Analysis and awareness of polycystic ovarian syndrome

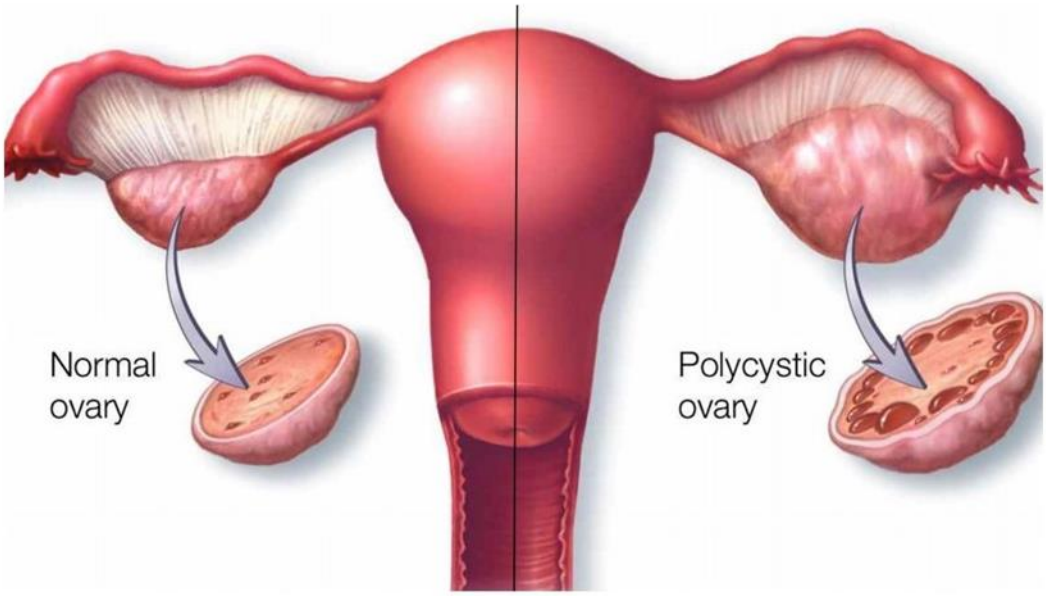
INTRODUCTION:

Polycystic ovary syndrome (**PCOS**) is a set of symptoms due to elevated androgens (male hormones) in females. Signs and symptoms of PCOS include irregular or no menstrual periods, heavy periods, excess body and facial hair, acne, pelvic pain, difficulty getting pregnant, and patches of thick, darker, velvety skin. Associated conditions include type 2 diabetes, obesity, obstructive sleep apnea, heart disease, mood disorders, and endometrial cancer.

PCOS is due to a combination of genetic and environmental factors. Risk factors include obesity, a lack of physical exercise, and a family history of someone with the condition. Diagnosis is based on two of the following three findings: no ovulation, high androgen levels, and ovarian cysts. Cysts may be detectable by ultrasound. Other conditions that produce similar symptoms include adrenal hyperplasia, hypothyroidism, and high blood levels of prolactin.

PCOS has no cure. Treatment may involve lifestyle changes such as weight loss and exercise. Birth control pills may help with improving the regularity of periods, excess hair growth, and acne. Metformin and anti-androgens may also help. Other typical acne treatments and hair removal techniques may be used. Efforts to improve fertility include weight loss, clomiphene, or metformin. In vitro fertilization is used by some in whom other measures are not effective.

PCOS is the most common endocrine disorder among women between the ages of 18 and 44. It affects approximately 2% to 20% of this age group depending on how it is defined. When someone is infertile due to lack of ovulation, PCOS is the most common cause. The earliest known description of what is now recognized as PCOS dates from 1721 in Italy.



Causes and effects of PCOS

Common signs and symptoms of PCOS include the following:

- Menstrual disorders: PCOS mostly produces oligomenorrhea (fewer than nine menstrual periods in a year) or amenorrhea (no menstrual periods for three or more consecutive months), but other types of menstrual disorders may also occur.
- Infertility: This generally results directly from chronic anovulation (lack of ovulation).
- High levels of masculinizing hormones: Known as hyperandrogenism, the most common signs are acne and hirsutism (male pattern of hair growth, such as on the chin or chest), but it may produce hypermenorrhea (heavy and prolonged menstrual periods), androgenic alopecia (increased hair thinning or diffuse hair loss), or other symptoms. Approximately three-quarters of women with PCOS (by the diagnostic criteria of NIH/NICHD 1990) have evidence of hyperandrogenemia.
- Metabolic syndrome: This appears as a tendency towards central obesity and other symptoms associated with insulin resistance. Serum insulin, insulin resistance, and homocysteine levels are higher in women with PCOS

Women with PCOS tend to have central obesity, but studies are conflicting as to whether visceral and subcutaneous abdominal fat is increased, unchanged, or decreased in women with PCOS relative to reproductively normal women with the same body mass index. In any case, androgens, such as testosterone, androstanolone (dihydrotestosterone), and nandrolone decanoate have been found to increase visceral fat deposition in both female animals and women.

