**MINDFULLNESS AND WELLNESS PROGRAM FOR WOMEN WITH PCOS**

***Abstract--* Polycystic Ovary Syndrome (PCOS) is an endocrinal disorder characterized by varied presentation that affects about one woman in every fifteen worldwide. Unlike a single disease, PCOS involves a group of different symptoms. Among these symptoms are usually high levels of male hormones (androgens) accompanied by abnormal insulin activities. Although its exact cause remains unknown, it is believed to result from unbalanced hormones; stress or lack of physical activity. This syndrome affects various systems in the body leading to health consequences, such as acne, fat gain, excessive body hairs, infertility problems, menstruation cycles that are either too short or too long or even absent altogether together with several ovarian cysts. There is an increased chance for type 2 diabetes development as well as possibly heart diseases among women suffering from this condition. However there are many medical treatment options available today but their effects only last briefly while others may have severe consequences if used over an extended period thus making them less desirable choices for dealing with polycystic ovarian syndrome (PCOS). The use of yoga has been shown to reduce and manage symptoms linked to the polycystic ovarian syndrome alongside modern drugs more effectively than other forms of therapy. This means that Yoga is a complete prescription for healthy body and mind healing which can address the primary problems of PCOS like obesity and stress for improved quality of life. Daily practice of yoga, meditating helps weights reduction and balancing hormone level, hormonal balance, stress management, which ultimately stabilize the normal function of the hypothalamus-pituitary-ovarian axis and can cure PCOS. This paper has been designed to show effectiveness of yoga for PCOS based on parameter**

Keywords— Polycystic Ovarian Syndrome, PCOS, yoga, Stress management, hormonal balance, mental health, Androgen.

# I. Introduction

Sedentary living pattern and physical inactivity level are the risk factors for major chronic noncommunicable diseases (NCDs). According to the report of World Health Organization (WHO) NCDs kill around 41 million people each year, that is around 74% of all deaths globally. Polycystic ovary syndrome has associations with major NCDs such as obesity, metabolic syndrome, and diabetes. Polycystic ovarian syndrome is a very common hormone disorder affecting women in the premenopausal age group (typically between puberty and menopause). In recent years, PCOS has come into light for various reasons. Firstly the incidence and prevalence of PCOS are increasing globally. As per present day statistics, approximately 1.55 million new cases of PCOS arise each year all around the world, which means a rise of 4.47% from about 10 years ago. This implies that there is an increasing trend in its diagnosis for PCOS. Existing cases in India average around 15.3%, and in Tamil Nadu (a state in southern India), about 18% of fertile women are affected. The women with PCOS commonly has some

symptoms such as absence of menstruation, excessive hair growth, multiple ovarian cysts. Beyond these Primary Symtoms PCOS can lead to significant complication like insulin resistance, hytension, cardiovascular disease, infertility, and reproductive organ carcinomas (cancer of the lining of the uterus) Even though PCOS causes many serious health problems, there is still no complete cure for it. Primarily because the exact cause is not fully understood. It creates a hurdle for treatment since women’s health is affected in various ways by it. Knowledge of PCOS causes and effects will enable improved care since there is no definite cure as it is on the increase. Hormonal irregularities, metabolic problems, personal habits and ecological conditions are said to contribute to PCOS. Among these approaches one primary intervention method suggested for dealing with PCOS is lifestyle modifications including yogic practices. Yoga assists in maintaining weight while increasing metabolic body health and reducing stress levels. This paper has examined the effects of yoga on different health parameters including, Body mass index (BMI), luteinizing hormone (LH), Follicle-stimulating hormone (FSH), Thyroid-stimulating hormone (TSH), Anti-Müllerian hormone (AMH), Homeostatic model assessment insulin resistance (HOMA IR), triglycerides high density lipoprotein cholesterol (HDL), Low density lipoprotein cholesterol (LDL), Fasting blood sugar (FBS), Blood pressure (BP), and Cortisol, women’s quality of life with PCOS.

# RELATED WORK

Many studies have investigated how yoga influences the management of Polycystic Ovary Syndrome (PCOS), highlighting its ability to alleviate symptoms and enhance overall wellness. According to this paper [1], nine weeks of practicing yoga can significantly reduce key hormonal markers such as Anti-Müllerian Hormone (AMH), luteinizing hormone (LH), and testosterone levels. This hormone reduction further normalizes the menstruation cycles and decreases hirsutism as well as acne symptoms. Besides increasing self-esteem, yoga also lowers the chances of depression, anxiety and stress besides controlling oxidative stress; thus supporting mitochondrial health and increasing fertility together with metabolic health. Moreover, it is stated by this work[2] that despite not being the actual remedy for PCOS, yoga manages its symptoms well by ensuring low testosterone levels decreasing levels of stress among others. Some yoga poses such as Garland Pose, Bridge Pose, and Bow Pose, along with the breathing technique Kapalbhati Pranayama, are recommended to aid in weight management, blood sugar control, and stress reduction. In a

