)	158 (22.64%)	698 (100%)			
	Total	598 (74.10%)	209 (25.90%)	807 (100%)			
Family history of Hypothyroidism	Yes	80 (58.82%)	56 (41.18%)	136 (100%)	20.186	1	< 0.0001
	No	518 (77.31%)	152 (22.69%)	670 (100%)			
	Total	598 (74.10%)	209 (25.90%)	807 (100%)			
Family history of Diabetes mellitus	Yes	294 (71.35%)	118 (28.65%)	412 (100%)	3.2986	1	0.0634
	No	304 (76.96%)	91 (23.04%)	395 (100%)			
	Total	598 (74.10%)	209 (25.90%)	807 (100%)			
Family history of breast cancer	Yes	45 (71.42%)	18 (28.58%)	63 (100%)	0.25442	1	0.614
	No	553 (74.32%)	191 (25.68%)	744 (100%)			
	Total	598 (74.10%)	209 (25.90%)	807 (100%)			
Family history of ovarian cancer	Yes	08 (80%)	02 (20%)	10 (100%)	0.18356	1	0.7476^{MC}
	No	590 (74.02%)	207 (25.98%)	797 (100%)			
	Total	598 (74.10%)	209 (25.90%)	807 (100%)			
Family history of Endometrial cancer	Yes	08 (61.53%)	05 (38.47%)	13 (100%)	1.0867	1	0.3363^{MC}
	No	590 (74.30%)	204 (25.70%)	794 (100%)			
	Total	598 (74.10%)	209 (25.90%)	807 (100%)			
Family history of PCOS	Yes	45 (71.42%)	18 (28.57%)	63 (100%)	0.2544	1	< 0.0001
	No	553 (74.32%)	191 (25.67%)	744 (100%)			
	Total	598 (74.10%)	209 (25.90%)	807 (100%)			

Abbreviations: MC: Monte-Carlo's simulation used in Chi-square test

In this study out of 109 participants with family history of menstrual irregularities, 51 (46.79%) had PCOS. Out of 136 participants with family history of hypothyroidism, 56 (41.18%) of them had PCOS. Out of 412 participants with family history of diabetes mellitus, 118 (28.65%) of them had PCOS. Out of 63 participants with family history of breast cancer, 18 (28.58%) of them had PCOS. Out of 10 participants with family history of ovarian cancer, two (20%) of them had PCOS. Out of 13 participants with family history of endometrial cancer, five (38.47%) of them had PCOS and out of 63 participants with family history of PCOS, 18 (28.57%) of them had PCOS. Significant association of PCOS was found only with family history of menstrual irregularities, family history of hypothyroidism and family history of PCOS ($p < 0.05$).

Table 24: Association between type of diet and PCOS

Type of diet	PCOS		Total
	Absent	Present	
Vegetarian	193 (75.98%)	61 (24.02%)	254 (100%)
Mixed	405 (73.23%)	148 (26.77%)	553 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
χ^2 =0.68457	df = 1		p = 0.408

In the present study, out of 254 participants consuming vegetarian diet, 61 (24.02%) had PCOS. Whereas among 553 participants consuming mixed diet, 148 (26.77%) had PCOS. Higher percentage of PCOS was found among participants who were consuming mixed diet. However, significant association was not found between type of diet and PCOS ($p > 0.05$).

Table 25: Association between physical exercise and PCOS

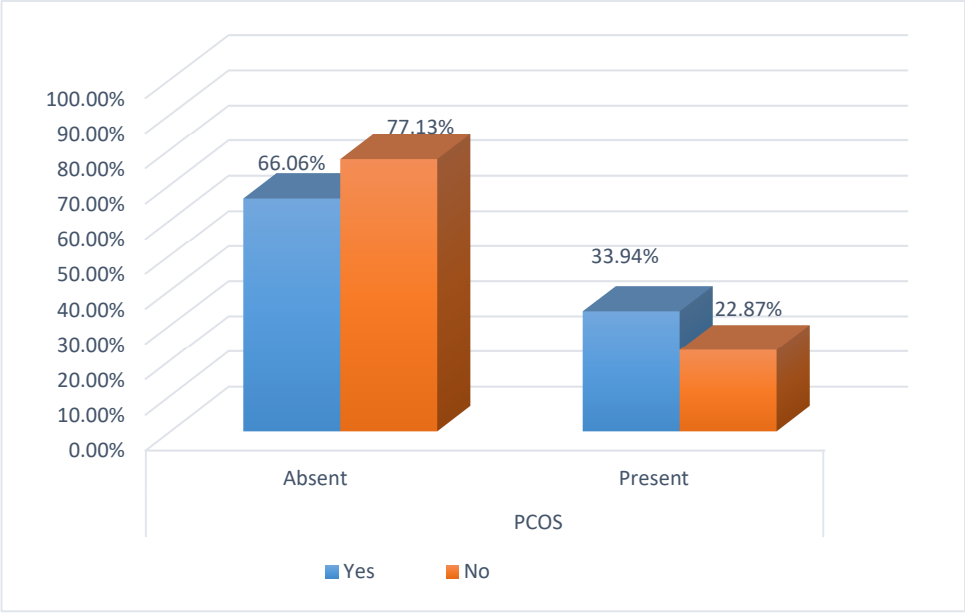
Physical Exercise	PCOS		Total
	Absent	Present	
Regular	152 (78.75%)	41 (21.25%)	193 (100%)
Irregular	446 (72.63%)	168 (27.37%)	614 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
χ^2 =2.864	df = 1		p = 0.09058

In our study, out of 193 participants exercising regularly, 41 (21.25%) had PCOS. Out of 614 participants exercising irregularly, 168 (27.37%) had PCOS. Higher percentage of PCOS was found among the participants who were doing irregular exercise. However, significant association was not found between physical exercise and PCOS ($p > 0.05$).

Table 26: Association between disturbed sleep in the night and PCOS.

Disturbed sleep in the night	PCOS		Total
	Absent	Present	
Yes	146 (66.06%)	75 (33.94%)	221 (100%)
No	452 (77.13%)	134 (22.87%)	586 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
χ^2 =10.247	df = 1	p = 0.001369	

Graph 16 (Table 26). Association between disturbed sleep in the night and PCOS.

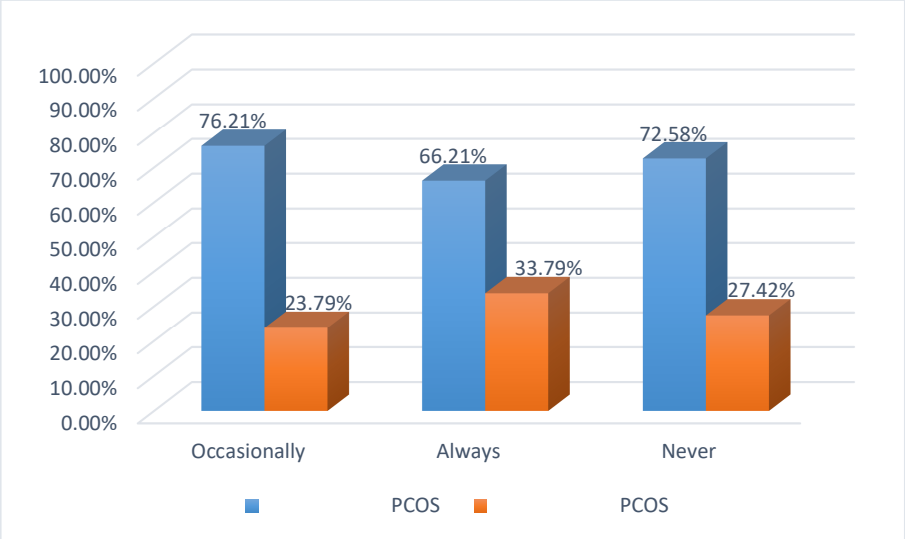


In this study, out of 221 participants with disturbed sleep, 75 (33.94%) had PCOS. Out of 586 participants without disturbed sleep, 134 (22.87%) had PCOS. Significant association was found between disturbed sleep in the night and PCOS ($p < 0.05$).

Table 27: Association between feeling sleepy in the afternoon and PCOS.

Feeling Sleepy in the Afternoon	PCOS		Total
	Absent	Present	
Occasionally	455 (76.21%)	142 (23.79%)	597 (100%)
Always	98 (66.21%)	50 (33.79%)	148 (100%)
Never	45 (72.58%)	17 (27.42%)	62 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
χ^2 =6.2586	df = 2	p = 0.04375	

Graph 17 (Table 27). Association between feeling sleepy in the afternoon and PCOS.