PCOS is a heterogeneous disorder of uncertain cause. There is some evidence that it is a genetic disease. Such evidence includes the familial clustering of cases, greater concordance in monozygotic compared with dizygotic twins and heritability of endocrine and metabolic features of PCOS. There is some evidence that exposure to higher than typical levels of androgens and the anti-Müllerian hormone (AMH) *in utero* increases the risk of developing PCOS in later life.

Genetics

The genetic component appears to be inherited in an autosomal dominant fashion with high genetic penetrance but variable expressivity in females; this means that each child has a 50% chance of inheriting the predisposing genetic variant(s) from a parent, and, if a daughter receives the variant(s), the daughter will have the disease to some extent. The genetic variant(s) can be inherited from either the father or the mother, and can be passed along to both sons (who may be asymptomatic carriers or may have symptoms such as early baldness and/or excessive hair) and daughters, who will show signs of PCOS. The phenotype appears to manifest itself at least partially via heightened androgen levels secreted by ovarian follicle theca cells from women with the allele. The exact gene affected has not yet been identified. In rare instances, single-gene mutations can give rise to the phenotype of the syndrome. Current understanding of the pathogenesis of the syndrome suggests, however, that it is a complex multigenic disorder .-

The severity of PCOS symptoms appears to be largely determined by factors such as obesity.

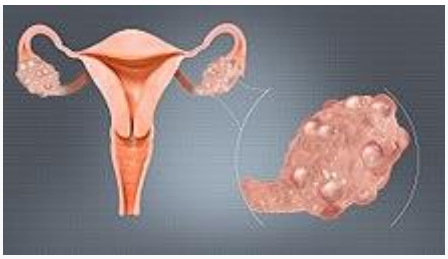
PCOS has some aspects of a metabolic disorder, since its symptoms are partly reversible. Even though considered as a gynecological problem, PCOS consists of 28 clinical symptoms.

Even though the name suggests that the ovaries are central to disease pathology, cysts are a symptom instead of the cause of the disease. Some symptoms of PCOS will persist even if both ovaries are removed; the disease can appear even if cysts are absent. Since its first description by Stein and Leventhal in 1935, the criteria of diagnosis, symptoms, and causative factors are subject to debate. Gynecologists often see it as a gynecological problem, with the ovaries being the primary organ affected. However, recent insights show a multisystem disorder, with the primary problem lying in hormonal regulation in the hypothalamus, with the involvement of many organs. The name PCOD is used when there is ultrasonographic evidence. The term PCOS is used due to the fact that there is a wide spectrum of symptoms possible, and cysts in the ovaries are seen only in 15% of people

Environment

PCOS may be related to or worsened by exposures during the prenatal period, epigenetic factors, environmental impacts (especially industrial endocrine disruptors, such as bisphenol A and certain drugs) and the increasing rates of obesity.

Pathogenesis



Polycystic ovaries

Polycystic ovaries develop when the ovaries are stimulated to produce excessive amounts of androgenic hormones, in particular testosterone, by either one or a combination of the following (almost certainly combined with genetic susceptibility)

- the release of excessive luteinizing hormone (LH) by the anterior pituitary gland
- through high levels of insulin in the blood (hyperinsulinaemia) in women whose ovaries are sensitive to this stimulus

The syndrome acquired its most widely used name due to the common sign on ultrasound examination of multiple (poly) ovarian cysts. These "cysts" are actually immature follicles not cysts. The follicles have developed from primordial follicles, but the development has stopped ("arrested") at an early antral stage due to the disturbed ovarian function. The follicles may be oriented along the ovarian periphery, appearing as a 'string of pearls' on ultrasound examination.

Women with PCOS experience an increased frequency of hypothalamic GnRH pulses, which in turn results in an increase in the LH/FSH ratio.