systematic review [3], synthesis from 74 articles showed that yoga contributed to alleviating some PCOS symptoms including; acne breakouts, weight gain and problems associated with reproduction generally. It is highlighted that blood lipid profile improved following the session with sessional practitioners compared to those who had not participated in any classes at all after one year. This work[4] validates these findings and it has been noted that practicing yoga leads to enhancement in menstrual cycles, lowering testosterone levels and overall quality of life among the participants. Some of the notable benefits highlighted include reducing excessive hair growth rate, improvement of body mass index (BMI) as well as insulin sensitivity but which require larger studies for confirmation. The article [5] states that yoga can be more effective than strenuous exercise for managing PCOS because it helps in regularity of menstrual flow, lower testosterone levels and at the same time boost mood. The poses recommended here include Garland Pose, Bridge Pose and Bow Pose all aimed at enhancing blood circulation, aiding digestion and reducing stress while advice is also provided advising combination to be made between Yoga with a sound diet plus stress management so as to achieve best results possible. According to this work [6], yoga comparatively reduces trait anxiety than regular exercises amongst adolescence suffering from PCOS and thus recommending it as a remedy put together with other controlled strategy aimed at advancing the mental wellness. In the work [7] proves that Yoga helps control PCOS through decreasing stress levels and balancing hormones thereby assisting women who experience irregular monthly cycles. Suggested mountain pose and child’s position are believed to be effective because they tend to promote better digestion and energy supplementation together with symptoms relief.

Further research has uncovered important links between PCOS and stress, oxidative stress, and inflammation. The paper [8] found out that women with PCOS often suffer from stress; this implies that there is a relationship between PCOS and stress. Studies done by Blair in this work [9] also carried out by Hilali et al. work [10] revealed higher oxidative stress levels in both lean as well as obese women who have PCOS condition. For example, In this work, [14] Mentioned the role of oxidative stress in polycystic ovary syndrome especially among Oman women. On the other hand, metabolic syndrome exacerbates oxidative stress and endoplasmic reticulum stress among patients with polycystic ovary syndrome according to findings made by this work [11]. Takahashi et al. discovered ovarian fibrosis in PCOS patients caused by endoplasmic reticulum stress in ovarian cells [12]. Moreover, This paper showed that depression, anxiety and stress are more common among women suffering from polycystic ovary syndrome [13]. Resveratrol has been noted to help reduce key signs of inflammation and tension in cases involving patients enduring PCOS as reported by this work [16], meanwhile regular yoga can enhance various conditions including reduction on male hormones results implying yoga serves as a good addition therapy management tool for controlling symptoms associated with polycystic ovary syndrome according this work [17].

III. PROPOSED METHODOLOGY

*3.1 Data Collection Phase*

The Data collection Phaseaims to comprehensively gather detailed information on Polycystic Ovary Syndrome (PCOS) from various sources. The parameter in the dataset such as Body Mass Index (BMI), weight changes, menstrual cycle patterns, and hormone levels (such as LH, FSH, TSH, SHBG, AMH), as well as indicators of insulin resistance, cholesterol levels, liver enzymes, blood pressure, follicle count, fasting blood sugar, thyroid levels, and the Free Androgen Index (FAI), blood sugar levels, heart rate Additionally, the collection will cover symptoms such as hair loss, acne, and stress levels to ensure a thorough evaluation of the patient's condition. This extensive data gathering will form the foundation for accurate analysis and personalized recommendations in managing PCOS.

*3.2 Data Pre-processing Phase*

In this phase, the goal is to prepare the collected data for analysis. The pre-processing steps begin with data cleaning, which involves removing errors, duplicate entries, and outliers. Handling missing values is also addressed using techniques such as mean or median imputation, or more advanced methods like K-Nearest Neighbours (KNN) imputation. Next, normalization or standardization is applied to bring all features to the same scale, which is crucial for improving the performance and accuracy of machine learning models.

