Analysis of the prevalence and health impact of [PCOD/PCOS] among women.

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1. ABSTRACT:

Polycystic Ovary Syndrome (PCOS), commonly referred to as Polycystic Ovarian Disease (PCOD), is one of the most prevalent endocrine and metabolic disorders affecting women of reproductive age. It is characterized by hormonal imbalance, menstrual irregularities, hyperandrogenism, and polycystic ovarian morphology. The condition has a significant impact on reproductive, metabolic, psychological, and overall health. This study aims to assess the prevalence of PCOD/PCOS among women and evaluate its associated health impacts. The analysis focuses on common clinical manifestations, including irregular menstruation, excessive hair growth, acne, weight gain, infertility, and metabolic abnormalities. PCOS is also associated with an increased risk of insulin resistance, type 2 diabetes mellitus, dyslipidemia, cardiovascular complications, and psychological concerns such as anxiety, depression, and reduced quality of life. Early identification and appropriate management through lifestyle modification, medical treatment, and regular monitoring can help reduce long-term complications. Increasing awareness among women and healthcare professionals is essential for timely diagnosis and effective management. Understanding the prevalence and broad health consequences of PCOD/PCOS can contribute to improved preventive strategies, reproductive health outcomes, and quality of life among affected women.

KEYWORDS: Polycystic Ovary Syndrome, PCOS, Polycystic Ovarian Disease, PCOD, prevalence, women of reproductive age, hormonal imbalance, menstrual irregularities, infertility, insulin resistance, metabolic health, mental health, quality of life.

INTRODUCTION

Polycystic Ovary Disease (PCOD), more accurately termed Polycystic Ovary Syndrome (PCOS),isacomplexendocrine–metabolicdisorderaffectingwomenofreproductiveage.The condition was first described in 1935 by Irving F. Stein Sr. and Michael L. Leventhal, who identified a cluster of symptoms including amenorrhea, infertility, hirsutism, and enlarged polycysticovaries.InitiallyreferredtoasStein–Leventhalsyndrome,PCOSisnowrecognized asaheterogeneoussystemicdisordercharacterizedbychronicanovulation,hyperandrogenism, and polycystic ovarian morphology. It is one of the most common causes of anovulatory infertility worldwide and is increasingly associated with metabolic complications such as insulin resistance, type 2 diabetes mellitus, Dyslipidemia, and cardiovascular risk.

The prevalence of PCOS/PCOD varies globally, largely depending on the diagnostic criteria applied and the population studied, but it is a significant public health concern:

Global Estimates: The global prevalence of PCOS/PCOD is generally estimated to range between5%and15%ofwomenofreproductiveage(15–49years),withsomeestimatesgoing ashighas26%dependingonthediagnosticcriteriaused.UndiagnosedCases:Amajorconcern isthehighnumberofundiagnosedcases;upto70%ofaffectedwomenworldwidemayremain undiagnosed.

Indian Context: India carries a considerable share of this burden, with a pooled prevalence estimated to be around 10% based on Rotterdam criteria in some studies. Regional studies have reported prevalence rates as highas 17.40% inspecific urbanareas, underscoring the severity of the issue in the country. In 2021, there were an estimated 65.8 million prevalent cases of PCOS/PCOD globally, with the burden increasing significantly over the past few decades.

AssociatedComplications:PCOS/PCOD is more than just are productive issue; it is acomplex syndrome linked to a wide array of long-term health problems, which amplify its burden on individuals and healthcare systems.

Metabolic Disorders: It is strongly associated with insulin resistance (IR), type 2 diabetes mellitus, impaired glucose tolerance, obesity, and metabolic syndrome. Women with PCOS, especially those with hyperandrogenism, are about 2.5 times more likely to develop type 2 diabetes.

DATA COLLECTION

- **Target population:** Women in the age group 12-45years.
- Data set consists of a total **260** sample Observations.
- Among **83** women diagnosed with PCOD/PCOS.
- **Prevalence assessment:** Questionnaires and physical examinations such as BMI, BP and signs of Hirsutism.
- **Data collection:** Collection of data (prescriptions)
- **StudyAreas:** College,villages near by college,gynaecology hospitals.
- **Analysis:**Apply standard criteria to calculate prevalence and identify risk factors.
- **Diseasesand complications:**
- **Reproductive issues:** Leading causes of infertility(anovulation) and irregular/absent periods
- **Metabolicsyndrome:**High risk of insulin resistance,obesity and high BP.
- **Other impacts:** Increased risk of Anxiety and Depression.

METHODOLOGY

In this study, machine learning classification technique has been proposed, trained and tested aims to differentiate between PCOS and non-PCOS ovaries. The ovary disease variables have been used as the input of the study from which the suggested method would determine whether or not the women having PCOD/PCOS.Along with this we performed comparative analysis to identify which classification technique is well suited for our data. The framework of the methodology used in this research is illustrated below:

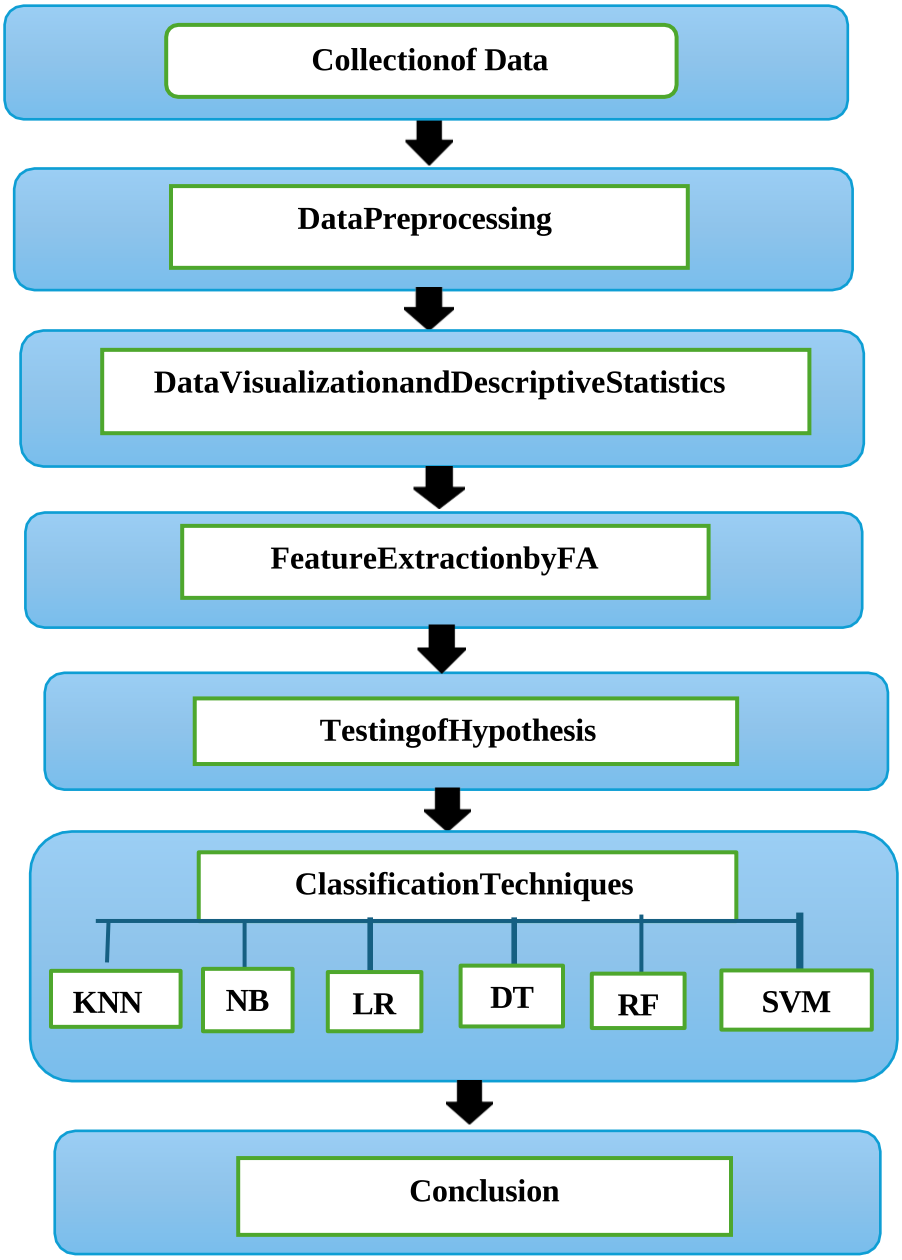

Fig.4.1:Methodology

STATISTICALTOOLS

Exploratory Data Analysis:

- Barcharts, PieCharts, CorrelationHeatmap
- Chi-squaretest
- Feature Extractionby FA
- Classifications Report

Machine Learning Algorithms (DataMiningClassifiers):

RandomForest,K-NearestNeighbourhood,NaiveBayes,SupportVectorMachine, Logistic Regression, Decision Tree.

StatisticalSoftware:

MS-Excel **Python**

GRAPHICAL REPRESENTATION

Table4.1:Menstrual cycle of irregular

Age group(years)	No.of women(irregular)
15-20	50
20-25	25
25-30	15
30-35	8
35-40	5

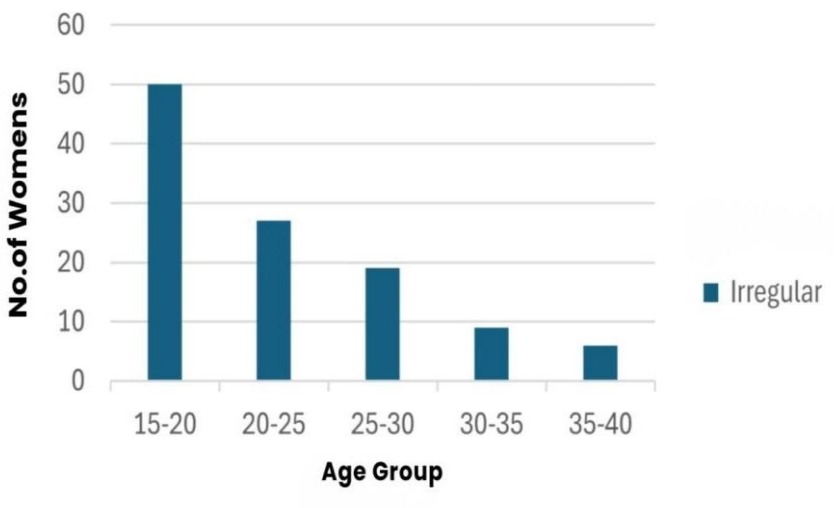

Fig.4.2:Graphical distribution of women with irregular menstrual cycles across different age groups.