A majority of women with PCOS have insulin resistance and/or are obese. Their elevated insulin levels contribute to or cause the abnormalities seen in the hypothalamic-pituitary-ovarian axis that lead to PCOS. Hyperinsulinemia increases GnRH pulse frequency, LH over FSH dominance, increased ovarian androgen production, decreased follicular maturation, and decreased SHBG binding. Furthermore, excessive insulin, acting through its cognate receptor in the presence of component cAMP signalling, upregulates 17α-hydroxylase activity

via PI3K, 17α-hydroxylase activity being responsible for synthesising androgen precursors. The combined effects of hyperinsulinemia contribute to an increased risk of PCOS. Insulin resistance is a common finding among women with a normal weight as well as overweight women.

Adipose tissue possesses aromatase, an enzyme that converts androstenedione to estrone and testosterone to estradiol. The excess of adipose tissue in obese women creates the paradox of having both excess androgens (which are responsible for hirsutism and virilization) and estrogens (which inhibits FSH via negative feedback).

PCOS may be associated with chronic inflammation, with several investigators correlating inflammatory mediators with anovulation and other PCOS symptoms. Similarly, there seems to be a relation between PCOS and increased level of oxidative stress.

It has previously been suggested that the excessive androgen production in PCOS could be caused by a decreased serum level of IGFBP-1, in turn increasing the level of free IGF-I, which stimulates ovarian androgen production, but recent data concludes this mechanism to be unlikely.

PCOS has also been associated with a specific FMR1 sub-genotype. The research suggests that women with *heterozygous-normal/low* FMR1 have polycystic-like symptoms of excessive follicle-activity and hyperactive ovarian function.

Transgender men on testosterone may experience a higher than expected rate of PCOS due to increased testosterone.

Objective

1. To analyse the causes of PCOS
2. To see which parameters, affect the PCOS more effectively.
3. To detect whether the woman is suffering from PCOS or not without doing sonography that is to check through our logistic regression model.
4. To find correlation between various parameters which affect the PCOS effectively.

Methodology:

We collected the data through primary as well as secondary method.

In the primary method we made a questionnaire which consisted of 40 questions and the questions mostly focused on irregular periods, weight gain, hair growth, etc. The link was shared through social media sites and through email. We also consulted 12 doctors from pune city for the data collection process. Through which we got data from hospitals as well as through from other cities of maharashtra state. But due to time limitations we took help from the secondary data. We got the data from Kaggle website. The data was from kerala state.

Analysis:

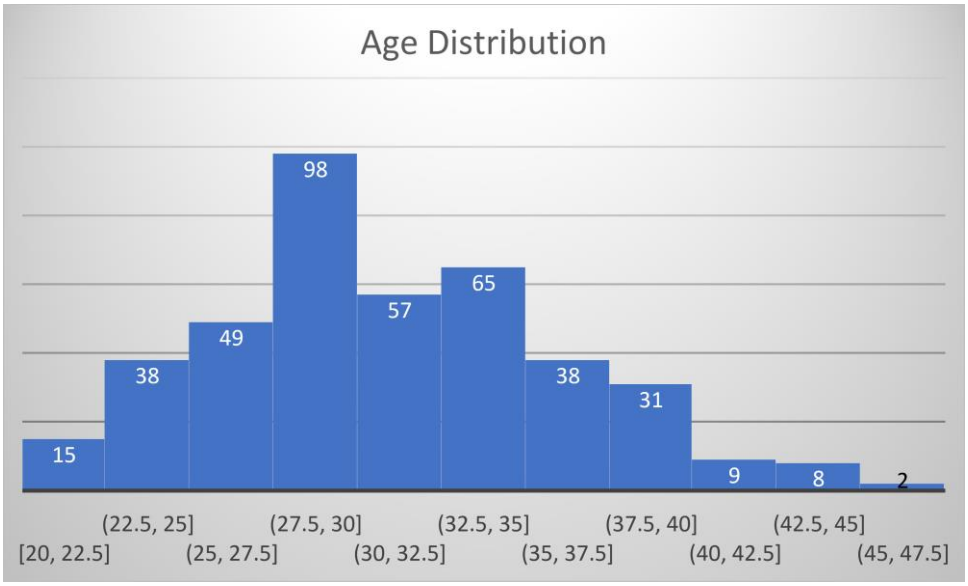
To check the skewness of the data

Mean: 31.1878

Median: 31

Mode: 28

Here mean > median > mode from this we can conclude that the data is positively skewed.



For secondary data:

We did chi square test of independence of attributes test and we fitted the logistic regression model through the secondary data.