*3.3 Feature Engineering Phase*

In Feature Engineering Phase, the process involves selecting, transforming, and creating features from raw data to enhance model performance. For **feature selection,** we focus on identifying the most impactful parameters for managing PCOS and suggesting appropriate yoga poses. We assess features such as **BMI, LH, FSH, TSH, SHBG, AMH,** and various symptoms like **hair loss** and **acne** by ranking their significance based on their correlation with PCOS outcomes and their role in predicting abnormalities. This helps us select key features, like **BMI** and **LH**, that are directly relevant to PCOS. **Feature extraction** involves generating new metrics from existing data to capture essential information. For example, we can calculate the **average menstrual cycle length** or the **ratio of LH to FSH** to understand hormonal balance. And Normalization and standardization are done to bring all features to an equal footing. Min-max scaling is one method which ensures that every aspect of the model counts equally by comparing them on the same chart through min-max scaling or z-score normalization. Here the goal is to recommend yoga based on PCOS parameters and symptoms, Gradient Boosting is a highly effective feature selection technique. It excels by providing detailed feature importance scores, capturing complex interactions between features, and evaluating their contributions to accurate predictions. Other feature selection technique such as K-Best Feature Selection, which only looks at individual feature scores and might miss how features interact with each other (not good for complex data). But, Gradient Boosting captures these interactions well. Recursive Feature Elimination can be useful but takes a lot of time and computing power for large datasets (can be slow). The Correlation Matrix is good for finding closely related features but only works well with linear relationships (doesn't handle complex patterns Mutual Information, although good for capturing complex relationships, can be computationally intensive (requires more computational power). Gradient Boosting stands out by efficiently handling non-linear interactions and providing clear insights into feature importance. Even though it is more computationally demanding and complex to tune, it is excellent for feature selection due to their ability to capture complex relationships and interactions between features. GBM provides detailed feature importance scores, helping you identify which features most significantly impact your predictions. This allows you to focus on the most relevant parameters, ensuring more accurate and insightful recommendations. Next Step is Model Development, It is a critical phase where the machine learning model is built, trained, and evaluated to meet the project’s objectives.

*3.4 Model Development and Evaluation Phase*

This is a crucial step where the machine learning model is developed, tested, and validated to meet the objectives of the project. This begins with Model Selection, where the most suitable algorithm is chosen based on the project requirements and dataset characteristics. Gradient Boosting Machines (GBM) and XGBoost are the best choices for building and refining your model due to their ability to handle complex, non-linear relationships and provide detailed insights into feature importance. GBM works by sequentially building models where each one focuses on correcting the errors of the previous model, making it adept at capturing intricate patterns and interactions in the data, which is crucial for understanding diverse PCOS parameters. XGBoost, an optimized version of GBM, further enhances performance with additional features like regularization to prevent overfitting and efficient computation, making it particularly suitable for large, complex datasets. Compared to simpler models like Decision Trees or Random Forests, which might not handle complex interactions as effectively, or Support Vector Machines and Neural Networks, which may struggle with very large datasets or require significant resources, GBM and XGBoost provide a robust solution with high accuracy and detailed feature importance scores. Logistic Regression and Naive Bayes are simpler models, but they might not capture the complexities of your data as effectively as ensemble methods. This makes GBM and XGBoost more suitable for accurately predicting PCOS abnormalities and recommending appropriate yoga practices. Once you choose your algorithm for the model, you start feeding it with the inputs and desired output during training period; thus, adjusting its error minimizing parameters so as to better predict using sample data. The effectiveness of a given model can be evaluated by standard performance metrics such as accuracy, precision, recall, F1-Measure etc. The validation process involved cross-validation or testing a separate validation set in order to obtain robustness against overfitting and generalizability course checking that the model will perform well with unseen new data also helps in this case. All these approaches ensure that the final model is accurate, reliable, and capable of making effective recommendations for managing PCOS based on the analyzed data.

*3.5 Data Analysis Phase*

The trained machine learning model is put to use during the Data Analysis phase for prediction and insight generation from the data. In the **Predictive Analysis step**, the model assesses whether parameters related to PCOS, such as BMI, hormone levels, or blood sugar levels, are within normal ranges or are abnormal. These predictions help identify areas of concern in a patient’s health and suggest specific yoga practices to manage or improve these conditions. Additionally, the **Interpretability step** ensures that these predictions are clear and understandable to end-users, such as healthcare providers or patients. The model not only provides an outcome (e.g., "abnormal hormone levels detected") but also explains why that prediction was made by highlighting key contributing factors like elevated LH levels or high BMI. This transparency builds trust in the model’s recommendations and helps users make informed decisions based on its analysis**.**

Polycystic Ovary Syndrome (PCOS) is a complex disorder with various underlying mechanisms that lead to multiple clinical manifestations. The table below outlines the key mechanisms involved in PCOS and their associated manifestations:

|  |  |
| --- | --- |
| Mechanism | Manifestations |
| Pituitary dysfunction | High serum LH  High serum prolactin |
| Anovulatory menstrual cycles | Oligomenorrhea  Secondary amenorrhea  Cystic ovaries  Infertility |
| Androgen excess | Hirsutism acne |
| Insulin resistance | Insulin resistance  Dyslipidaemia Hypertension |
| Obesity | Hyperglycemia  Elevated oestrogens |

*Table 1: Major Feature of PCOS [18]*

Recognizing these major mechanisms and their associated manifestations is essential for comprehensively diagnosing and managing PCOS. By targeting these underlying factors, healthcare providers can develop more personalized and effective treatment strategies, ultimately improving the quality of life for those affected by this multifaceted syndrome.