Conclusion: Menstrual irregularity is most common in the 15-20 age group. The prevalence decreases gradually as age increases

Table4.2:Menstrual cycle of regular

Age group	No of women (regular)
15-20	44
20-25	83
25-30	15
30-35	4
35-40	1

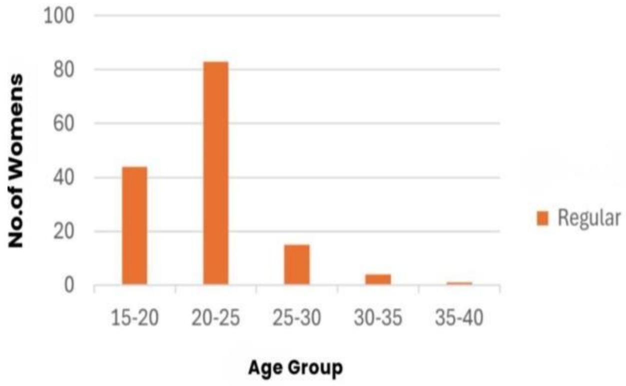

Fig. 4.3: Graphical distribution of women with regular menstrual cycles across different age groups.

Conclusion: The graph shows that regular menstrualcycles are most prevalent in the 20-25 years age group.

Table4.3:Menstrualcycleofirregularandregular

Age Group	Irregular	Regular
15-20	50	44
20-25	27	83
25-30	19	15
30-35	9	4
35-40	6	1

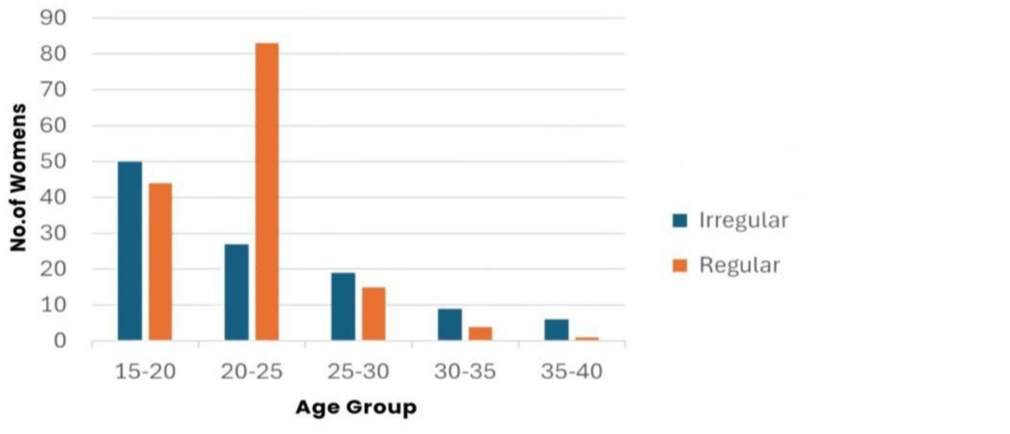

Fig.4.4: Graphical distribution of women with irregular and regular menstrual cyclesacross different age groups.

Conclusion:women aged 20-25 have the highest prevalence of irregular menstrualcycles. Regular cycles are more common in ages 15-20, with irregularities decreasing after 25

Table4.4:Impact of BMI on PCOD/PCOS women

BMI Category	Irregular	Regular
Normal	50	90
Obese	8	6
Overweight	25	10
Underweight	27	20

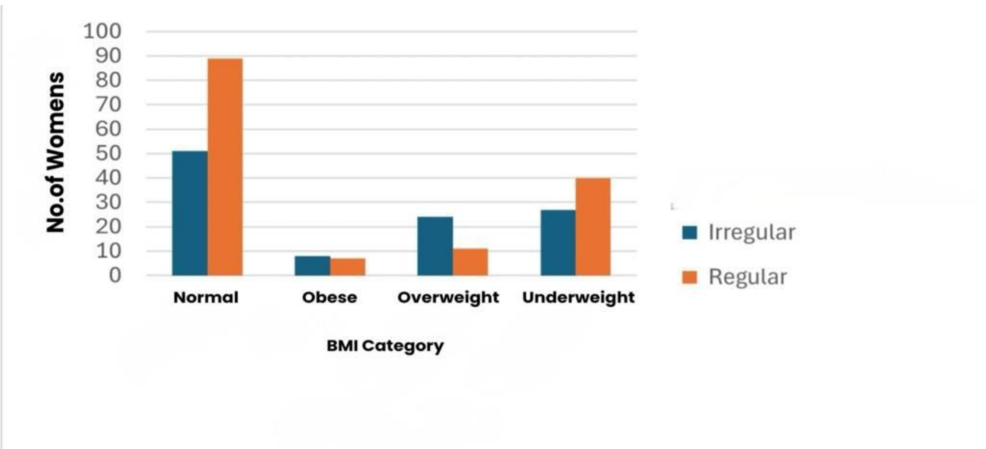

Fig.4.5: Graphical distribution of womenwith irregular andregular menstrual cycles according to different BMI categories.

Conclusion: Most PCOD/PCOS affected women are in the normal BMI category. Irregular menstrual cycles are more common among overweight and obese women.

Table4.5:Reasons behind PCOD/PCOS

Reasons	Number of cases	Percentage
Hormonalimbalance	31	37.3%
EatingDisorder	21	25.3%
Stress	19	22.9%
Others	12	14.5%

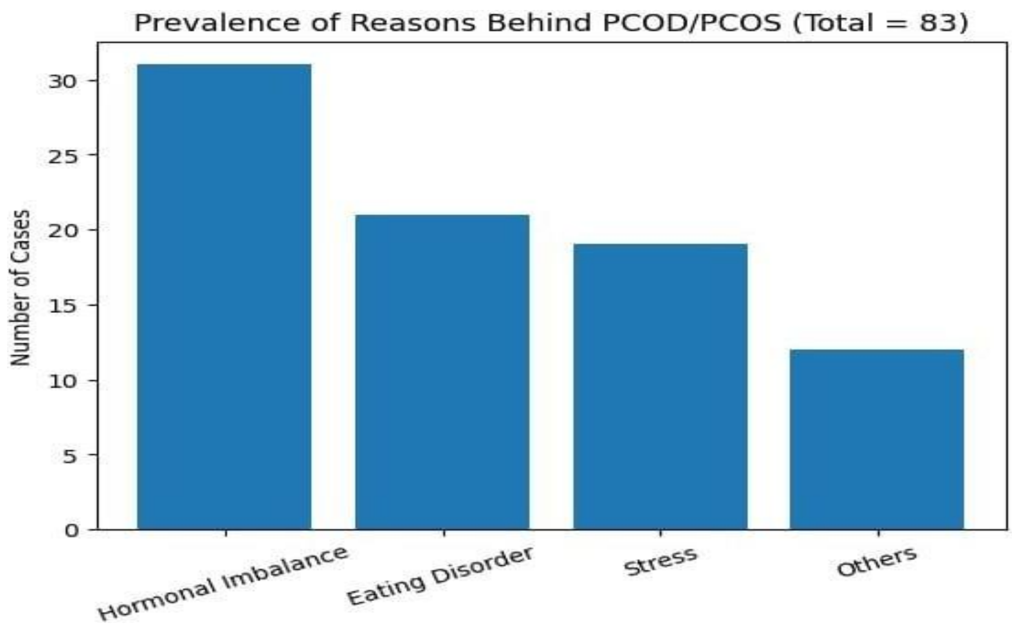

Fig.4.6:Represents the different reasons behind PCOD and the number of cases observed for each reason.

Conclusion:Hormonal imbalance is the leading cause of PCOD/PCOS, accounting for the highest proportion of cases (37.3%).Eating disorders and stress also contribute significantly, while other factors represent a smaller share

Table4.6:Day off low inPCOD/PCOS

Age group	2-3days	4-5days	6-7days
15-20	5	18	0
20-25	11	20	9
25-30	3	7	3
30-35	0	3	1
35-40	1	1	0

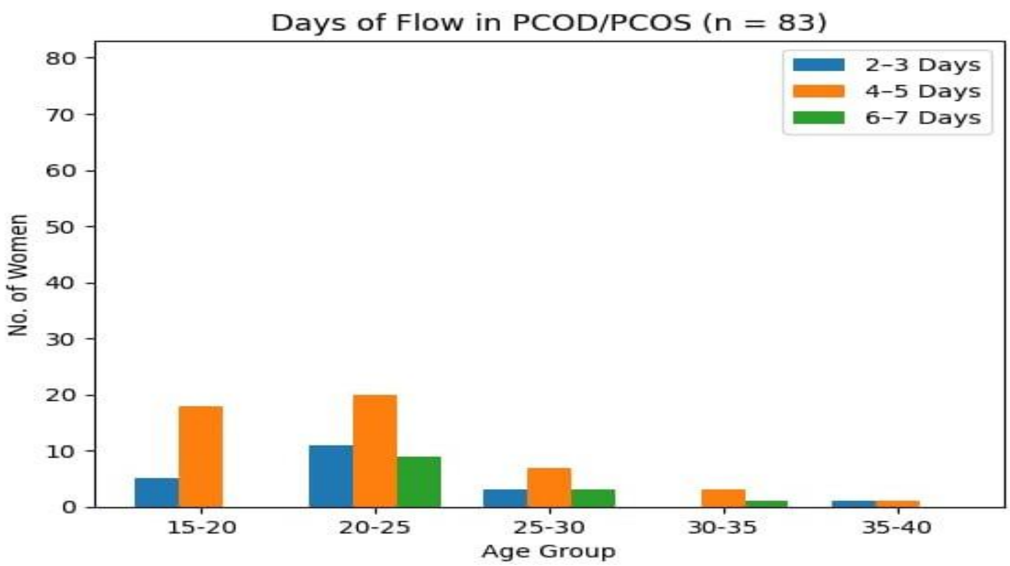

Fig.4.7:Representstherelationshipbetweenagegroupanddaysofmenstrualflowamong women.