In the present study, 142 (23.79%) study participants who felt sleepy occasionally, 50 (33.79%) who felt sleepy always and 17 (27.42%) who never felt sleepy had PCOS. Significant association was found between feeling sleepy in the afternoon and PCOS ($p < 0.05$).

Table 28: Association between comorbidities and PCOS

Comorbidities		PCOS		Total	χ^2	df	p-value
		Absent	Present				
Diabetes Mellitus	**Yes**	2 (0.33%)	1 (0.48%)	3 (100%)	**0.08673**	1	1^{MC}
	No	596 (99.67%)	208 (99.52%)	804(100%)			
Hypertension	**Yes**	1 (0.17%)	0 (0%)	1(100%)	**0.34993**	1	1^{MC}
	No	597 (99.83%)	209 (100%)	806(100%)			
Depression	**Yes**	8 (1.34%)	2 (0.96%)	10(100%)	**0.18356**	1	0.7471
	No	590 (98.66%)	207 (99.04%)	797(100%)			
Bipolar	**Yes**	1 (0.17%)	0 (0%)	1(100%)	**0.34993**	1	1^{MC}
	No	597 (99.83%)	209 (100%)	806(100%)			
Skin problems	**Yes**	50 (8.36%)	21 (10.05%)	71(100%)	**0.54907**	1	0.4953
	No	548 (91.64%)	188 (89.95%)	736(100%)			
Cardiac diseases	**Yes**	1 (0.17%)	0 (0%)	1(100%)	**0.34993**	1	1^{MC}
	No	597 (99.83%)	209 (100%)	806(100%)			
Epilepsy	**Yes**	1 (0.17%)	0 (0%)	1(100%)	**0.34993**	1	1^{MC}
	No	597 (99.83%)	209 (100%)	806(100%)			
Migraine	**Yes**	41 (6.86%)	20 (9.57%)	61(100%)	**1.6316**	1	0.2339^{MC}
	No	557 (93.14%)	189 (90.43%)	746(100%)			
Hypothyroidism	**Yes**	27 (38.57%)	43 (61.42%)	70 (100%)	**50.42**	1	0.0004998^{MC}
	No	571 (77.47%)	166 (22.52%)	737 (100%)			
Multiple	**Yes**	11 (32.35%)	23 (67.64%)	34 (100%)	**32.237**	1	0.0004998^{MC}
	No	587 (75.93%)	186 (24.06%)	773 (100%)			

Abbreviations: MC: Monte-Carlo's simulation used in Chi-square test

In this current study, among three participants with diabetes mellitus, one (0.48%) had PCOS. Among 10 participants with depression, two (0.96) had PCOS. Out of 71 participants with skin problems, 21 (10.05%) had PCOS. Out of 61 participants with migraine, 20 (9.57%) had PCOS. Out of 70 participants with hypothyroidism, 43 (20.57%) had PCOS. Out of 34 participants with multiple comorbidities, 23 (11%) had PCOS. Significant association of PCOS was found only with hypothyroidism and multiple comorbidities.

Table 29: Association between consumption of bakery items and PCOS.

Bakery Items	PCOS		Total
	Absent	Present	
Once a Month	21 (63.63%)	12 (36.37%)	33 (100%)
Several Times a Month	137 (71.72%)	54 (28.28%)	191 (100%)
Once a Week	272 (77.27%)	80 (22.73%)	352 (100%)
Several Times a Week	129 (72.47%)	49 (27.53%)	178 (100%)
Every Day	31 (75.60%)	10 (24.40%)	41 (100%)
Several Times a Day	08 (66.66%)	04 (33.34%)	12 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
χ^2=4.9291	df = 5	p = 0.4238 ^{MC}	

Abbreviations: MC: Monte-Carlo's simulation used in Chi-square test

In the present study, 12 (36.37%) participants who consumed bakery items once a month, 54 (28.28%) who consumed several times a month, 80 (22.73%) who consumed once a week, 49 (27.53%) who consumed several times a week, 10 (24.40%) who consumed every day and four (33.34%) who consumed bakery items several times a day had PCOS. Significant association was not found between consumption of bakery items and PCOS ($p > 0.05$).

Table 30: Association between consumption of aerated drinks and PCOS.

Aerated Drinks	PCOS		Total
	Absent	Present	
Once a Month	161 (79.31%)	42 (20.69%)	203 (100%)
Several Times a Month	204 (70.83%)	84 (29.17%)	288 (100%)
Once a Week	139 (77.22%)	41 (22.78%)	180 (100%)
Several Times a Week	75 (71.42%)	30 (28.58%)	105 (100%)
Every Day	13 (59.01%)	09 (40.91%)	22 (100%)
Several Times a Day	06 (66.66%)	03 (33.34%)	09 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
χ^2=8.6194 df = 5		p = 0.1119^{MC}	

Abbreviations: MC: Monte-Carlo's simulation used in Chi-square test

In the current study, 84 (29.17%) participants who consumed aerated drinks several times a month, 42 (20.69%) who had once month, 41 (22.78%) who had once a week, 30 (28.58%) who had several times a week, nine (40.91%) of them who had every day and three (33.34%) who consumed several times a day had PCOS. Higher percentage of PCOS was found among the participants who were consuming aerated drinks daily. However, significant association was not found between consumption of aerated drinks and PCOS ($p > 0.05$).

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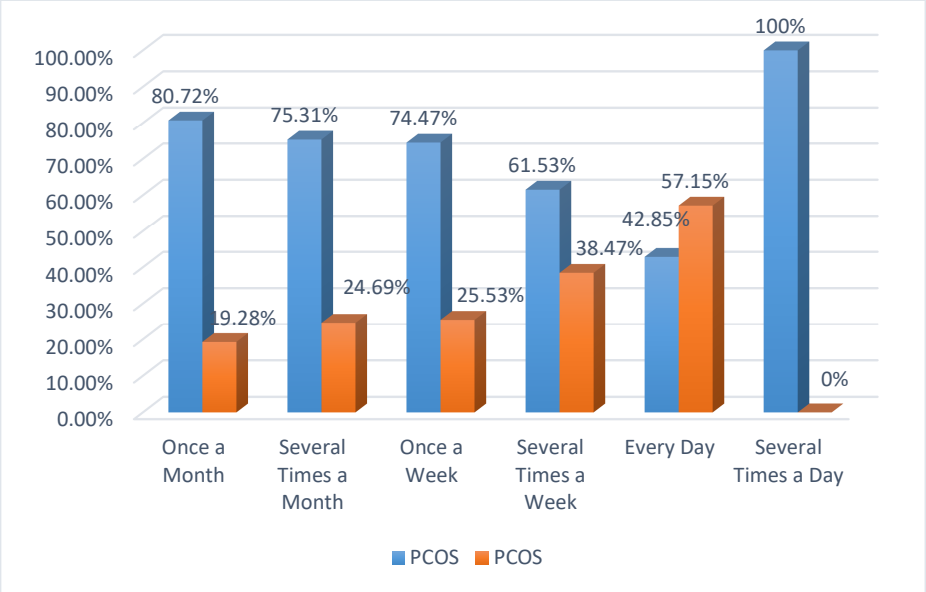
Table 31: Association between consumption of pizza and burger and PCOS.

Pizza and Burger	PCOS		Total
	Absent	Present	
Once a Month	67 (80.72%)	16 (19.28%)	83 (100%)
Several Times a Month	299 (75.31%)	98 (24.69%)	397 (100%)
Once a Week	178 (74.47%)	61 (25.53%)	239 (100%)
Several Times a Week	48 (61.53%)	30 (38.47%)	78 (100%)
Every Day	03 (42.85%)	04 (57.15%)	07 (100%)
Several Times a Day	03 (100%)	0 (0%)	3 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
χ^2=13.242	df = 5		p = 0.01649^{MC}

Abbreviations: MC: Monte-Carlo's simulation used in Chi-square test

Graph 18 (Table 31). Association between consumption of pizza and burger and PCOS.



In the current study, 16 (19.28%) study participants who consumed pizza and burger once a month, 98 (24.69%) who consumed several times a month, 61 (25.53%) who consumed once a week, 30 (38.47%) who consumed several times a week, four (57.15%) who consumed every day had PCOS. Higher percentage of PCOS was found among the participants who were consuming pizza and burger daily. Significant association of PCOS was found with consumption of pizza and burger ($p < 0.05$).

Table 32: Association between consumption of chat items and PCOS.