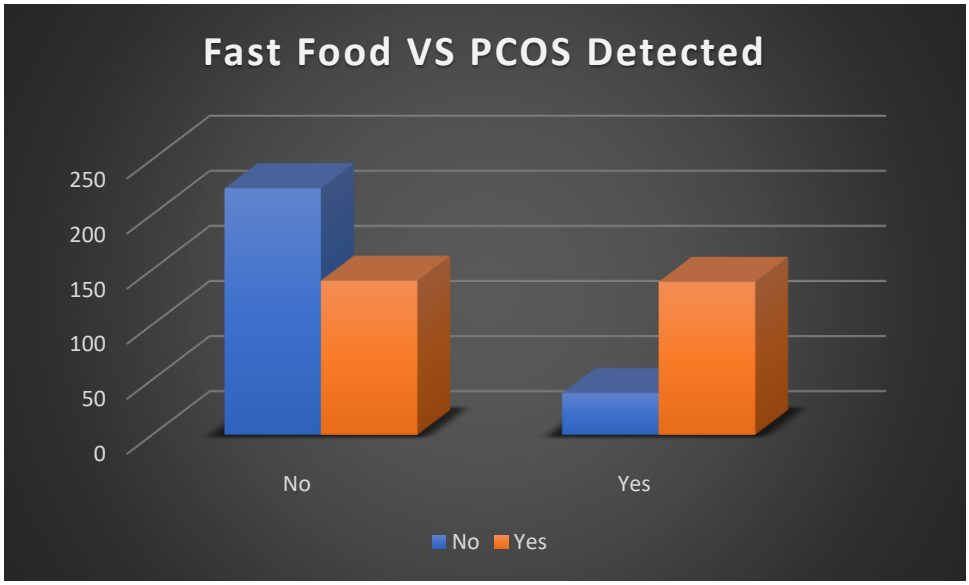
Chi-square test of independence of attributes tells whether the attributes are associated with each other or not.

Test Statistic:

H0: Attributes are independent (are not associated)

H1: Attributes are dependent (are associated)

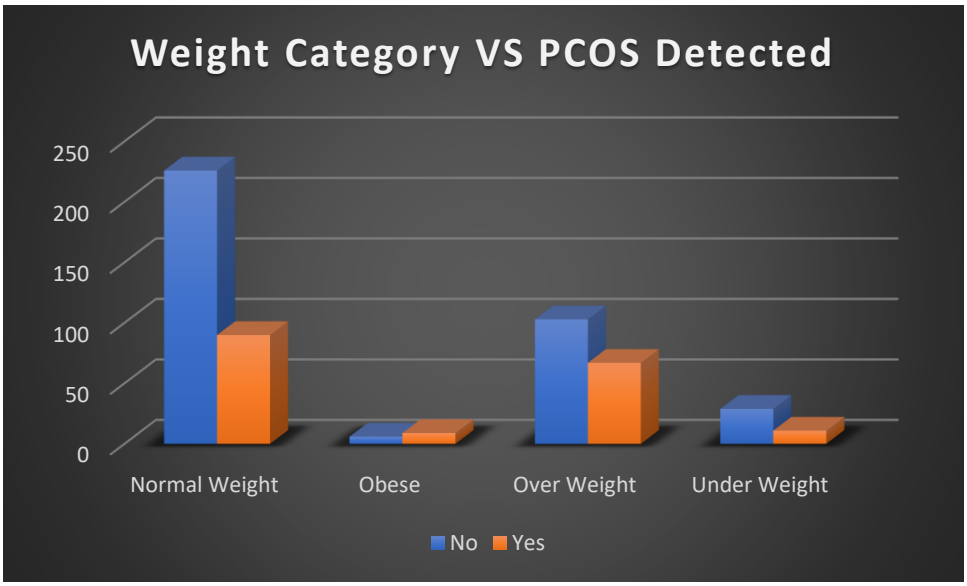
Intake of Junk Food



p – value: 2.1375E-18

Conclusion: We may conclude that Intake of Junk Food & PCOS are Dependent Variables

Weight Category VS PCOS Detected



p – value: 0.008871

Conclusion: We may conclude that weight Categories & PCOS are Dependent Variables

Logistic Regression:

As the response variable (i.e PCOS detected or not) is dichotomous we have predicted our results using the logistic regression model. While considering the model we included only the external parameters so that without doing any kind of sonography we can predict whether the female is suffering from pcos or not. We did backward stepwise regression and from that we got the most significant parameters.