Conclusion: MostwomenwithPCOD/PCOShave4-5daysofmenstrualflowintheagegroup 20-25**.**

4.7:PiechartofpregnancyprobleminPCOD/PCOSwomen

Response	**Percentage**
Yes	73%
No	27%

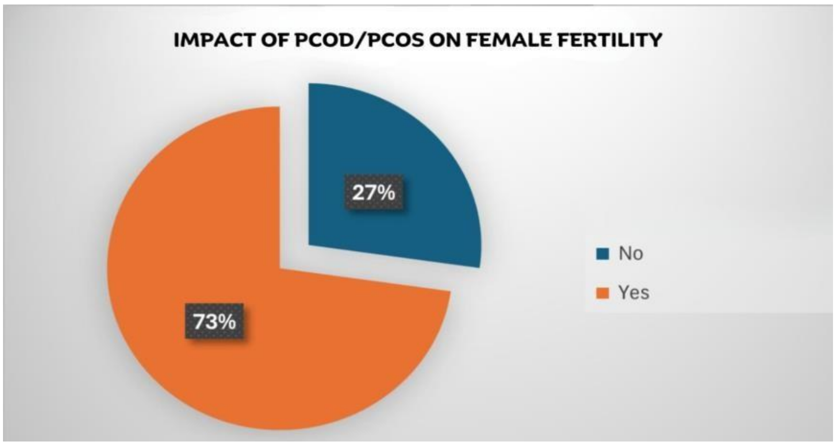

Fig.4.8:RepresentstheimpactofPCOD/PCOSonfemalefertility.

Conclusion: It observed that 73% ofwomenwith PCOD/PCOS have experienced pregnancy problem.

Table4.8:PiechartofeatinghabitinPCOD/PCOSwomen

DietaryPattern	No.ofWomen	Percentage
Fastfood	30	40%
Balanceddiet	26	30%
Oily/spicyfoods	26	30%

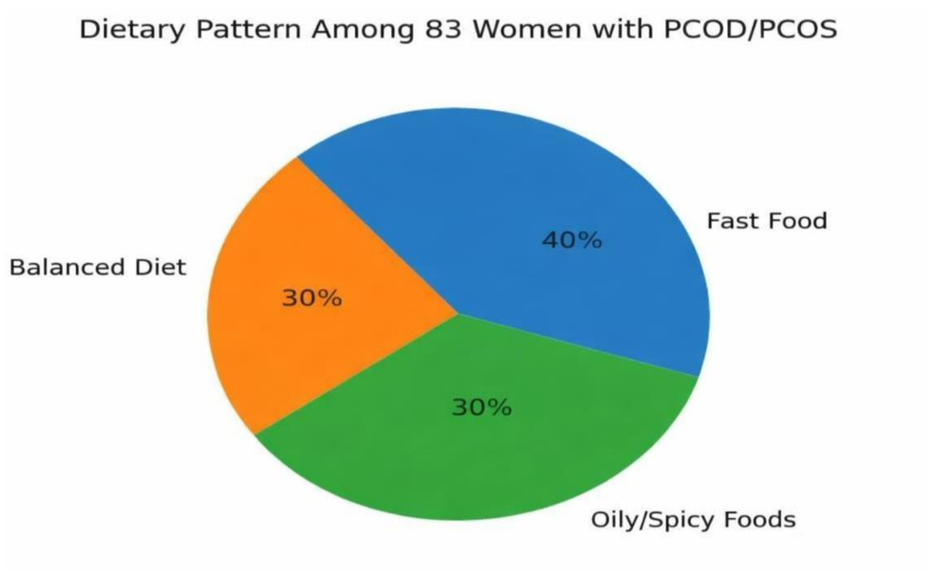

Fig.4.9:RepresentsthedietarypatternamongwomenwithPCOD/PCOS.

Conclusion: Most women with PCOD/PCOS (72%) follow a balanced diet. However, 28% consume fast food (11%) and oily/spicy foods (17%), which may negatively impact their condition

Table4.9:ImpactofPCOD/PCOSduringperiods

ProblemFaced	**NoofRespondents**
Noproblem	16
Backpain	30
Stomachpain	33
Legpain	4

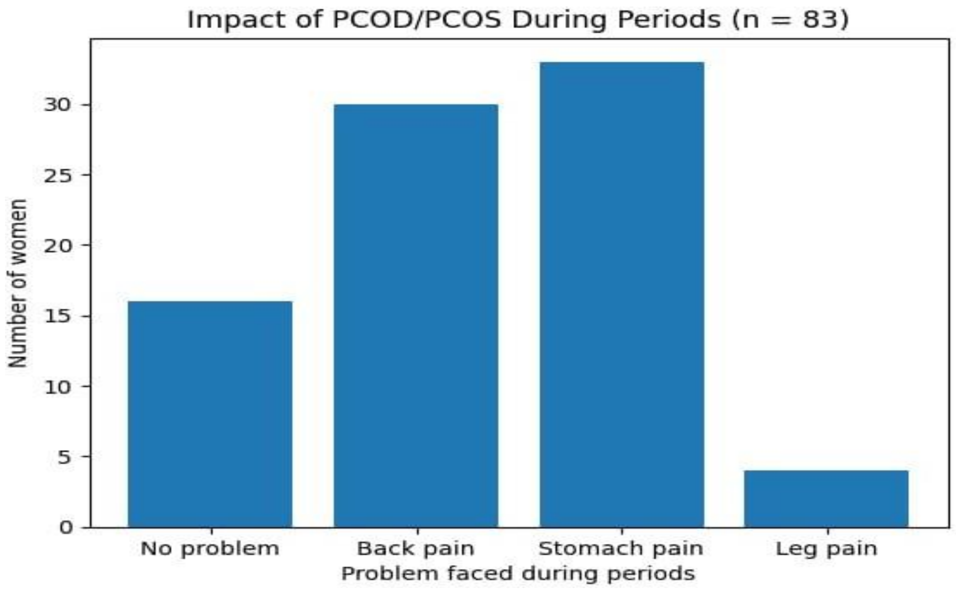

Fig.4.10:Representsthe impactofPCOD/PCOSduringperiodsamongwomen.

Conclusion: Stomachpain(33)and backpain(30)arethe mostcommonlyreportedproblems during periods among the women. While leg pain (4) was the least experienced problem.

Table4.10:ComparisonofMedicalApproaches

Treatmenttype	**NoofWomen**
Allopathic	61
Homeopathic	22

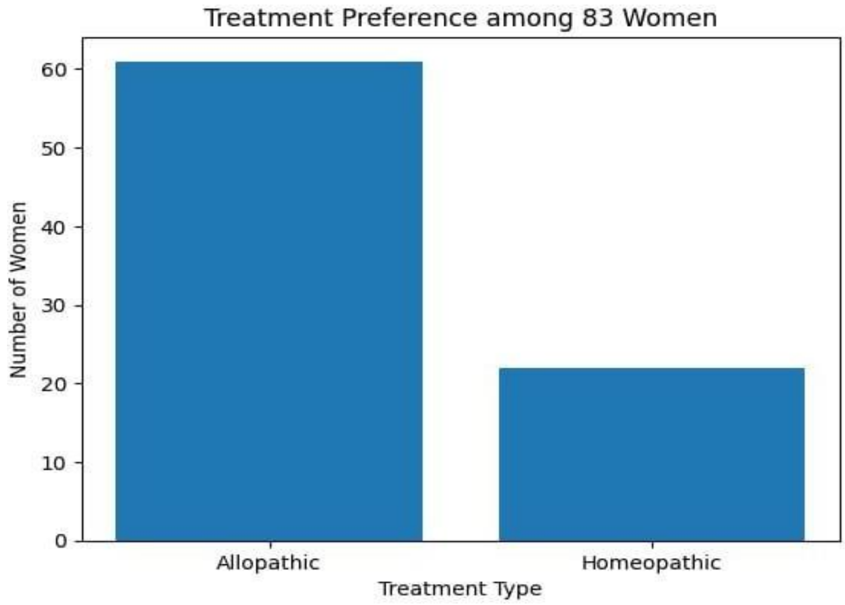

Fig.4.11:RepresentsthetreatmentpreferenceamongwomenwithPCOD/PCOS.

Conclusion: The majority of women with PCOD/PCOS prefer allopathic over homeopathic treatment.