Chat Items	PCOS		Total
	Absent	Present	
Once a Month	75 (75.75%)	24 (24.25%)	99 (100%)
Several Times a Month	253 (71.26%)	102 (28.74%)	355 (100%)
Once a Week	186 (78.81%)	50 (21.19%)	236 (100%)
Several Times a Week	73 (72.27%)	28 (27.73%)	101 (100%)
Every Day	03 (42.85%)	04 (57.15%)	07 (100%)
Several Times a Day	08 (88.88%)	01 (11.12%)	09 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
χ^2=9.1189	df = 5	p = 0.1014^{MC}	

Abbreviations: MC: Monte-Carlo's simulation used in Chi-square test

In the current study, 102 (28.74%) participants who consumed chat items several times a month, 50 (21.19%) who consumed chat items once a week, 28 (27.73%) who consumed chat items several times a week, 24 (24.25%) who consumed chat items once a month, one (11.12%) who consumed chat items several times day, four (1.91%) who consumed chat items every day had PCOS. Higher percentage of PCOS was found among the participants who were consuming chat items daily. However, significant association was not found between consumption of chat items and PCOS ($p > 0.05$).

Table 33: Association between consumption of Chinese food and PCOS.

Chinese food	PCOS		Total
	Absent	Present	
Once Month	106 (73.61%)	38 (26.39%)	144 (100%)
Several Times Month	274 (73.45%)	99 (26.55%)	373 (100%)
Once Week	157 (76.58%)	48 (23.42%)	205 (100%)
Several Times Week	55 (70.51%)	23 (29.49%)	78 (100%)
Every Day	06 (85.71%)	01 (14.29%)	07 (100%)
Several Times Day	0 (0%)	0 (0%)	0 (0%)
Total	598 (74.10%)	209 (25.90%)	100%
$\chi^2 = 1.7728$	df = 5		$p = 0.7821^{MC}$

Abbreviations: MC: Monte-Carlo's simulation used in Chi-square test

In the present study, 99 (26.55%) participants consumed Chinese food several times a month, 48 (23.42%) consumed once a week, 38 (26.39%) consumed once a month, 23 (29.49%) consumed several times a week, one (14.29%) consumed every day and none of them consumed several times a day had PCOS. Higher percentage of PCOS was found among the participants who were consuming Chinese foods several times a week. However, significant association was not found between consumption of Chinese food and PCOS ($p > 0.05$).

Table 34: Association between consumption of fried foods and PCOS.

Fried Foods	PCOS		Total
	Absent	Present	
Once a Month	17 (77.27%)	05 (22.73%)	22 (100%)
Several Times a Month	195 (78%)	55 (22%)	250 (100%)
Once a Week	192 (75.29%)	63 (24.71%)	255 (100%)
Several Times a Week	148 (66.36%)	75 (33.64%)	223 (100%)
Every Day	29 (78.37%)	08 (21.63%)	37 (100%)
Several Times a Day	17 (85%)	03 (15%)	20 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
χ^2=10.825	df = 5	p = 0.05747^{MC}	

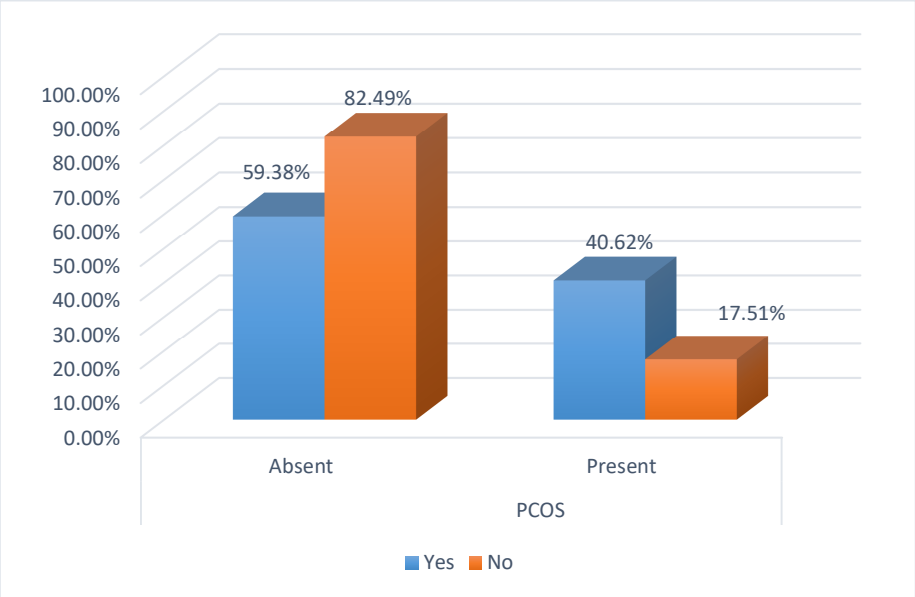
Abbreviations: MC: Monte-Carlo's simulation used in Chi-square test

In the current study, 63 (24.71%) who consumed fried foods once a week, 55 (22%) who consumed fried foods several times a month, 75 (33.64%) who consumed fried foods several times a week, eight (21.63%) who consumed fried foods every day, five (22.73%) who consumed fried foods once a month and three (15%) who consumed fried foods several times a day had PCOS. Higher percentage of PCOS was found among the participants who were consuming fried foods several times a week. Significant association was found between consumption of fried foods and PCOS (p = 0.05).

Table 35: Association between difficulty in staying in ideal weight and PCOS.

Difficulty in Staying in Ideal Weight	PCOS		Total
	Absent	Present	
Yes	174 (59.38%)	119 (40.62%)	293 (100%)
No	424 (82.49%)	90 (17.51%)	514 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
χ^2=51.91	df = 1	p < 0.0001	

Graph 19 (Table 35). Association between difficulty in staying in ideal weight and PCOS.

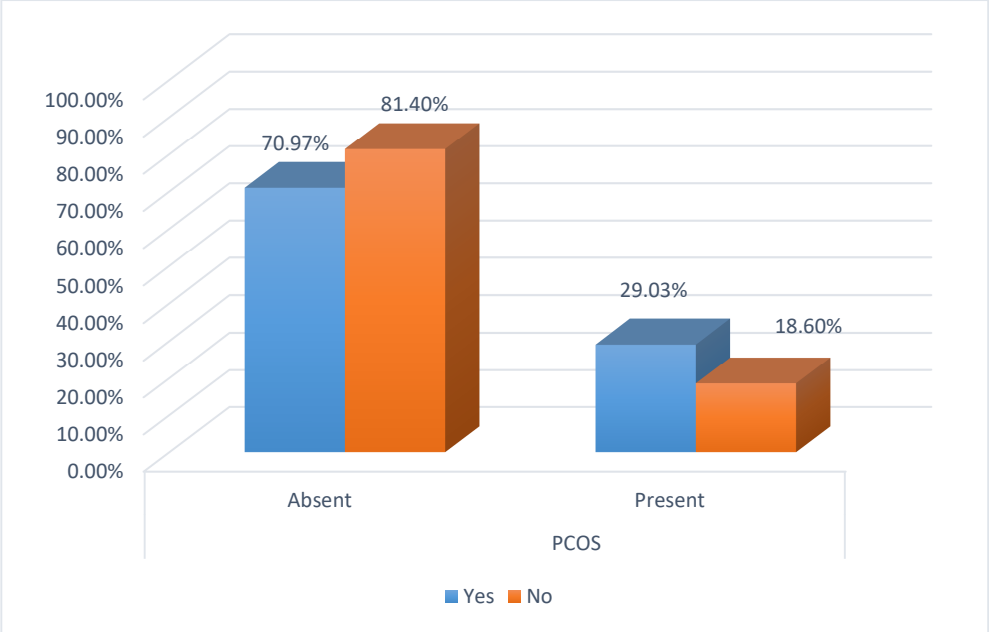


In this study out of 293 study participants who had difficulty in staying in ideal weight, 119 (40.62%) of participants had PCOS. Higher percentage of PCOS participants had difficulty in staying in ideal weight. Significant association was found between difficulty in staying in ideal weight and PCOS ($p < 0.05$).

Table 36: Association between mood changes and PCOS.

Mood Changes	PCOS		Total
	Absent	Present	
Yes	401 (70.97%)	164 (29.03%)	565 (100%)
No	197 (81.40%)	45 (18.60%)	242 (100%)
Total	598 (74.1%)	209 (25.90%)	807 (100%)
χ^2=21.949	df = 1		p < 0.0001

Graph 20 (Table 36). Association between mood changes and PCOS.



In the current study out of 565 participants with mood changes, 164 (29.03%) participants had PCOS. Among 242 participants, 45 (18.60%) without mood changes had PCOS. This difference was found to be statistically significant (p < 0.05).