#ALL EXTERNAL PARAMETERS

a=Age..yrs.
b=Weight..Kg.
c=Height.Cm.
e=BMI
f=Blood.Group
g=Pulse.rate.bpm.
h=RR..breaths.min.
i=Hb.g.dl
j=Cycle.R.I.
k=Cycle.length.days.
l=Marraige.Status..Yrs.
m=Pregnant.Y.N.
n=No..of.aborptions
o=Hip.inch.
p=Waist.inch.
q=Waist.Hip.Ratio
r=Vit.D3..ng.mL.
s=Weight.gain.Y.N.
t=hair.growth.Y.N.
u=Skin.darkening..Y.N.
v=Hair.loss.Y.N.
w=Pimples.Y.N.
x=Fast.food..Y.N.
y=Reg.Exercise.Y.N.
z=BP._Systolic..mmHg.
a1=BP._Diastolic..mmHg.
Y=PCOS..Y.N.

As we wanted to find the most significant factors that can accurately predict the chances of causing PCOS to a particular woman we have used stepwise regression. The factors after backward elimination of model are:

x1=a=Age
x2=j=Cycle regular or irregular
x3=k=Cycle length
x4=q=Waist hip ratio
x5=s=weight gain
x6=t=hair growth
x7=u=skin darkening
x8=w=pimples
x9=x=fast food

The model using these significant factors are:

e= 0.657048-0.007072*x1+0.072585*x2-0.023940*x3-
0.602100*x4+0.162284*x5+0.341105*x6+0.219321*x7+0.106144*x8+0.093270*x9

$\pi(x)$= exp(e)/(1+exp(e)) ($\pi(x)$ is probability of success)

$$\pi(x) = \frac{\exp\{0.657048-0.007072*x1+0.072585*x2-0.023940*x3-0.6.2100*x4+0.162284*x5+0.341105*x6+0.219321*x7+0.106144*x8=0.093270*x9\}}{1+\exp\{0.657048-0.007072*x1+0.072585*x2-0.023940*x3-0.6.2100*x4+0.162284*x5+0.341105*x6+0.219321*x7+0.106144*x8=0.093270*x9\}}$$

After building the model on 80% of the observations from the data collected the checking is done on remaining 20% of the observations. Since we detected 141 patients from our analysis following are few examples of our observations.

The Examples are as follows :

1. Observation No.96

x1= 27	x6= 1
x2= 4	x7= 1
x3= 2	x8= 1
x4= 0.9	x9= 1
x5= 1	

$\pi(x)$=0.7481553

From the above regression model, we can conclude that the woman has 74.8% chances of having PCOS. From sonography data we also came to know that the particular woman is suffering from PCOS.

2. Observation No. 141

x1= 31	x6= 1
x2= 4	x7= 1
x3= 2	x8= 1
x4=0.893476	x9= 1
x5= 0	

$\pi(x)$=0.7190222

From the above regression model, we can conclude that the woman has 71.9% chances of having PCOS. From sonography data we also came to know that the particular woman is suffering from PCOS.

3. Observation No.103

x1= 38	x6= 0
x2= 2	x7= 0
x3= 5	x8= 0
x4= 0.9722222	x9= 0
x5= 0	

π(x)=0.4572067

From the above regression model, we can conclude that the woman has 45.2% chances of having PCOS. From sonography data we also came to know that the particular woman is not suffering from PCOS.

4. Observation No.81

x1= 26	x6= 0
x2= 2	x7= 0
x3= 5	x8= 0
x4= 0.972222	x9= 0
x5= 0	

π(x)=0.4738313

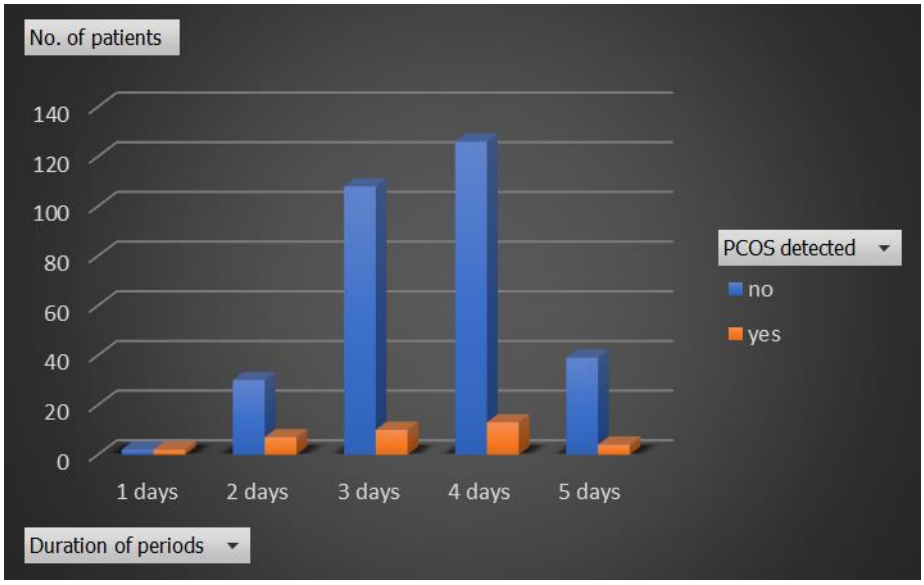
From the above regression model, we can conclude that the woman has 47.3% chances of having PCOS. From sonography data we also came to know that the particular woman is not suffering from PCOS.