Table4.11:UrbanandruraldistributionofPCOD/PCOSwomen

Area	Percentage
Urban	74%
Rural	26%

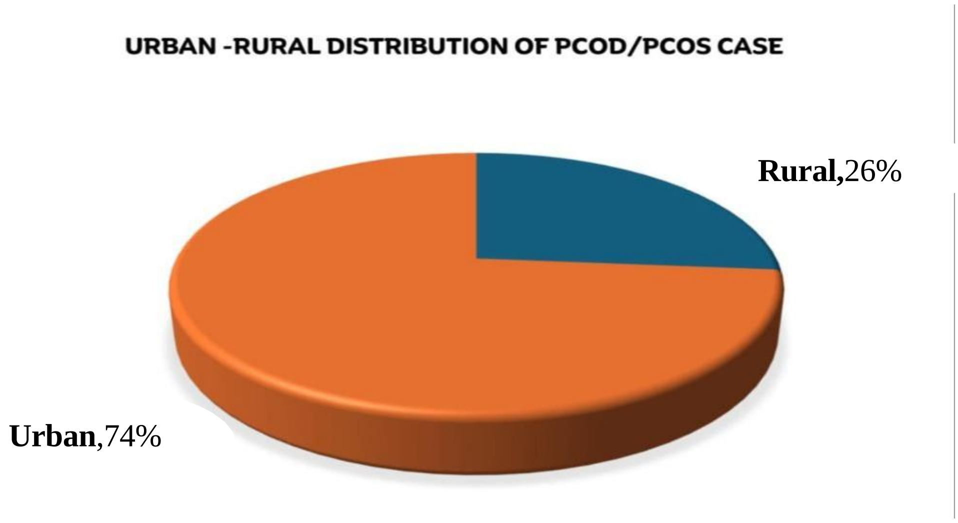

Fig.4.12:Representstheurban–ruraldistributionofPCOD/PCOScases.

Conclusion: Urbanareashowsahigherprevalenceof PCOD/PCOScaseswith106cases [74%] compared to rural areas with 38 cases [26%].

Table4.12:FoodhabitpatterninPCOD/PCOSwomen

FoodHabit	NoofWomen
Vegetarian	20
Non-vegetarian	10
Both	228

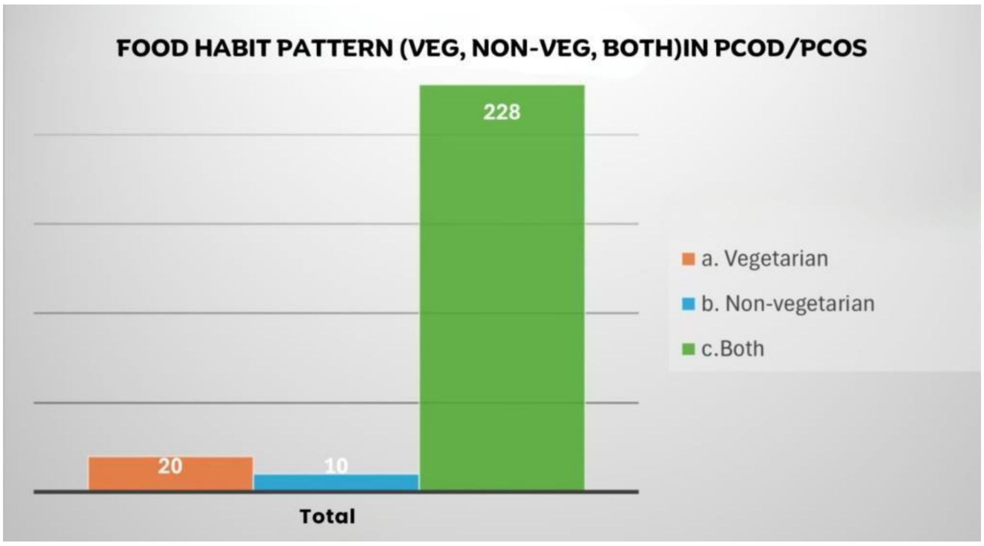

Fig.4.13:Representsthefoodhabitpattern.

Conclusion: ThegraphindicatesthatthemajorityofPCOD/PCOS casesareassociatedwitha mixed diet pattern.

Table4.13:MaritalstatusamongPCOD/PCOSwomen

Maritalstatus	Percentage
Unmarried	79%
Married	21%

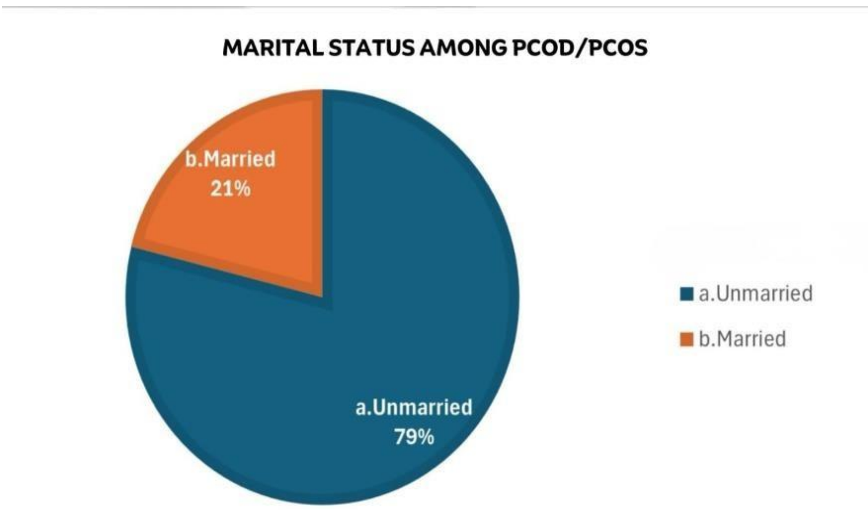

Fig.4.14:Representsthemaritalstatusamongwomenwith PCOD/PCOS.

Conclusion: Thepiechart showsthatthe majorityofPCOD/PCOScasesareobservedamong unmarried women compared to married women.

Table4.14:PCOD/PCOSStatusofrelatedpillsconsumption

Consumption	Percentage
Ibuprofen	0%
Meftal-spas	33%
No	67%

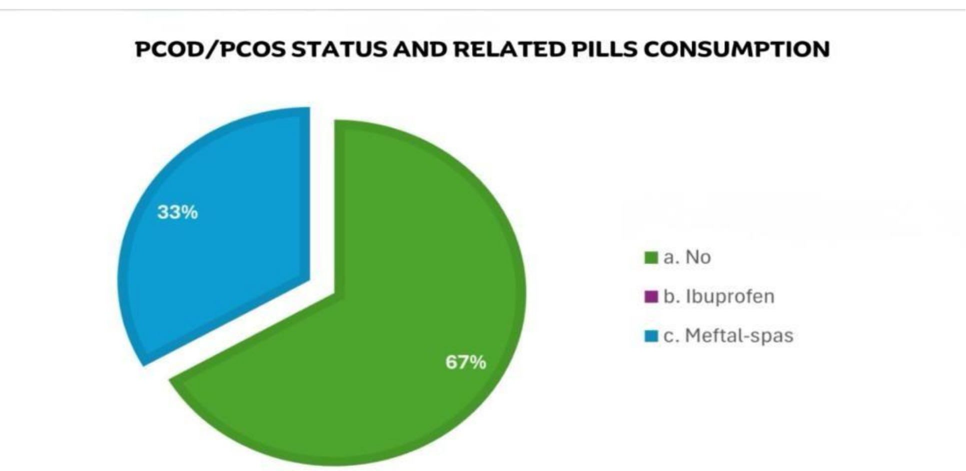

Fig.4.15:ShowstheconsumptionofpillsrelatedtoPCOD/PCOS.

Conclusion: Mostofthewomen’s(67%) donottakeanypillsrelatedto PCOD/PCOS. Only 33% use medications such as Meftal-spas or Ibuprofen.

STATISTICALANALYSIS

Chi-SquareTestAnalysis

➢ TestingtheplaceofresidenceandoccurrenceofPCOD/PCOS

Ho: Residenceandoccurrenceareindependent **H1:** Residence and occurrence are dependent Chi-SquareStatistic:14.1209,P-Value:0.0069 Degrees of Freedom: 4

Result: Reject null hypothesis and there is dependency between residence and occurrence of PCOD/PCOS

➢ TestingthefoodconsumptionandoccurrenceofPCOD/PCOS

Ho: Foodconsumptionandoccurrenceareindependent **H1:** Food consumption and occurrence are dependent

Chi-Square Statistic:2

Result: Reject null hypothesis and there is dependency between consumption and occurrence of PCOD/PCOS

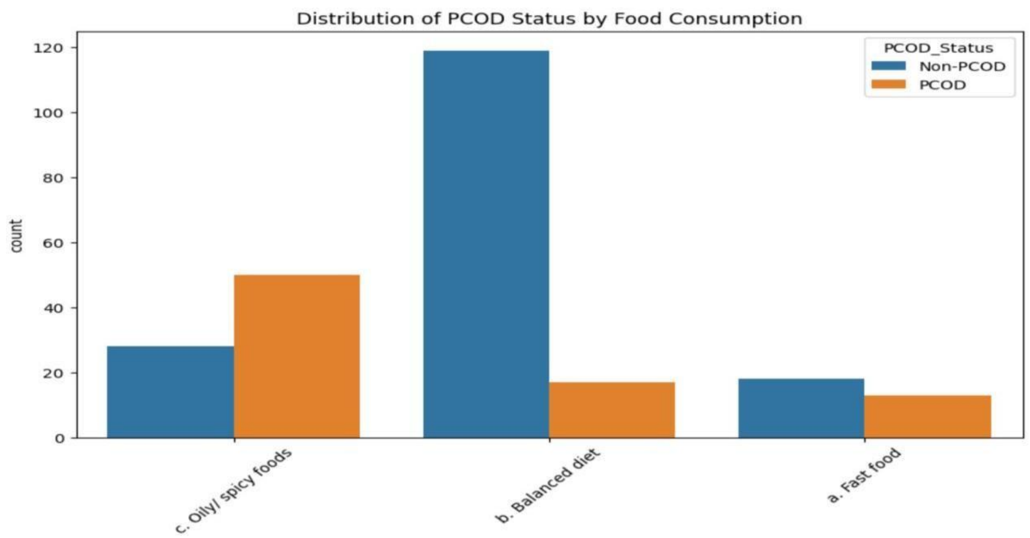

Fig.4.16:DistributionofPCODbyfood consumption

CorrelationHeatmap

Correlation heatmap are type of plot that visualize the strength of relationship between numericalvariables.Correlationplotsareusedtounderstandwhichvariablearerelatedtoeach other and the strength of relationship.