Table 37: Association between menstrual history and PCOS

Menstrual history		PCOS		Total	X^2	df	p-value
		Absent	Present				
Duration Of Menstrual Cycle	< 45 Days	592 (85.79%)	98 (14.21%)	690 (100%)	339.21	1	< 0.00001
	> 45 Days	06 (5.12%)	111 (94.88%)	117 (100%)			
	Total	**598 (74.1%)**	**209 (25.90%)**	**807 (100%)**			
Length of menstrual cycle	<2 Days	03 (27.27%)	08 (72.73%)	11 (100%)	75.767	1	< 0.00001[MC]
	3-7 Days	588 (77.47%)	171 (22.53%)	759 (100%)			
	>7 Days	07 (18.91%)	30 (81.09%)	37 (100%)			
	Total	**598 (74.1%)**	**209 (25.90%)**	**807 (100%)**			
Passage of Clots during menstrual cycle	Yes	195 (63.10%)	114 (36.90%)	309 (100%)	31.541	1	< 0.00001
	No	403 (81.08%)	95 (18.92%)	497 (100%)			
	Total	**598 (74.1%)**	**209 (25.90%)**	**807 (100%)**			
Dysmenorrhoea	Yes	289 (68.48%)	133 (31.52%)	422 (100%)	14.549	1	0.00013
	No	309 (80.25%)	76 (19.75%)	385 (100%)			
	Total	**598 (74.1%)**	**209 (25.90%)**	**807 (100%)**			

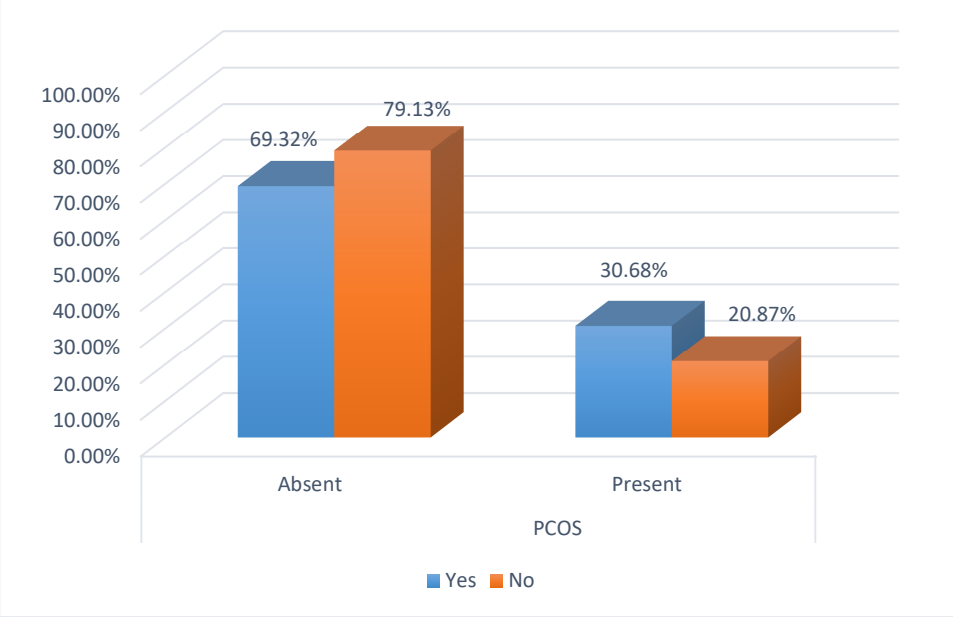
Abbreviations: MC: Monte-Carlo's simulation used in Chi-square test

In this study out of 117 participants with more than 45 days duration of menstrual cycle, 111 (94.88%) had PCOS. Among 11 participants with less than two days length of menstrual cycle, majority eight (72.73%) had PCOS. Out of 37 participants with more than seven days length of menstrual cycle 30 (81.09%) had PCOS. Out of 309 participants who had history of passage of clots during menstrual cycle, 114 (36.90%) had PCOS. Among 422 participants with dysmenorrhea, 133 (31.52%) of them had PCOS. Higher percentage of PCOS was found among participants with menstrual cycle more than 45 days, length of menstrual cycle of less than two days or more than seven days, history of passage of clots and dysmenorrhea which was found to be statistically significant ($p < 0.05$).

Table 38: Association between history of acne and PCOS.

History of Acne	PCOS		Total
	Absent	Present	
Yes	287 (69.32%)	127 (30.68%)	414 (100%)
No	311 (79.13%)	82 (20.87%)	393 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
χ^2=10.113	df = 1		p = 0.001473

Graph 21 (Table 38). Association between history of acne and PCOS.

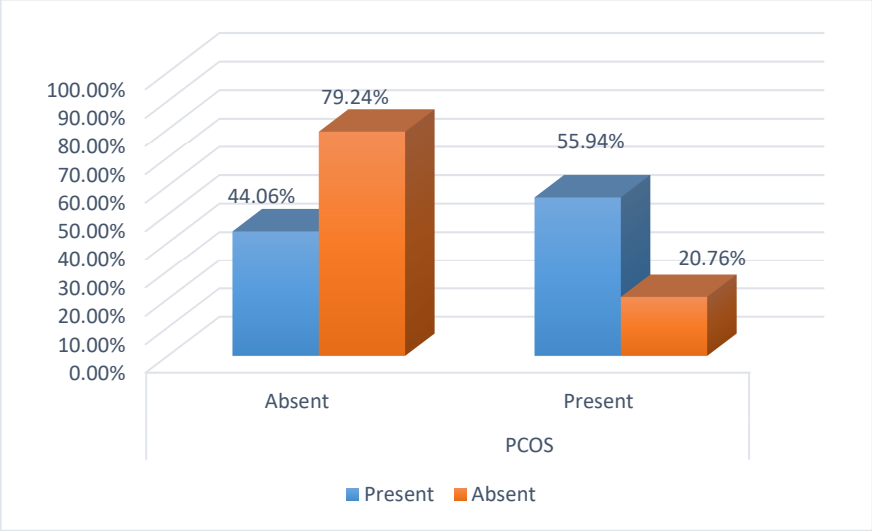


In this study out of 414 study participants, 127 (30.68%) participants with acne had PCOS. Out of 393 participants without history of acne 82 (20.8%) had PCOS. This difference was found to be statistically significant ($p < 0.05$).

Table 39: Association between dis-coloration of skin behind the neck and PCOS

Dis-coloration of kin behind the neck	PCOS		Total
	Absent	Present	
Present	52 (44.06%)	66 (55.94%)	118 (100%)
Absent	546 (79.24%)	143 (20.76%)	689 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
χ^2=65.982	df = 1	p < 0.00001	

Graph 22 (Table 39). Association between dis-coloration of skin behind the neck and PCOS.

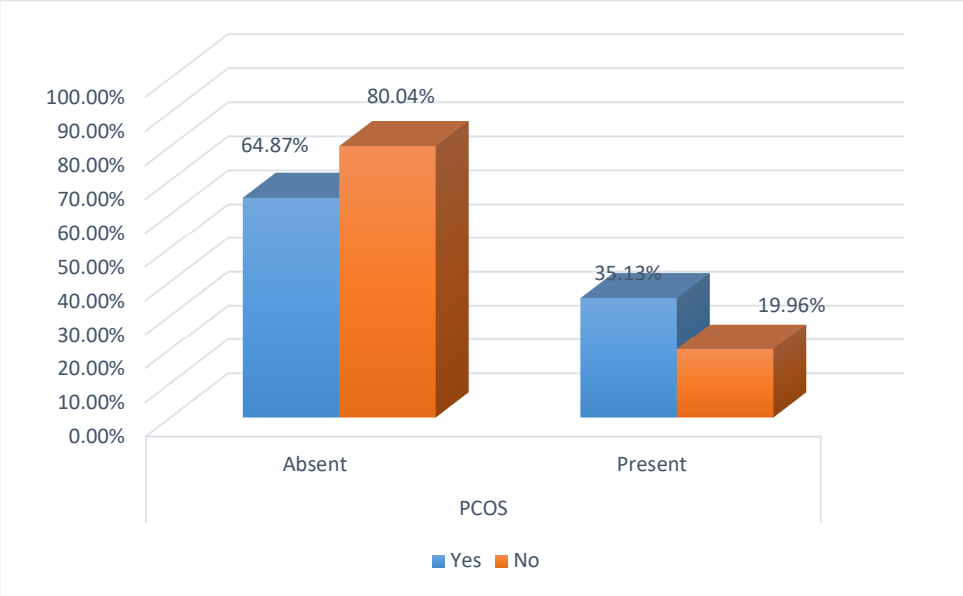


In the present study out of 118 participants with discoloration of skin behind the neck, 66 (55.94%) had PCOS and out of 689 participants without discoloration of skin behind the neck143 (20.76%) had PCOS. In this study discoloration of skin behind the neck was found more among participants with PCOS which was found to be statistically significant ($p < 0.05$).