For Primary Data:

On the primary data we have fitted the chi-square test for independence of attributes :

Chi-square test for independence of attribute test is used to check whether the attributes are associated with each other or not.
H0: Attributes are independent (are not associated)
H1: Attributes are dependent (are associated)

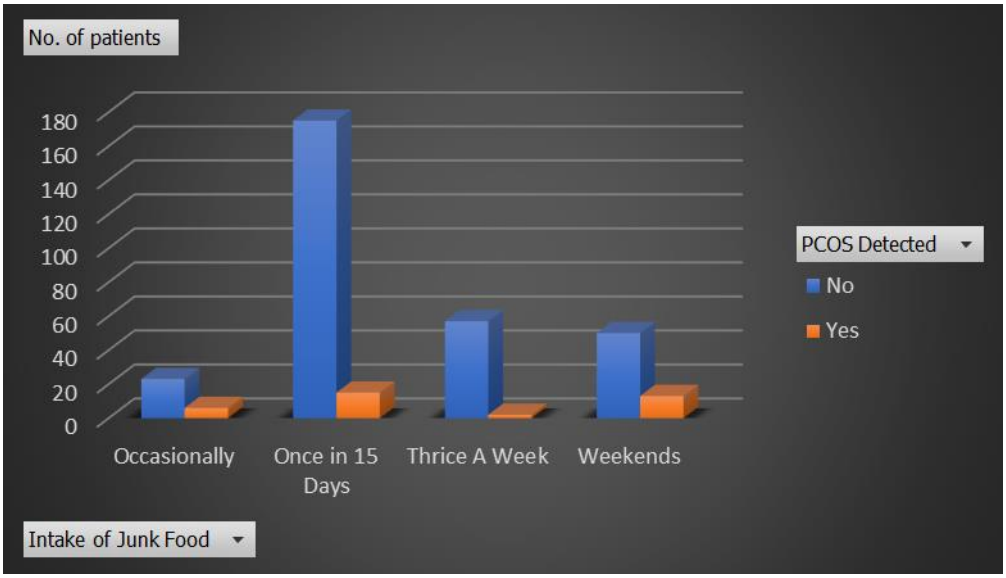
Duration of Periods Vs PCOS Detected



p – value: 0.03786

Conclusion: We may conclude that Duration of periods & PCOS are Dependent Variables

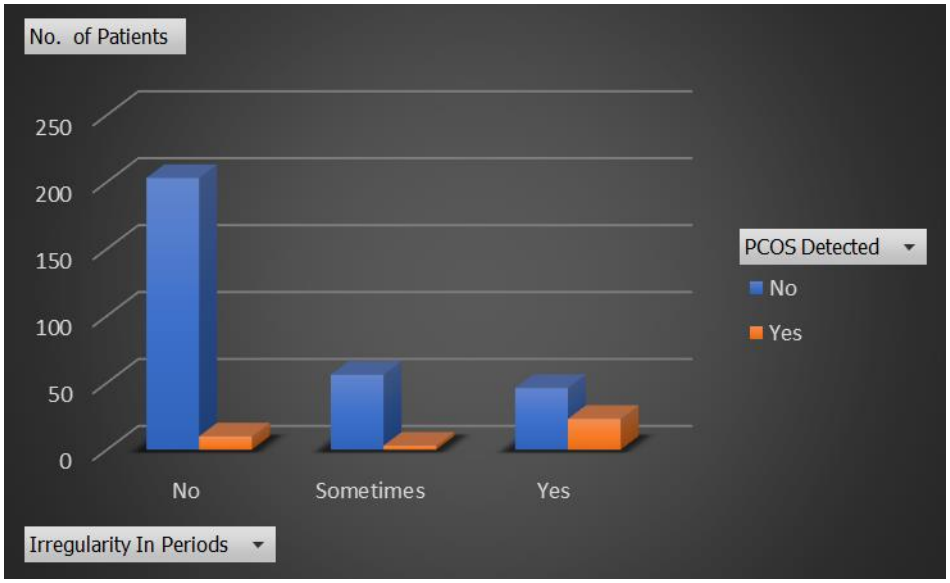
Intake of Junk Food



p – value: 0.00222857

Conclusion: We may conclude that Intake of Junk Food & PCOS are Dependent Variables