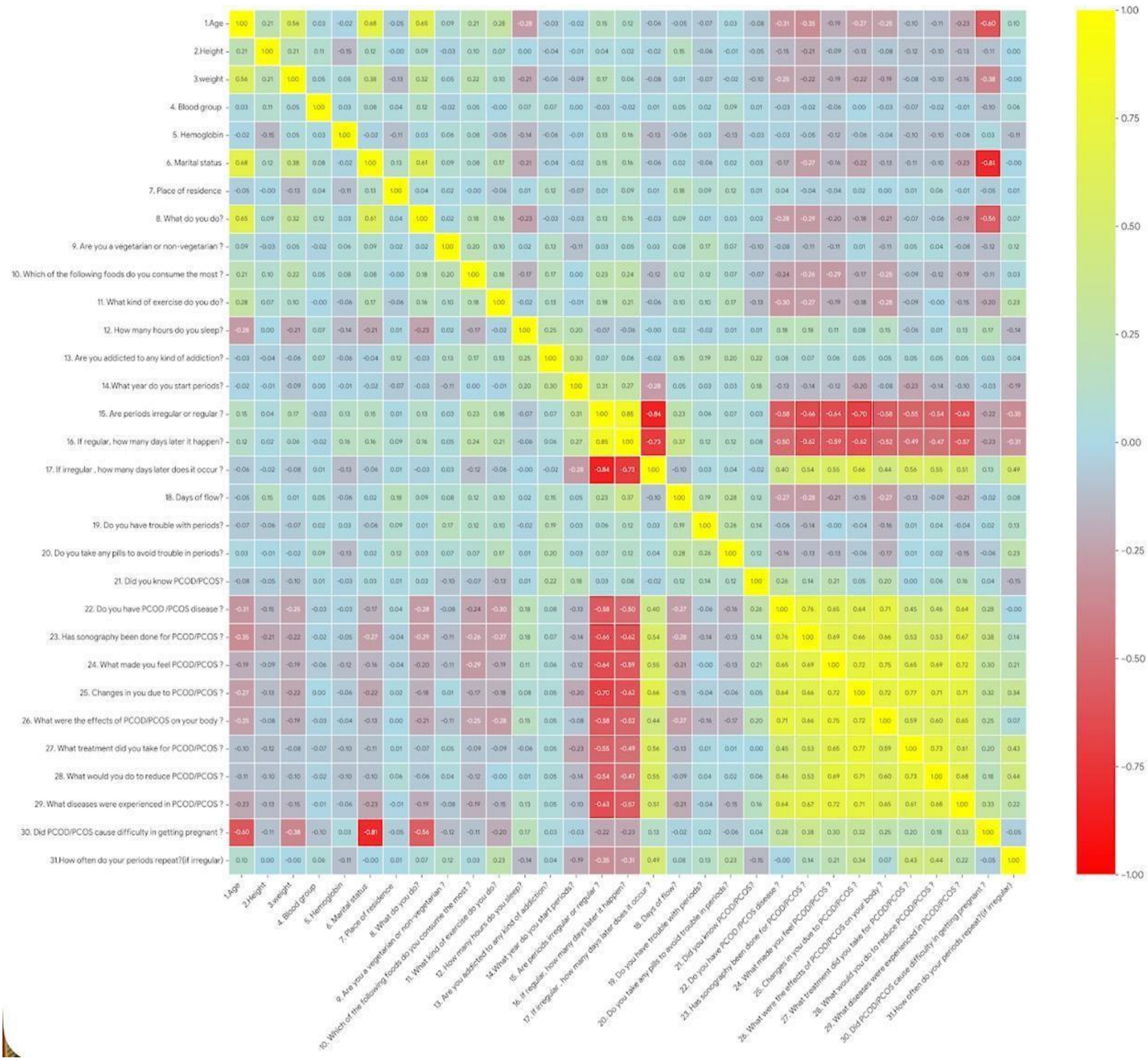

Fig.4.17:Correlationheatmap

Conclusion: Yellow areas show strong positive correlation mainly among PCOD/PCOS and menstrual variables, while red areas Indicates negative relationship. Most other variables appear light Coloured, showing weak correlation.

LogisticRegressionClassifier

Logisticregressionisthegeneralizationoflinearregression.Itisprimarilyused forpredicting binaryormultipleclassdependentvariablesbecausetheresponsevariableisdiscrete,itcannot be modelled directly by linear regression. While logistic regression is a powerful modelling tool, It assumes that the response variable is linear in the coefficients ofpredictor variable.

Table.4.15:ClassificationReport

Precision	Recall	F1-Score	Accuracy	ROC
0.82	0.82	0.82	0.82	0.94

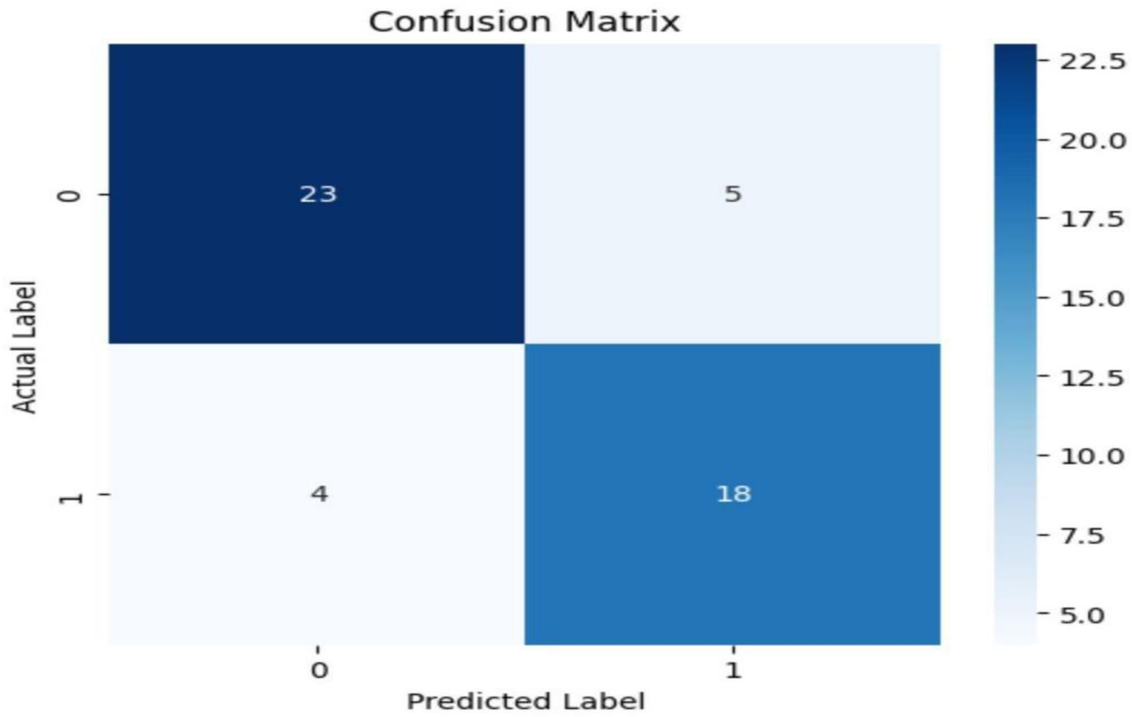

Fig.4.18:Logisticregressionclassifier

Conclusion:82.0%predictedvaluesarecorrectlyclassified

NaiveBayes Classifier

ANaveBayesClassifierisaprobabilisticmachinelearningmodelthat'susedforclassification problem. There are three types of naive bayes classifier, viz.Multinominal naïve bayes, binominalnaive bayesandGaussiannaivebayesclassifier. Inthisproject, weuseMultinominal naïve bayes.

Table4.16:ClassificationReport

Precision	Recall	F1- Score	Accuracy	ROC
0.82	0.82	0.82	0.82	0.95

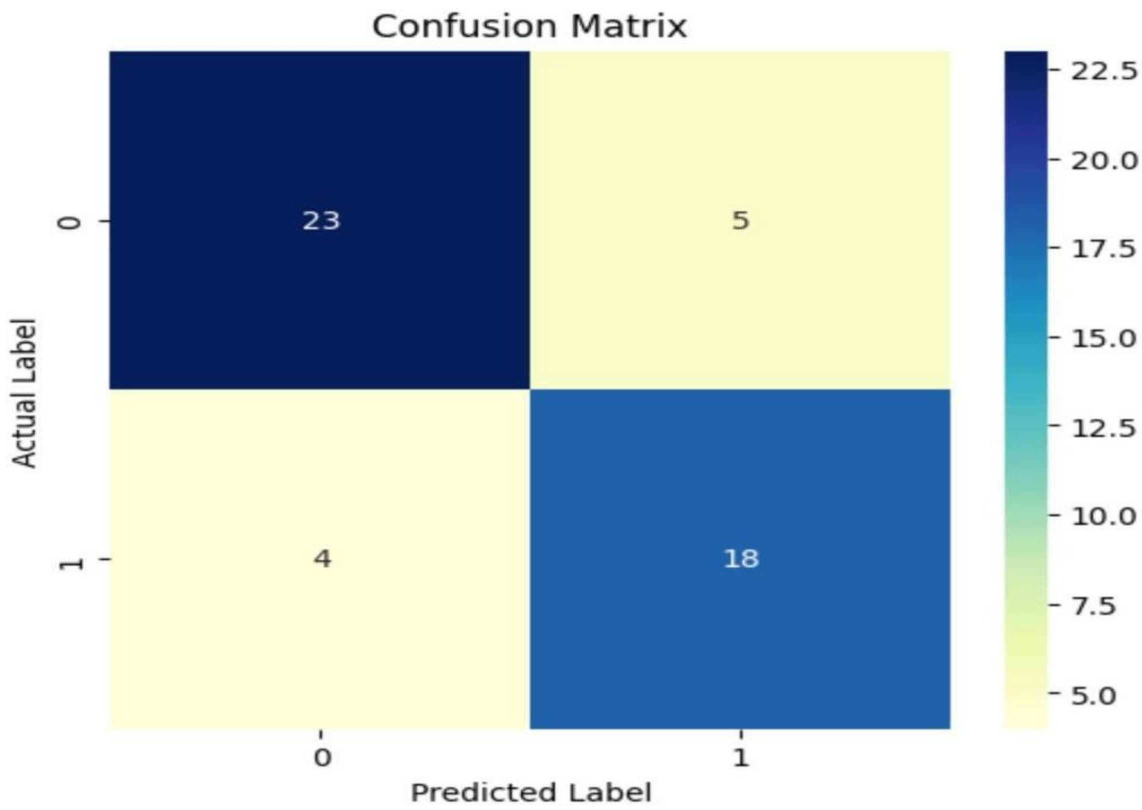

Fig.4.19:Naïvebayesclassifier

Conclusion:82.0%predicatedvaluesarecorrectlyclassified.