Table 40: Association between excessive loss of hair and PCOS.

Excessive loss of hair	PCOS		Total
	Absent	Present	
Yes	205 (64.87%)	111 (35.13%)	316 (100%)
No	393 (80.04%)	98 (19.96%)	491 (100%)
Total	598 (74.1%)	209 (25.90%)	807 (100%)
χ^2=23.047	df = 1		p < 0.00001

Graph 23 (Table 40). Association between excessive loss of hair and PCOS.



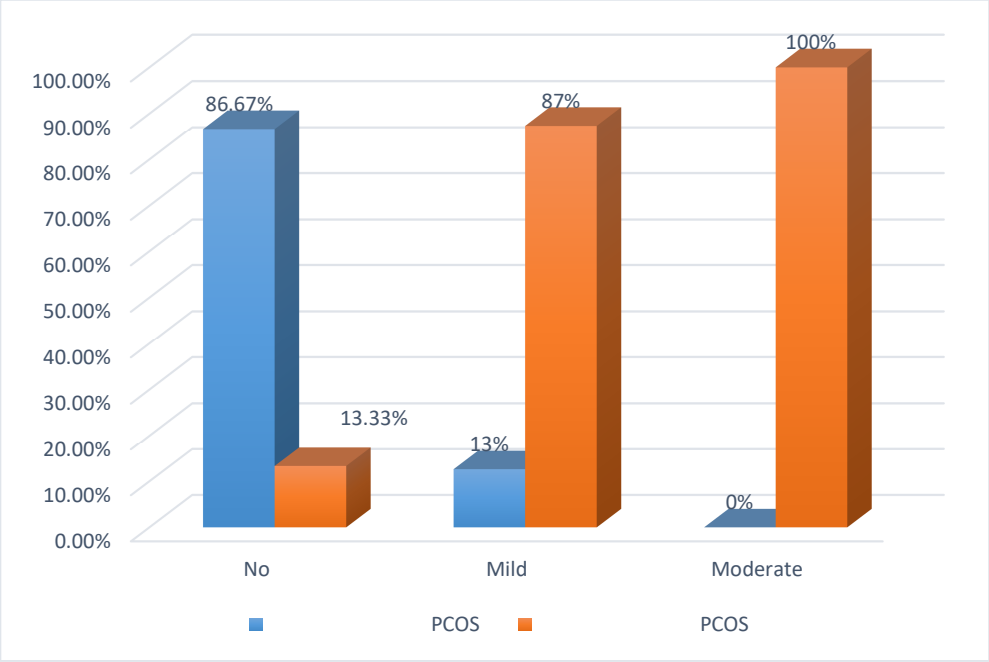
In our study, out of 316 participants with history of excessive hair loss, 111 (35.13%) had PCOS and out of 491 participants without history of excessive hair loss, 98 (19.96%) had PCOS. In this study excessive loss of hair was found more among participants with PCOS which was found to be statistically significant (p < 0.05).

Table 41: Association between clinical hyperandrogenism (Modified Ferriman Gallway Scale) and PCOS.

Clinical Hyperandrogenism	PCOS		Total
	Absent	Present	
No clinical hyperandrogenism	585 (86.67%)	90 (13.33%)	675 (100%)
Mild	13 (12.62%)	90 (87.38%)	103 (100%)
Moderate	0 (0%)	29 (100%)	29 (100%)
Total	598 (74.1%)	209 (25.9%)	807 (100%)
χ^2= 341.37	df = 2	$p < 0.05^{MC}$	

Abbreviations: MC: Monte-Carlo's simulation used in Chi-square test

Graph 24 (Table 41). Association between clinical hyperandrogenism (Modified Ferriman Gallway Scale) and PCOS.



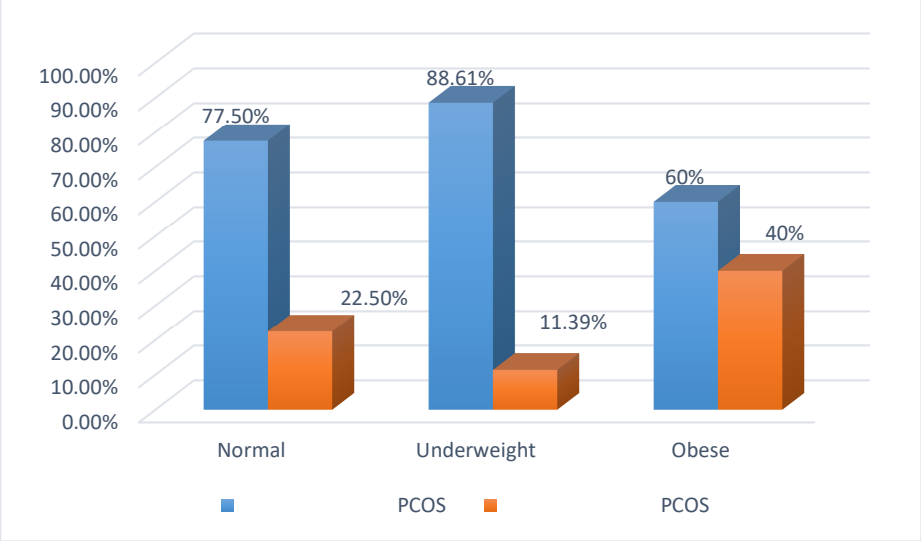
In the current study, 90 (13.33%) with no clinical hyperandrogenism, 90 (87.38%) with mild clinical hyperandrogenism and 29 (100%) with moderate clinical hyperandrogenism had PCOS. Percentage of participants having PCOS increased with increasing severity of clinical hyperandrogenism which was also found to be statistically significant ($p < 0.05$). The mean score of clinical hyperandrogenism among PCOS participants was 9.62 ± 3.44. The mean score of clinical hyperandrogenism among non-PCOS participants was 5.25 ± 1.59. The overall mean score of clinical hyperandrogenism was 6.38 ± 3.44

Table 42: Association between body mass index and PCOS.

Body mass index (kg/m^2)	PCOS		Total
	Absent	Present	
Normal weight	348 (77.50%)	101 (22.50%)	449 (100%)
Underweight	109 (88.61%)	14 (11.39%)	123 (100%)
Obese	141 (60%)	94 (40%)	235 (100%)
Total	598 (74.10%)	209 (25.90%)	807 (100%)
χ^2= 40.567	df = 2	p = 0.0004998^{MC}	

Abbreviations: MC: Monte-Carlo's simulation used in Chi-square test

Graph 25(Table 42). Association between body mass index and PCOS.



In our study, out of 449 participants who were of normal weight, 101 (22.50%) had PCOS. Among 123 participants who were underweight, 14 (11.39%) of them had PCOS, and out of 235 participants who were obese, 94 (40%) had PCOS. PCOS was found to be more in obese individuals which was found to be statistically significant ($p < 0.05$).

Table 43: Association between waist hip ratio and PCOS.

Anthropometric Parameters	PCOS		Total	p-value
	Absent	Present		
Waist Circumference	79.82±10.85	86.48±13.54	81.55±11.96	< 0.00001[Wt]
Hip Circumference	96.71±9.96	102.45±12.64	98.2±11	< 0.00001[Wt]
Waist Hip Ratio	0.82±0.06	0.84±0.06	0.83±0.06	< 0.00001[t]

Abbreviations: Wt: Welch's t-test; t: t-test.

In our study, mean value of waist circumference of participants with PCOS was 86.48±13.54 and mean value of Hip circumference of participants with PCOS was 102.45±12.64. The mean value of waist hip ratio was 0.84 ± 0.06 in participants with PCOS. Significant association of PCOS was found with waist and hip circumference and waist hip ratio ($p < 0.05$).