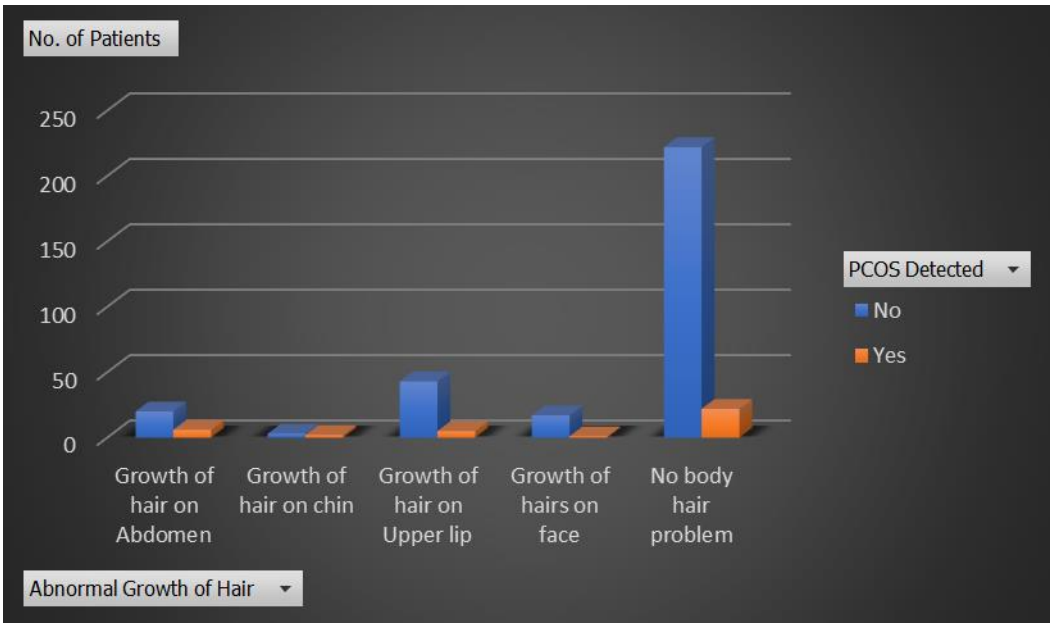
Irregularity in Periods Vs PCOS Detected



p – value: 4.77475E-11

Conclusion: We may conclude that Irregularity in Periods & PCOS are Dependent Variables

Abnormal Body Hair Growth Vs PCOS Detected



p – value: 4.77475E-11

Conclusion: We may conclude that Irregularity in Periods & PCOS are Dependent Variables

Our main aim was just to help the women in our society. We fitted the logistic regression model only through external parameters so that without any kind of sonography we can detect that whether the women is suffering from PCOS or not. PCOS is one of the major causes for infertility in females and also various other diseases such as type2 diabetes and endometrial cancer. This problem should be discussed in the society so that all women can be aware of this major problem.

Limitations:

We faced lot of problems while data collection. While collecting the primary data we were totally restricted by the hospital authorities for privacy purposes and due to time limitations, we had to move ourselves with the secondary data.

Preventive measures: To help decrease the effects of PCOS, try to:

1. Maintain a healthy weight. Weight loss can reduce insulin and androgen levels and may restore ovulation.
2. Limit carbohydrates. Low-fat, high-carbohydrate diets might increase insulin levels.
3. Be active. Exercise helps lower blood sugar levels.

Reference:

Questionnaire used to collect primary data.

This Questionnaire cares about your privacy. Your answers will not be misused.

1) **Name :**

2) **City :**

3) **Area of residence :**

a) Urban

b) Rural

c) Semi Urban

4) **Birth Year :**

a) Before1950

b) 1950- 1960

c) 1960 - 1970

d) 1970 - 1980

e) 1980 - 1990

f) 1990 - 2000

g) 2000 - 2010

h) After 2010

5) Age :

6) Occupation :

a) Employed - Full time

b) Employed - Part time

c) Unemployed - Looking for a Job

d) Unemployed - Not looking for a Job

e) Student

f) House Wife

g) Retired

7) Working Place :

a) IT Sector

b) Government Sector

c) Private Sector

d) College / School Student

e) Personal Firm

f) Work From Home

g) House Wife

8) Working Shifts :

a) Morning

b) Afternoon

c) Evening

d) Night

e) Shift may change

9) Marital Status :

a) Married

b) Unmarried

c) Widow

d) Divorced

e) Live-in-relationship

f) Separated

g) Single

10) Height (in cm or in feet) :