Randomforestclassifier

Random Forest is ensemble learning method where it Combine multiple decision tree during training and predict model. Random forest is a classifier that contains a number of decision treesonvarioussubsetsofthegivendataset andtakestheadvantagetoimprovethepredictive accuracy of that dataset.

Table.4.17:ClassificationReport

Precision	Recall	F1-Score	Accuracy	ROC
0.9	0.9	0.9	0.9	0.95

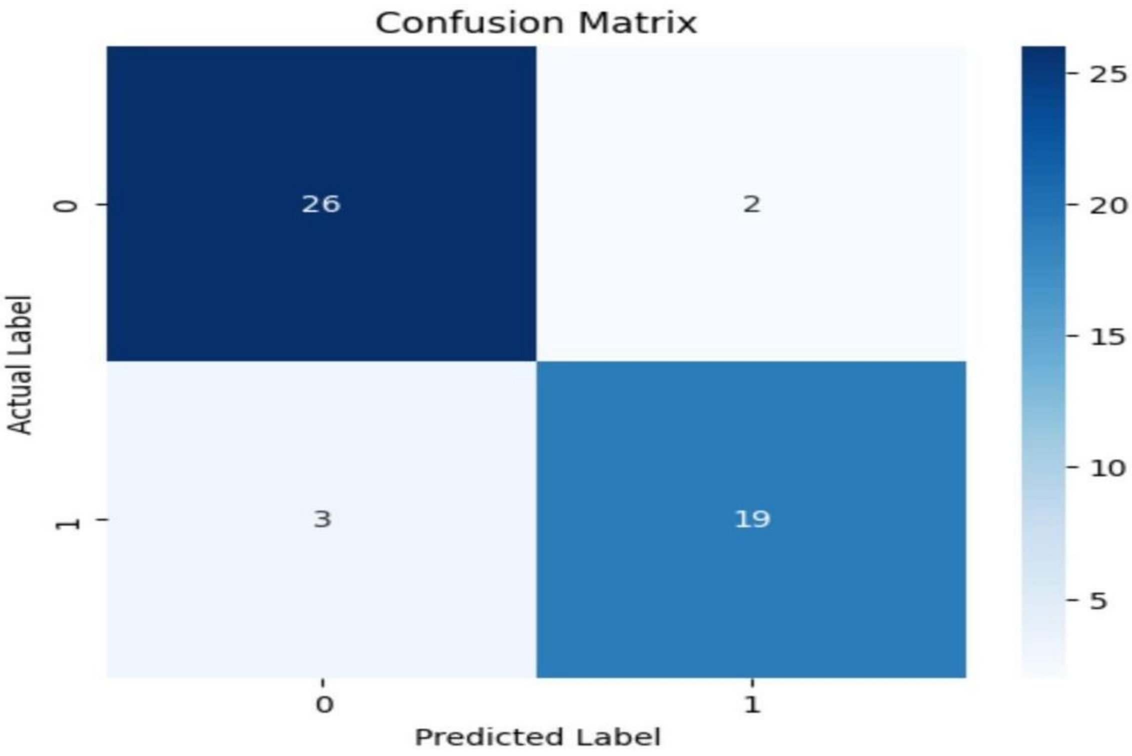

Fig.4.20:Randomforestclassifier

Conclusion:90.0%predicatedvaluesarecorrectly classified.

SupportVectorMachine

A Support Vector Machine is a discriminative classifier formally defined by a separating hyperplane. In 2D space this hyperplane is a line dividing a plane in two parts where in each class lay in either side.

Table.4.18:ClassificationReport

Precision	Recall	F1-Score	Accuracy	ROC
0.81	0.78	0.77	0.78	0.93

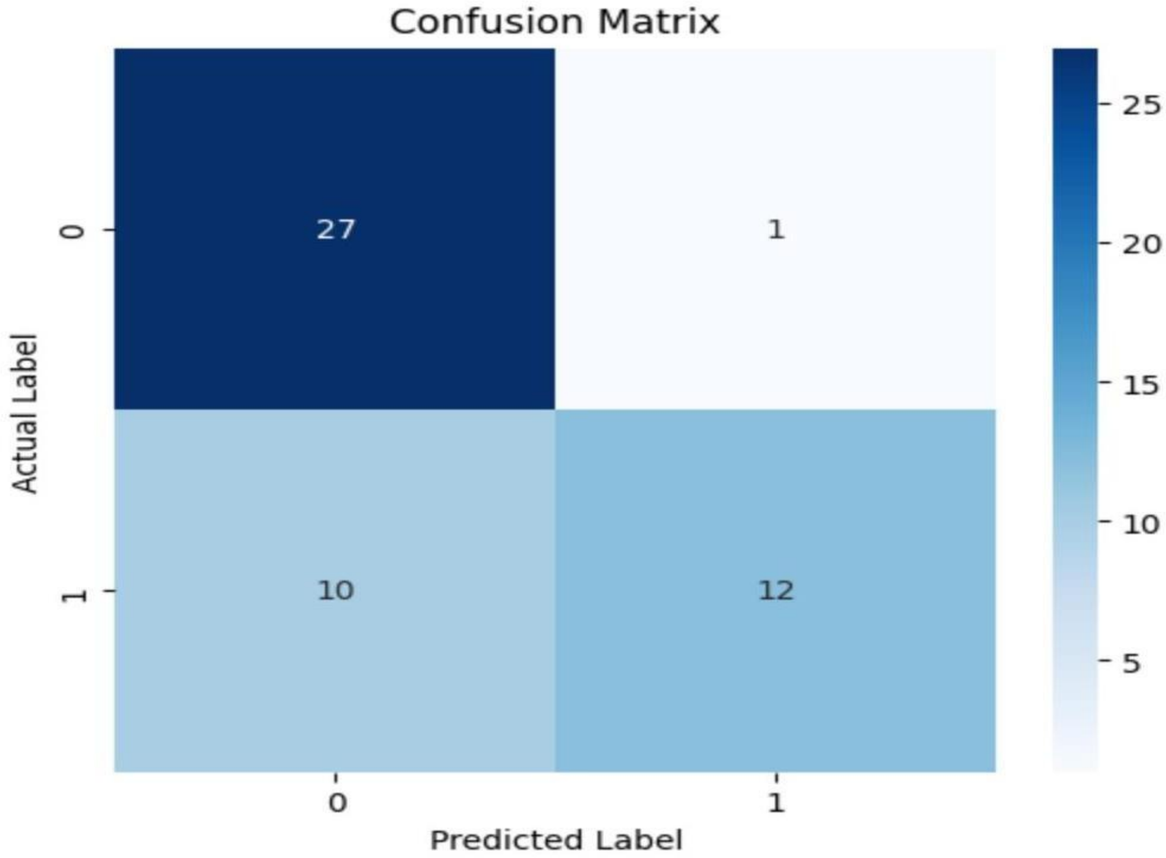

Fig.4.21:Supportvectormachine

Conclusion:78.0%predicatedvaluesarecorrectly classified.

DecisionTreeClassifier

Decision tree algorithm falls under the category of supervised learning. They can he used to solve bothregressionand classificationproblems. Decisiontreeusesthetreerepresentationto solve the problem in which each leaf node corresponds to a class label and attributes are represented on the internal node of the tree. In Decision Tree the major challenge is to identificationoftheattributefurtherrootnodeineachlevel.Thisprocessisknownasattribute selection. We have two popular attribute selection measures:

Table.4.19:ClassificationReport

Precision	Recall	F1-Score	Accuracy	ROC
0.9	0.9	0.9	0.9	0.9

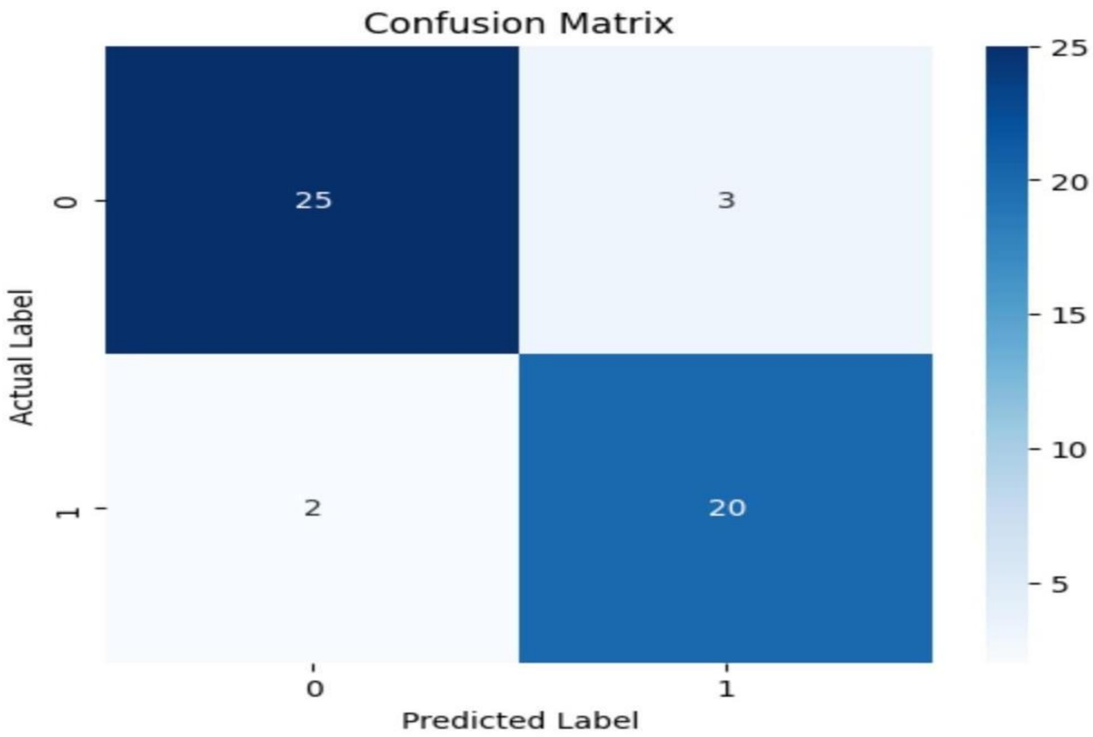

Fig.4.22:Decisiontreeclassifier Conclusion:90.0%predicatedvaluesarecorrectly classified.

K-NearestNeighbours(KNN)Classifier

Thek-nearestneighbours(KNN)algorithmisasimple,easy-to-implementsupervisedmachine learning algorithm that can be used to solve both classification and regression problems. An object is classified by a majority voteof its Neighbours, with the object being assigned to the class most common among its k nearest neighbours.

Table.4.20:ClassificationReport

Precision	Recall	F1-Score	Accuracy	ROC
0.88	0.88	0.88	0.88	0.91

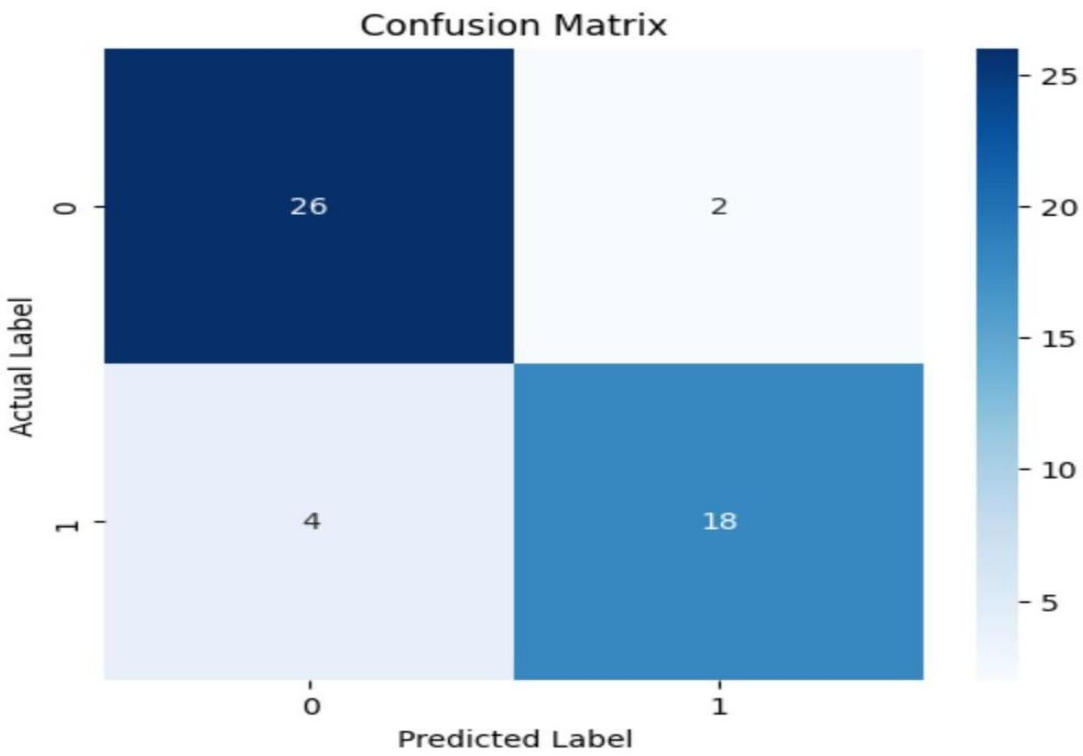

Fig.4.23:K nearestneighboursclassifier

Conclusion:88.0%predicatedvaluesarecorrectlyclassified.

FeatureExtractionbyFactorAnalysis

Itisafeatureextractiontechnique.Thepercentageindicatesthathowmucheachvariable contribute to variation in the dataset.

Table.4.21:Futureextractionbyfactorialanalysis

Features	**Variationin%**
Age	15.14
Height	9.14
Weight	4.41
Bloodgroup	4.26
Hemoglobin	3.83
Maritalstatus	3.16
Placeofresidence	3.04
Whatdoyoudo?	2.63
Areyouavegetarianornon-vegetarian?	2.56
Whichofthefollowingfoodsdoyouconsumethe most?	2.48
Whatkindofexercisedoyoudo?	2.27

Howmanyhoursdo yousleep?	2.22
Whatyeardoyoustartperiods?	2.13
Areperiods irregularor regular?	2.10
Ifregular,howmanydays laterithappen?	1.96

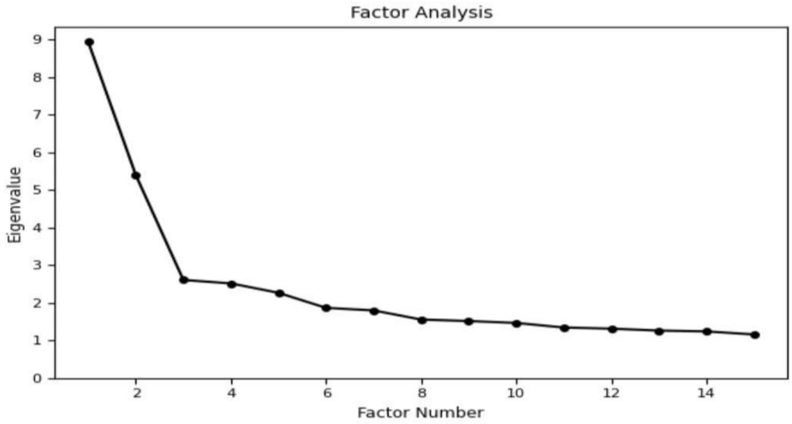

Fig.4.24:Featureextractionbyfactorialanalysis

Conclusion: Weextracted13componentsfrom31componentswhichcoversmaximum variation (61%) within dataset.

ClassificationResults

Toclassifywomen'swithPCOD/PCOSfromgivenvariables,weappliedfollowingtechniques.

Table.4.22:Classificationresults

Performance			
Classifier	Accuracy	Recall	F-1score
Randomforest	0.77	0.77	0.72
KNN	0.71	0.71	0.66
LogisticRegression	0.67	0.67	0.68
Decisiontree	0.71	0.71	0.71
NaiveBayes	0.04	0.04	0.03
SVM	0.73	0.73	0.67

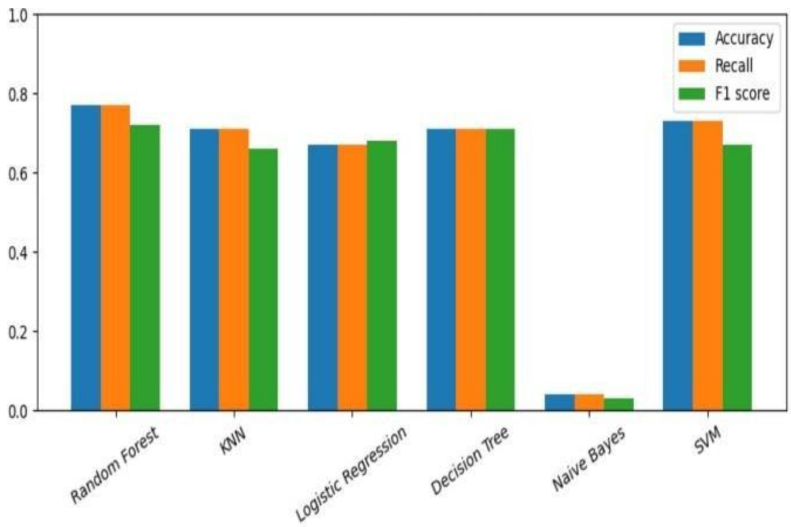

Fig.4.25:Classificationresults

Conclusion: From above, we can conclude that Random Forest model gives highest (77%)accuracy of classification.

ReceiverOperatingCharacteristic(ROC)

ROCcurveiscommonlyusedtovisualizetheperformanceofthe classifier.