Table 44: Multivariate logistic regression analysis of risk factors associated with PCOS

Risk factors		Estimate	AOR (95% CI)	p-value
(Intercept)		-1.7569	0.17 (0.11, 0.26)	<0.0001*
Literacy status of the mother	Secondary	Reference		
	PUC	0.2172	1.24 (0.69, 2.24)	0.46998
	Graduate	-0.3396	0.71 (0.43, 1.19)	0.19074
	Post Graduate	0.118	1.12 (0.70, 1.82)	0.6264
Family history of menstrual irregularities	No	Reference		
	Yes	0.6169	1.85 (1.11, 3.05)	0.01615*
Family history of hypothyroidism	No	Reference		
	Yes	0.668	1.95 (1.29, 2.94)	0.00158*
Family history of PCOS	No	Reference		
	Yes	0.6979	2.00 (1.11, 3.61)	0.01972*
Multiple comorbidities	Absent	Reference		
	Present	1.1139	3.04 (2.15, 4.30)	<0.0001*

In the present study multivariate logistic regression analysis showed that family history of menstrual irregularities, family history of hypothyroidism, family history of PCOS and having multiple comorbidities are the risk factors for polycystic ovarian disease.

Participants whose mothers completed collegiate education were 1.2 times more likely to have PCOS when compared to those whose mothers had secondary education. [AOR:1.24; 95% CI (0.69 – 2.24)]. However, it was not statistically significant. Participants whose mothers completed postgraduation were 1.12 times more likely to have PCOS when compared to those whose mothers had secondary education. [AOR:1.12; 95% CI (0.70– 1.82)]. However, it was not statistically significant ($p > 0.05$).

Participants with family history of menstrual irregularities were 1.8 times more likely to have PCOS when compared to those without family history of menstrual irregularities. [AOR:1.85; 95% CI (1.11 - 3.05)]. This was found to be statistically significant ($p < 0.05$).

Participants with family history of hypothyroidism were 1.9 times more likely to have PCOS when compared to those without family history of hypothyroidism. [AOR:1.95; 95% CI (1.29- 2.94)]. This was found to be statistically significant ($p < 0.05$).

Participants with family history of PCOS were two times more likely to have PCOS when compared to those without family history of PCOS. [AOR: 2.00; 95% CI (1.11 – 3.61)]. This was found to be statistically significant ($p < 0.05$).

Odds of having PCOS is three times more in participants with multiple comorbidities when compared to participants with no comorbidities [AOR: 3.04; 95% CI (2.15 – 4.30)].

This was found to be statistically significant ($p < 0.05$).

CONCLUSION:

- In the present study, the prevalence of PCOS among the study participants was 25.90%. Among them 12.76% were old cases of PCOS and 13.14% were new cases. In the new cases using Rotterdam's criteria, 4.21% had oligomenorrhoea and clinical hyperandrogenism, 4.09% had oligomenorrhoea and polycystic ovaries whereas 4.83% of participants had clinical hyperandrogenism and polycystic ovaries.
- Increasing literacy status of parents, internet as source of information about PCOS, family history of menstrual irregularities, family history of hypothyroidism, family history of PCOS, disturbed sleep in the night, feeling sleepy in the afternoon, having hypothyroidism and multiple comorbidities, consumption of pizza and burger, fried foods, difficulty in staying in ideal weight, having mood changes, history of acne, discoloration of skin behind the neck, excessive loss of hair, presence of clinical hyperandrogenism, obesity were factors influencing the prevalence rate of PCOS in the present study ($p < 0.05$).
- In the present study family history of menstrual irregularities (OR = 1.85), family history of hypothyroidism (OR = 1.95), family history of PCOS (OR = 2.01) and having multiple comorbidities (OR = 3.05) were identified as risk factors of PCOS ($p < 0.05$).

RECOMMENDATIONS

1) Periodic screening especially those with positive family history of PCOS should be done for early diagnosis and clinical intervention for PCOS to prevent long term complications.
2) Lifestyle modifications such as exercise, weight reduction, healthy dietary habits to be promoted.
3) Counselling services for emotional support among PCOS participants can be done.

STRENGTHS

1) This study involved students studying in various disciplines of education like medical, dental and nursing students who were from different geographical areas.
2) Bigger sample size was used using proportionate to population size.
3) Rotterdam's criteria was used to diagnose PCOS.
4) USG was done to identify polycystic ovaries and Modified Ferriman Gallway scale was used to identify clinical hyperandrogenism.

LIMITATIONS

1. Biochemical assessment was not done due to cost constraints.

2. Milder cases could have been missed due to absence of clinical features.

SUMMARY

The present study was cross-sectional study which was done to know the prevalence and risk factors associated with PCOS. Total 807 female health science students were enrolled in the study using proportionate to population size sampling in the time period of January 2021 to December 2021. Participants were administered predesigned, pretested questionnaire after obtaining informed consent from each individual participant.

The mean age (± S.D) of study participants was 22.02 ± 2.9 years. Majority 60.72% participants belonged to 20-25 age group, 83.02% were Hindus, 41.02% participants fathers were post graduates, 35.69% study participants mothers were post graduates. and 84.39% of them were from socioeconomic class I. Almost 43.49% participants knew the information about PCOS from multiple sources, only 13.14% were unaware about PCOS.

Almost half 51% had family history of diabetes mellitus, 13.51% had family history of menstrual irregularities, 16.85% had family history of hypothyroidism and 7.85 % had family history of PCOS. Among the total participants 8.79% had skin problems, 8.67% had hypothyroidism and 4.08% had multiple comorbidities. Almost 49.19% participants were consuming junk foods several times a month, 29.62% were consuming once a week, 10.29 % were consuming once a month and 67% of them were consuming several times a week.

Majority 85.50% participants had less than 45 days duration of menstrual cycle, 38.29% had history of passage of clots and 52.29% had history of

dysmenorrhea. Almost half 51.3% of them had acne, 14.62% of them had discoloration of skin behind the neck, 39.16% had history of excessive hair loss.

The prevalence of PCOS among our study participants was 25.90%. In the present study the old cases of PCOS were 12.76% and 13.14% were new cases. Among the new cases using Rotterdam's criteria, 4.21% had oligomenorrhoea and clinical hyperandrogenism, 4.09% had oligomenorrhoea and polycystic ovaries whereas 4.83% of participants had clinical hyperandrogenism and polycystic ovaries.

The mean score of clinical hyperandrogenism among PCOS participants was 9.62 ± 3.44. The mean score of clinical hyperandrogenism among non-PCOS participants was 5.25 ± 1.59. The overall mean score of clinical hyperandrogenism was 6.38 ± 3.44.

Literacy status of parents, disturbed sleep in the night, feeling sleepy in the afternoon, hypothyroidism, multiple comorbidities, consumption of pizza and burger, fried foods, difficulty in staying in ideal weight, mood changes, history of acne, clinical hyperandrogenism, body mass index and waist hip ratio were found to be associated with PCOS ($p < 0.05$).

Factors such as source of information about PCOS, family history of menstrual irregularities, family history of hypothyroidism, family history of PCOS, discoloration of skin behind the neck, excessive loss of hair were also associated with PCOS ($p < 0.05$).

Multivariate logistic regression analysis showed that family history of menstrual irregularities, family history of hypothyroidism, family history of PCOS and having multiple comorbidities are the risk factors for polycystic ovarian disease ($p < 0.05$).

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ANNEXURE – I – WRITTEN INFORMED CONSENT FORM

'Prevalence of poly cystic ovarian syndrome among health science students'

Principal Investigator: **Dr.**
Pg student, Dept of Community Medicine,
J.N. Medical College, KAHER, Belagavi -10

Guide: **Dr.**
Associate professor, Dept of Community Medicine,
J.N. Medical College, KAHER, Belagavi -10

Co guide: **Dr.**
Professor & HOD, Dept of obstetrics and gynecology
J.N. Medical College, KAHER, Belagavi

Introduction: You are being invited to participate in this study **"Prevalence of polycystic ovarian syndrome among health science students"**. PCOS is the most common endocrinal disorder among reproductive age group women. It affects 2.2% to 20% of reproductive age women. Multiple factors like stress, consumption of fatty and high calorie foods and reduced physical activity are risk factors of PCOS. Women diagnosed with PCOS are more prone to cardiovascular, metabolic and oncogenic manifestations on long-term, if left untreated. Early diagnosis and prompt treatment are essential to prevent early and late sequel of the syndrome. Also there is a need to know other risk factors contributing to PCOS. Hence the present study is undertaken to know the prevalence and risk factors of PCOS among the health science students. Participation in this study is completely voluntary.

Explanation of procedures: In this study, you will have to answer a few questions prepared about socio demographic details, diseases running in family, personal history, menstrual history and clinical history related to PCOS. After you

agree to participate, then the questions will be posed to you. At any moment, you can withdraw from the study. Information will be collected using pre-designed, pretested questionnaire. If you are found to have suspected features of PCOS, you will be subjected to ultrasound abdomen for further confirmation

Possible Benefits: The investigator does not promise that you will receive direct benefit in this study. It will benefit the whole community.

Possible Risks: There is no risk involved in this study.