11) Weight (in kg) :

12) Blood Pressure :

a) Low

b) Moderate

c) High

13) Diabetes :

a) Yes

b) No

c) Maybe

14) Haemoglobin :

a) Below 0

b) 0 - 3

c) 3 - 6

d) 6 - 9

e) 9 - 12

f) 12 - 15

g) Above 15

15) Thyroid :

a) Yes

b) No

16) If you have thyroid, then is it ?

a) Hypothyroidism

b) Hyperthyroidism

c) None (No Thyroid Problem)

17) Intake of Junk food (in last 3 months) or how often you consume junk food ?

a) More than thrice a week

b) On Weekends

c) Once in a 15 days

d) Once in a month

e) On the occasion

f) None

18) Which type of physical exercise you do ?

a) Yoga

b) Gym

c) Zumba Dance

d) Walking / Jogging

e) Other

f) None

19) Schedule for exercise :

a) Daily

b) More than thrice a week

c) On Weekends

d) 2-3 times in 15 days

e) Hardly in a month

f) When you get free time

g) None

20) When did your 1st period start ?

a) Less than age 10

b) age 10- age 12

c) age 12 - age 14

d) age 14 - age 16

e) age 16 - age 18

f) More than age 18

21) Duration of periods ?

a) 2 days

b) 3 days

c) 4 days

d) 5 days

f) More than 5 days

22) Do you have problem of irregular period ?

a) Yes

b) No

c) Sometimes

d) Maybe

23) Menstrual Problems :

a) Irregular Periods

b) Headache

c) Abdominal Bloating

d) Menstrual Cramps

e) Heavy Menstrual Bleeding

f) Periods with clots

g) None

24) If your age is more than 40 are you facing a problem of irregular periods ?

a) Yes

b) No

c) Maybe

d) Age less than 40

25) Is PCOS detected (through sonography) ?

a) Yes

b) No

c) Maybe

26) How long you are taking treatment for PCOS ?

a) Less than 3 months

b) 3 months

c) 6 months

d) More than 6 months

e) 1 year

f) 1 - 5 year

g) More than 5 years

h) None (Not taking treatment)

27) If you are married, are you facing a problem of infertility (inability to have children) ?

a) Yes

b) No

c) Maybe

d) Unmarried (No infertility problem)

28) At what age your menstrual period stopped (Menopause) ?

a) Below age 35

b) age 35 - age 40

c) Age 40 - Age 45

d) Age 45 - Age 50

e) More than age 50

f) None (Not yet Menopause)

29) If you are having 1st children, is there any problem in having 2nd baby (problem in infertility) ?

a) Yes

b) No

c) Maybe

d) Unmarried (Haven't face such problem yet)

30) Problem of body hair ?

a) No body hair problem.

b) Growth of visible hair on face

c) Growth of hair on chin

d) Growth of hair on upper lip

e) Growth of hair on abdomen

31) Do you consume Alcohol?

a) Yes

b) No

32) How often you consume Alcohol ?

a) Never

b) Hardly any time

c) Sometimes

d) Most of the times

e) Daily

33) Do you smoke?

a) Yes

b) No

34) How often you smoke ?

a) Never

b) Hardly any time

c) Sometimes

d) Most of the time

e) Daily

35) In last two or more months are you worried about Irregular Periods ?

a) No

b) Hardly

c) Sometimes

d) Moderately

e) A major problem

f) A severe problem

g) Life problem

36) Are you having problem of getting angry (due to any situation) ?

a) Never

b) Hardly any time

c) Sometimes

d) Most of the time

e) All the time

37) Are you feeling Depressed ?

a) Never

b) Hardly any time

c) Sometimes

d) Most of the time

e) All the time

38) Are you feeling lonely ?

a) Never

b) Hardly any time

c) Sometimes

d) Most of the time

e) All the time

39) Are you feeling sad because of infertility problem ?

a) Never

b) Hardly any time

c) Sometimes

d) Most of the time

e) All The time

40) Give rank 1 to 10 for the stress due to any situation you are feeling currently. (1 - low , 5 - moderate , 10 - high in this manner)

Thank You For Giving Your Valuable Time And Honest Response.

For secondary data following is the given link:

https://www.kaggle.com/prasoonkottarathil/polycystic-ovary-syndrome-pcos