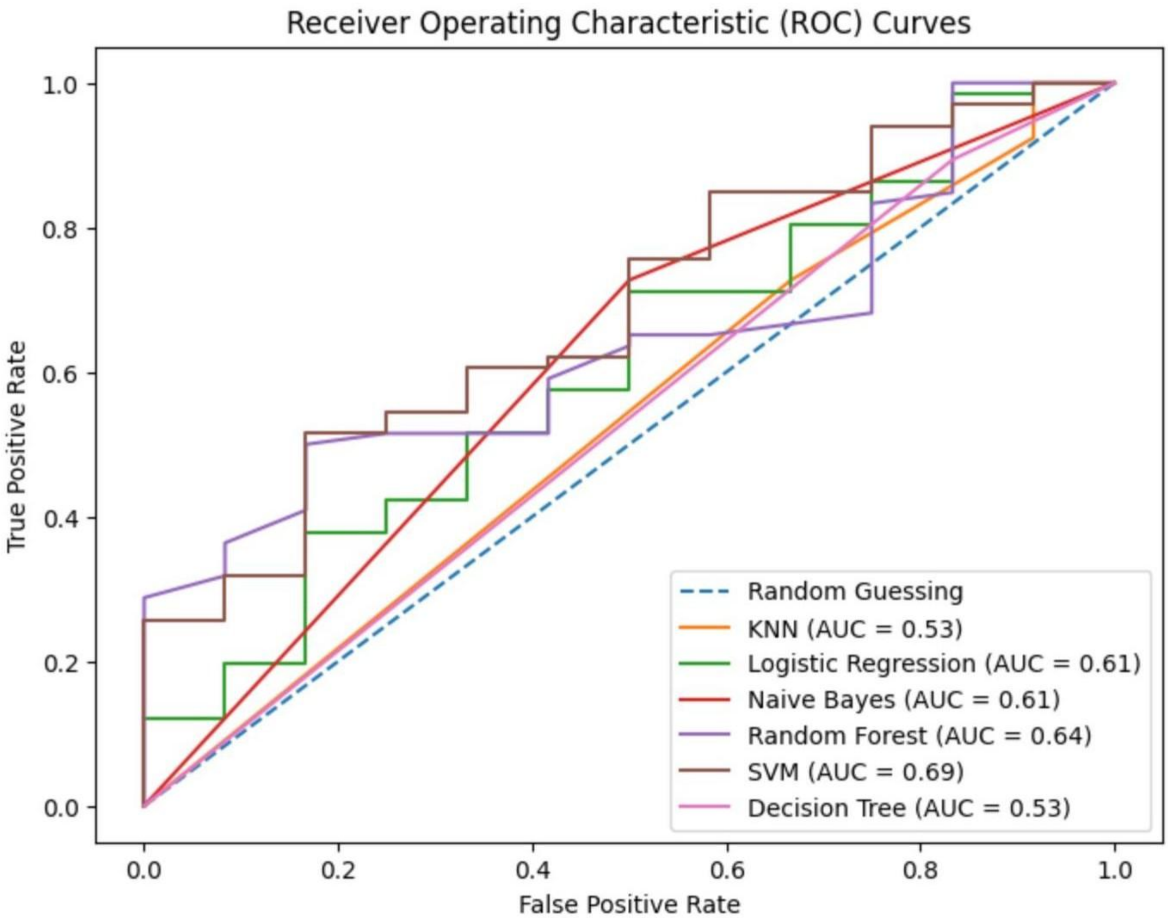

Fig.4.26:Receiveroperating characteristic

Conclusion: FromtheaboveROCcurve,thebest modelisSVWwithAUC=0.69.

SuggestiontocontrolPCOD/PCOS

Fig.5.1:SuggestiontoncontrolPCOD/PCOS

ClassificationTechniques

➢ **KNN**

from sklearn.neighbors **import**KNeighborsClassifierk=KNeighborsClassifier(n_neighbors=5) k.fit(X_train_res,y_train_res) pred-k.predict(X_test) pred accuracy metrics.accuracy_score(y_test,pred)print("AccuracyfromKNN="accuracy)

print(classification_report(y_test,pred))print(confusion_matrix(y_test,pred))

➢ **Naïvebayes**

from sklearn naïve bayes **import**GaussianNBnGaussianNB()n.fit(X_train_res,y_train_res)class_pred-n.predict(X_test)class_predaccuracymetrics.accuracyscore(y_test,class_pred) print("Accuracy from Naïve bayes accuracy)

print(classification_report(y_test,class_pred))print(confusion_matrix(y_test.class_pred))

- **LogisticsRegression**

fromsklearn.linearmodel**import**LogisticRegressionlogistic=LogisticRegression() logistic fit(X_train_resy_train_res) prod3-logistic.predict(X test)pred3 accuracy2=metrics.accuracy_score(y_test.pred3)print("AccuracyoflogisticsRegression=", accuracy2)

print(classification_report(ytestpred3))print(confusion_mateix(ytest,pred3))

- **RandomForest**

fromskicarn.cnsemble **import**RandomForestClassifierRandomForestClassifierta_estimators-10)r.fit(Xtrain_res,y train res) pred5-r.predict(X_test)pred5 accuracy5-metrics.accuracy_score(ytest pred5)print("AccuracyofRandomForest" accuracy5)

print(classification reportly_test.pred5)) print(confusion_matrixiy test.pred5))pred5r.predict(X_test)pred5accuracy5-metrics.accuracy_score(y_test.pred5) print("Accuracy of Random Forest", accuracy5)

print(classification_report(y_test,pred5))print(confusion_matrix(y_test,pred5))

- **DecisionTree**

fromsklearn.tree **import** Decision TreeClassifierD-Decision Tree Classifier(max_depth=5) D=D.fit(X_train_res.y_train_res) pred4=D.predict(X_test) pred4 accuracy4 metrics.accuracy_score(y_test,pred)print("AccuracyofDecisionTree",accuracy4) print(classification_report(y_test.pred4)) print(confusion_matrix(y_test.pred4)) **from** sklearn **import** treeT-tree.export_text(D) print(T) fir-plt.figure(figsize=(25.18))T1-tree.plot_free(D)

- **SupportVectorMachine**

fromsklearn.svm **import**SVCsvmSVC()svm.fit(X_train_res,y_train_res)pred6-svm.predict(X_test)pred6 print(confusion_matrix(y_test.pred6))a6 metrics.accuracy_score(y_test.pred6) print("Accuracy from Support Vector Machine", a6)

print(classification_report(y_test,pred6))

- **ReceiverOperatingCharacteristic(ROC)Curves**

importnumpyasnp
import matplotlib.pyplotaspit
from sklearn datasets **import** make_classification **from** sklearn.model_selection **import** train_test split

from skleam.preprocessing **import** StandardScaler **from** sklearn.neighbors

importKneighborsClassifier**from**sklearn.linear_model**import**LogisticRegression**from** sklearn.naive bayes

import GaussianNB

fromskleam.ensemble**import** RandomForestClassifier

fromskicam.svmimportSVC

fromsklearntree **import** DecisionTreeClassifier

fromsklearn.metrics**import**roccurve,auc

- **Standardizethefeatures**

Scaler=StandardScaler)

Xtram=scalerfit_transform(X_train) X_test = scaleraransform(X_test)

- **Initializeallclassifiers**

Classifiers={

“KNN”:KneighborsClassifier(),

“LogisticRegression”:LogisticRegression(), “Naïve Bayes”: GaussianNB(),

“RandomForest”:RandomForestClassifier(), “SVM”: SVC(probability =**True**),

“DecisionTree”:DecisionTreeClassifier()

SUMMARYANDCONCLUSION

- **Summary:**

Polycystic OvarySyndrome (PCOS) or Polycystic OvaryDisease (PCOD) is one ofthe most common hormonal disorders affecting women of reproductive age. The present study was conductedtoAnalyzetheprevalenceand healthimpactofPCOD/PCOSamongwomeninthe selected population.

In this study, a totalof260 women aged between 12–45 years were included, among which 83 women were diagnosed with PCOD/PCOS. Data were collected using questionnaires, physicalexaminationparameterssuchasBMI, bloodpressure, andclinicalsymptoms, along with lifestyle and dietary habits. The studywas conducted in colleges, nearby villages, and gynecology hospitals.

The results showed that PCOD/PCOS was more common in younger women, especially in the20–

25yearsagegroup.Menstrualirregularitieswerefrequentlyobservedamongaffected women. Lifestyle factors such as stress, hormonal imbalance, unhealthydiet, and lack of physical activity were identified as major contributors to the occurrence of the disorder.

The analysis also showed that many women experienced symptoms such as stomach pain, back pain, irregular menstrual cycles, and pregnancy difficulties. Around 73% of women reportedpregnancy-relatedproblemsassociatedwithPCOD/PCOS.Urbanwomenshoweda higher prevalence compared to rural women.

Different machine learning classification techniques such as Logistic Regression, Naïve Bayes,RandomForest,SupportVectorMachine,DecisionTree,andK-NearestNeighbors were applied to analyze the dataset.Among these methods, the Random Forest model provided the highest accuracy for classification, indicating its effectiveness in predicting PCOD/PCOS cases.

Thestudyhighlightsthat earlydiagnosis, awareness, and lifestyle modificationplayacrucial role in reducing the complications associated with PCOD/PCOS.

➢ Conclusion:

Fromthepresent study,it canbeconcludedthatPCOD/PCOS isasignificant healthproblem among women of reproductive age. The prevalence of the disorder is increasing, especially among young women due to lifestyle changes, stress, and dietary habits.

Thefindingsindicatethatmenstrualirregularities,hormonalimbalance,obesity,andstress are major risk factors associated with PCOD/PCOS. The condition not only affects reproductivehealthbutalsoleadstometabolicdisorders,psychologicalissues,and pregnancy complications.

Statisticalandmachinelearninganalysisrevealedthat RandomForest andDecisionTree models showed better prediction accuracy compared to other classification methods.

Therefore,earlyscreening, propermedicaltreatment,regularexercise,healthydiet, and lifestyle management areessentialto controlandpreventthecomplicationsofPCOD/PCOS. Increasing public awareness and health education programs can help women identify symptoms early and seek appropriate medical care.

Overall,thisstudyemphasizesthe importanceoftimelydiagnosisandpreventive healthcare strategies to reduce the burden of PCOD/PCOS and improve women's reproductive and overall health.

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