Confidentiality; All the data collected will remain confidential and only aggregated data will be published. Your personal identity will remain anonymous.

Withdrawal: Your participation in this study is purely voluntary. You may decide to participate or not. Even though you decide not to participate, you will not be deprived of the benefits of this study.

Costs of Participation: The cost of the study will be borne by the researcher. There will be no additional cost to you for participating in this study.

Payment of Participation: There will be no incentives to you for participating in this study.

Questions: If you have any questions regarding the study, you should contact Principal Investigator **DR._____, MD admission batch,** Department of Community Medicine J. N. Medical College, Belagavi, 590010, Ph. No –9494282414

Guide: DR. _____, Associate Professor, Department of Community Medicine, J. N. Medical College, Belagavi, 590010.

Co guide: DR._____ Professor & Head, Department of Obstetrics & Gynaecology.

If you have any questions about your rights as a study participant, you may contact **Dr. Harsha Hegde,** Chairman, Institutional Ethics Committee on Human Subjects' Research, J.N. Medical College, Belagavi -590010, Ph. No 0831-2473777, Extn 4052, 4057.

Legal Rights: By signing this consent form; you are not waiving any of your Legal rights.

Consent statement:

"I volunteer and consent to participate in the study. I have read (or it has been read to me in the language known to me) the information sheet thoroughly. Full opportunity was given to me to ask questions. I am fully satisfied with the answers to the questions I wanted to ask. I hereby voluntarily agree to participate in this research project".

Name of the Participant	Signature of the participant
or Left-Hand Thumb impression	
Name of Investigator	Signature of investigator
Name of Witness	Signature of Witness

Date: _____ Place: _____

Assent (<18 years)

'Prevalence of poly cystic ovarian syndrome among health science students"

I have read the information in this form. After understanding all details about the study, I agree to give assent to be included as a volunteer in the study titled "Prevalence of polycystic ovarian syndrome among health science students"

Name of the Participant	Signature of the participant
or Left-Hand Thumb impression	
Name of the Parent	Signature of the parent
Name of Investigator	Signature of investigator
Name of Witness	Signature of Witness

Date: _____ Place: _____

ANNEXURE – II -PROFORMA

PREVALENCE OF POLYCYSTIC OVARIAN SYNDROME AMONG FEMALE HEALTH SCIENCE STUDENTS

Serial no: **Date of enrolment:**

I SOCIODEMOGRAPHIC DETAILS:

1. Name:
2. Age: years
3. Course: Medical (UG/PG) ; Dental (UG/ PG); Nursing (UG/PG)
4. Religion: Hindu / Muslim / Christian / Jain / Sikh / Others
5. Education of father: i. Illiterate / ii. Primary / iii. Secondary/ iv. Collegiate / v. PUC / vi. Graduate / vii. Post-graduate
6. Education of mother: i. Illiterate / ii. Primary / iii. Secondary/ iv. Collegiate / v. PUC /vi. Graduate/ vii. Post graduate
7. Occupation of father: …….
8. Occupation of mother: ……
9. No. of family members:
10. Per capita income: Rs / month
11. Socio-economic class: I / II/ III / IV/ V

II MARITAL HISTORY

12. Marital status: i Unmarried / ii Married / iii Separated
13. Source of information about PCOS: Doctors / Friends / Family members / Internet / Books / Television / others

III. FAMILY HISTORY:

14. Family history of menstrual irregularities: yes / no.
15. Family history of Diabetes mellitus: yes / no.
16. Family history of Hypothyroidism: yes / no.

17. Family history of PCOS: yes/no.

18. Family history of breast cancer: yes /no.

19. Family history of ovarian cancer: yes/no.

20. Family history of endometrial cancer: yes/no.

IV. PERSONAL HISTORY:

21. Diet history: vegetarian / mixed

22. Physical exercise: regular (at least 5 days in a week)/ irregular (< 5 days in a week)

23. Disturbed sleep in the night: yes / no

24. Feeling sleepy in the afternoon: occasionally / always / never

25. Co-morbidities if any: Diabetes / Hypertension / Diabetes with hypertension / Depression Bipolar disorders / Skin problems / Cardiac diseases / Epilepsy /

Migraine/ other endocrine disorders …….

26. Any previous surgery done: yes / no, if yes specify …….

27**. CONSUMPTION OF JUNK FOODS**:

Food items	Several times a day	Every day	Several times a week	Once a week	Several times a month	Never
	6	5	4	3	2	1
Bakery items						
Aerated drinks						
Pizza and burger						
Chat items						
Chinese food						
Fried foods						

28. If obese only, trouble to control excess weight: yes / no

29. Difficulty in staying in ideal weight: yes / no

30. Do you experience any mood changes: Yes / No
If yes, Daily / occasionally / weekly

V. MENSTRUAL HISTORY:

31. Age at menarche: Years

32. Duration of menstrual cycle: <22 days / 22-45 days / > 45 days
Or
33. Length of menstrual cycle: <2 days/ 3-7 days / >7 days

34. History of passage of clots: Yes / No

35. Dysmenorrhoea: yes/no

36. If yes, before menstruation/ during menstruation

V. **CLINICAL HISTORY**

37. History of acne: yes / no

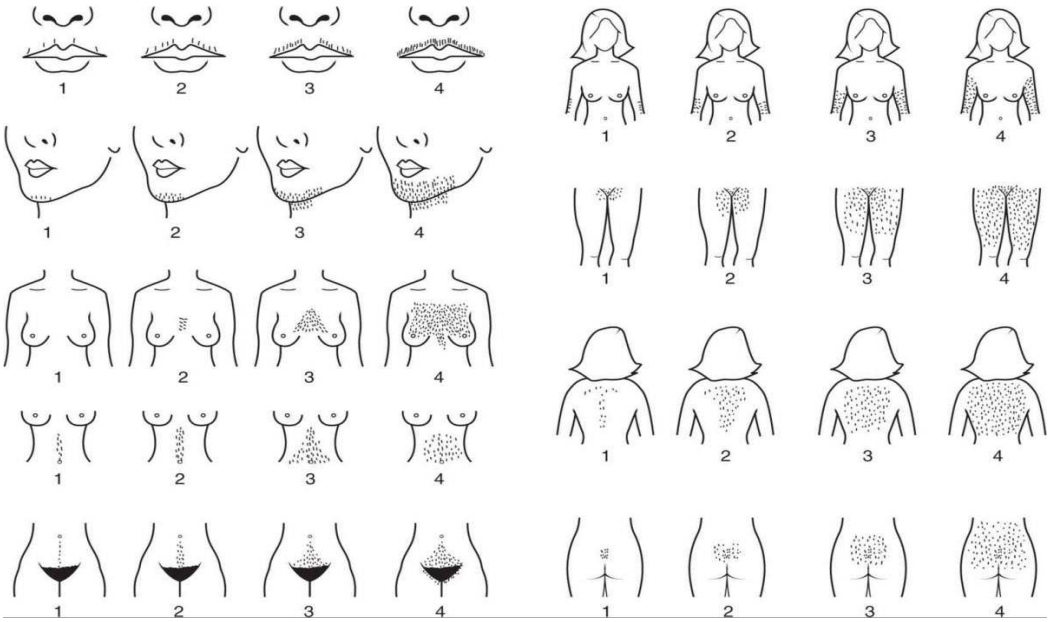
38. Acne with menstrual cycle: Yes / No

39. Discolouration of skin behind the neck: Yes/ No

40. History of excessive loss of hair: Yes/ No

41. History of skin tags: Yes / No

42. EXAMINATION OF CLINICAL HYPERANDROGENISM: with the help of modified Ferriman Gallway scale [Mfg], hair distribution is assessed in 9 different body areas; upper lip, chin, chest, upper abdomen, lower abdomen, arms, thigh, upper back, lower back. Grading in each area is done from 0- 4. Minimum score, Maximum score 36



VI. Anthropometric measurements:

43. Height: cms

44. Weight: kgs

45. BMI: weight in kgs/ [height in metres]^2

46. Waist circumference _____cms

47. Hip circumference_____cms

48. Waist hip ratio__

ANNEXURE- III - KEY TO MASTER CHART

A. Sl.no

B. Age:

C. Course: Medical ug (1); Medical pg (2)

Dental ug (3); Dental pg (4)
Nursing ug (5); nursing pg (6)

D. Religion: Hindu (1); Muslim (2); Christian (3)

E. Education of the father: secondary (1); PUC (2); graduate (3); post graduate (4)

F. Education of the mother: secondary (1); PUC (2); graduate (3); post graduate (4)

G. No. of family members: nos

H. Socioeconomic status: 1/2/3

I. Marital status: unmarried (1); married (2)

L. Source of information about PCOS: Doctors (1); friends (2); family members (3); don't know (4); Internet (5)

FAMILY H/O

M. Family h/o Menstrual Irregularities: yes (1); no (2)

O. Family h/o DM: yes (1); no (2)

Q. Family h/o Hypothroidism: yes (1); no (2)

S. Family h/o PCOS: yes (1); no (2)

U. Family h/o breast cancer: yes (1); no (2)

W. Family h/o ovarian cancer: yes (1); no (2)

Y. Family h/o endometrial cancer: yes (1); no (2)

PERSONAL H/O

AA. Diet h/o: vegetarian (1); mixed (2)

Ab. Physical exercise: regular (1); irregular (2)

Ac. Disturbed sleep in the night: yes (1); no (2)

Ad. Feeling sleepy in the afternoon: occasionally (1); always (2); never (3)

AE. Comorbidities:

No comorbidity	1	Cardiac diseases	7
DM	2	Epilepsy	8
HTN	3	Migraine	9
Depression	4	Others	10
Bipolar	5	Multiple	11
Skin problems	6		

CONSUMPTION OF JUNK FOODS

Several times day	Every day	Several times week	once week	several times month	once month
6	**5**	**4**	**3**	**2**	**1**

AH. Bakery items

AI. Aerated drinks

AJ. Pizza and burger

AK. Chat items

AL. Chinese food

AM. Fried foods

AN. If obese only, trouble to control excess weight: yes (1); no (2)

AO. Difficulty in staying in ideal weight: yes (1); no (2)

AP. Do you experience any mood changes: yes (1); no (2)

AQ. If yes. Daily (1); occasionally (2); weekly (3)

MENSTRUAL HISTORY

AS. Age at menarche: nos

AT. Duration of menstrual cycle: < 45 days (1); > 45 days (2)

AU. Length of menstrual cycle: <2 days (1); 3-7 days (2); >7 days (3)

AV. H/o passage of clots: yes (1); no (2)

AW. Dysmenorrhea: yes (1); no (2)

AX. If yes, before menstruation (1); during menstruation (2); both (3)

CLINICAL HISTORY

AY. H/o acne: yes (1); no (2)

AZ. Acne with menstrual cycle: Yes (1); No (2)

BA. Discoloration of skin behind the neck: Yes (1); No (2)

BB. IF YES, Brownish (1); Blackish (2); Not applicable (0)

BC. H/o excessive loss of hair: Yes (1); No (2)

BD. H/o skin tags: Yes (1); No (2)

BE. EXAMINATION OF CLINICAL HYPERANDROGENISM:

Cut off: ≥ 8 implies clinical hyperandrogenism.

Minimum: 0; Maximum: 36

mild = 8–16; moderate = 17–25; and severe > 25.

ANTHROPOMETRIC MEASUREMENTS:

BF. Height: No

BG. Weight: No

BH. BMI

BI. WC: No

BJ. HC: No

BL. PCOS STATUS:

No PCOS	1
Old PCOS	2
New PCOS	3

BM. USG STATUS

CODING NO	IMPLIES
0	No PCOS
1	New case with other 2 criteria present
2	New case with USG report (presence of cysts)
3	Old USG report
4	Old USG report not available

Note:

Criteria 1(AT) - Absence of menstruation
for 45 days or more and/or less than 8 menses per year.

Criteria 2(BE) - Modified Ferriman and Gallway[mFG] score of 8 or higher.

Criteria 3(BM) - Presence of more than 10 cysts,2-8 mm in diameter, with increased ovarian volume of more than 10 cm^3, and an echo dense stroma in pelvic ultrasound scan.

SL.NO	AGE	COURSE	RELIGION	EDUCATION OF FATHER	EDUCATION OF MOTHER	NO. OF FAMILY MEMBERS	SOCIOECONOMIC STATUS	MARITAL STATUS	IF MARRIED, DURATION OF MARRIAGE	IF, MARRIED H/O OF INFERTILITY	Source of information about PCOS	FAMILY H/O OF MENSTRUAL IRREGULARITIES	IF, YES IN WHOM	FAMILY H/O OF DM	IF, YES IN WHOM	FAMILY H/O HYPOTHROIDISM	IF, YES IN WHOM	FAMILY H/O OF PCOS	IF YES, IN WHOM	FAMILY H/O BREAST CANCER	IF YES, IN WHOM	FAMILY H/O OF OVARIAN CANCER	IF YES IN WHOM	FAMILY H/O ENDOMETRIAL CANCER	IF, YES IN WHOM	DIET H/O	PHYSICAL EXERCISE	DISTURBED SLEEP IN THE NIGHT	FEELING SLEEPY IN THE AFTERNOON	COMORBIDITIES?	ANY TREATMENT	PRESENCE OF WISDOM TOOTH	BAKERY ITEMS	AERATED DRINKS	PIZZA AND BURGER	CHAT ITEMS	CHINESE FOOD	FRIED FOODS	IF OBESE ONLY, TROUBLE TO CONTROL EXCESS WEIGHT	DIFFICULTY IN STAYING IN IDEAL WEIGHT	DO YOU EXPERIENCE ANY MOOD CHANGES	IF YES, HOW OFTEN	BIRTH H/O OF PARTICIPANT	AGE AT MENARCHE	DURATION OF MENSTRUAL CYCLE	LENGTH OF MENSTRUAL CYCLE	H/O PASSAGE OF CLOTS	DYSMENORRHOEA	IF YES, BEFORE MENSTRUATION/DURING	H/O OF ACNE	ACNE WITH MENSTRUAL CYCLE	DISCOLORATION OF SKIN BEHIND THE NECK	IF YES, BROWNISH/BLACKISH	H/O OF EXCESSIVE LOSS OF HAIR	H/O OF SKIN TAGS	EXAMINATION OF CLINICAL HYPERANDROGENISM	HEIGHT	WEIGHT	BMI	WAIST CIRCUMFERENCE	HIP CIRCUMFERENCE	WHR	PCOS STATUS	USG FINDINGS	quality of life
1	21	3	1	3	3	2	1	1	0	0	5	2	0	1	4	2	0	2	0	2	0	2	0	2	0	2	2	2	1	1	0	2	2	1	2	2	1	2	2	2	2	0	1	14	2	02-Jan	2	2	0	2	2	2	0	1	2	5	168	64		79	95		1	0	
2	21	3	1	3	4	4	1	1	0	0	1	2	0	1	5	2	0	2	0	1	3	2	0	2	0	2	1	2	1	1	0	2	4	4	1	2	2	2	1	1	1	2	1	12	3	3	1	1	2	1	1	2	0	2	2	10	176	82		107	120		3	1	
3	21	3	1	3	3	3	1	1	0	0	1	2	0	1	4	2	0	2	0	2	0	2	0	2	0	1	1	1	3	6	7	2	3	3	2	3	1	3	2	2	2	0	2	13	2	2	2	1	2	2	1	2	0	2	2	6	159	65		80	105		1	0	
4	20	3	1	4	2	4	1	1	0	0	1	2	0	1	1	2	0	2	0	2	0	2	0	1	4	1	1	2	1	1	0	2	4	1	2	4	4	4	2	2	2	0	1	16	2	2	1	2	0	1	2	2	0	1	2	4	155	35		63	77		1	0	
7	22	3	1	4	3	4	1	1	0	0	2	2	0	1	1	2	0	2	0	2	0	2	0	2	0	2	2	2	1	1	0	1	3	3	2	3	2	3	2	1	1	2	1	14	2	02-Jan	2	2	0	2	2	2	0	2	2	6	162	70		92	101		1	0	
9	21	3	1	2	3	4	1	1	0	0	5	2	0	1	3	1	1	1	2	2	0	2	0	2	0	2	1	2	1	6	7	1	2	1	2	2	1	2	0	2	1	2	1	13	2	2	1	1	2	1	1	2	0	2	2	6	165	65		88	105		1	0	
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11	21	3	3	3	3	4	1	1	0	0	1	2	0	1	5	2	0	2	0	2	0	2	0	2	0	2	2	2	1	1	0	1	2	2	2	2	2	2	0	1	1	2	1	13	2	2	2	2	0	2	2	2	0	2	2	5	160	65		83	106		1	0	
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57	19	3	1	3	3	4	1	1	0	0	5	2	0	1	1	2	0	2	0	2	0	2	0	2	0	1	2	2	1	1	0	1	2	2	2	3	2	2	0	2	2	0	1	14	2	2	2	2	0	2	2	2	0	2	2	6	167	65		84	104		1	0	
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