*3.6 Dashboard Creation Phase*

The final phase involves designing a user-friendly dashboard that displays key health parameters related to PCOS while providing tailored yoga recommendations. The dashboard includes intuitive layouts and engaging visualizations, such as bar charts, line graphs, and pie charts, to help users interpret their data. It highlights both normal and abnormal parameters, offering tailored yoga recommendations for each detected abnormality. Whenever the body mass index goes up, dashboard might suggest some poses such as Sun Salutations or Boat Pose will be helpful in controlling body weight. In case luteinizing hormone levels tends to increase, where it will advised to perform calming poses like Child’s Pose and Legs-Up-The-Wall pose for hormonal balance. The relaxation effect of corpses pose and seated forward bends are best suited for individuals with hypertension which is synonymous with high blood pressure (hypertension). Most people are normally advised chair poses and warrior II poses so as to reduce blood sugar levels in their bodies. Each recommendation is accompanied by an explanation of how the yoga practice benefits the specific health parameter, helping users understand the holistic impact of these exercises on their overall well-being.

*3.7 Methodology Architecture:*

The methodology architecture acts as an all-encompassing outline which describes how the project runs in sequence starting from the early stages of gathering data all through to the last phase of implementing user interface. This project’s system architecture is a seamless progression from data collection to the ultimate user interface, thus approaching PCOS management comprehensively through personalized yoga recommendations. It starts with the Data Collection Phase, where comprehensive information regarding PCOS is gathered including vital points like BMI, hormone levels and insulin resistance indicators. Then in Data Preprocessing Phase we clean, normalize and prepare this data for analysis. Feature Engineering Phase sees us selecting and transforming most salient features using techniques such as Gradient Boosting Machines (GBM) thus enriching our data. The enriched dataset is then split into Learning Set and Validation Set where learning set is used for Model Building and Hyperparameter Tuning. Here the model is meticulously improved through iterations in order to enhance its accuracy. The next phase after that is called Model Evaluation Phase which employs the validation set to estimate how well the model works on new data points making sure it generalizes well. Finally, it culminates in a Dashboard Creation Phase which applies the validated model on user data enabling creation of an end-user friendly interface that displays basic health parameters relevant to them together with customized yoga recommendations regarding their specific situations keeping things simple but effective at all times when fighting against this annoying condition called polycystic ovary syndrome (PCOS). This flowchart visually represents the sequence of steps taken from data collection to the final dashboard development and user interface phase. Each phase is crucial in ensuring the accurate assessment and management of PCOS through the recommendation of personalized yoga practices.

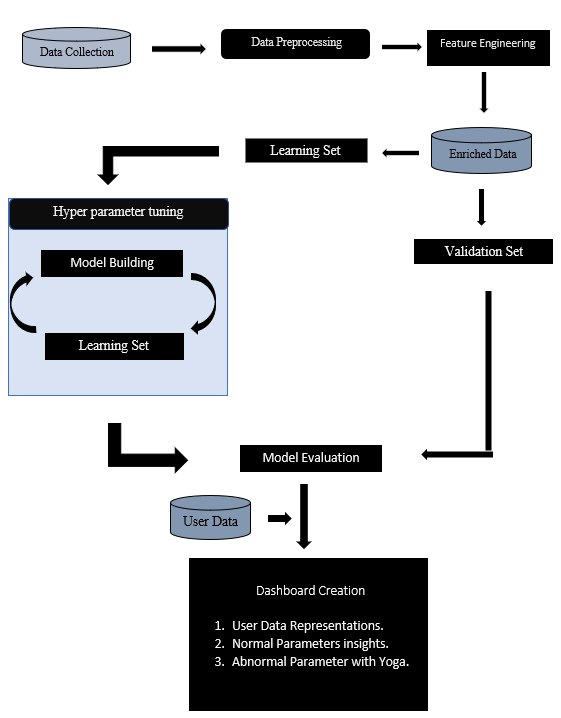


Figure 1: System Architecture Diagram

As depicted in the flowchart, the project follows a structured approach, starting with comprehensive data collection and meticulous preprocessing to ensure data quality. The process continues through feature engineering and model development, culminating in the creation of a user-friendly dashboard that provides tailored yoga recommendations. This phase-wise methodology ensures a robust, accurate, and user-centric solution for managing PCOS through holistic practices.

IV. CONCLUSION

This work showcases the efficiency of integrating yoga into managing Polycystic Ovary Syndrome (PCOS). The device measures important health indicators to recommend personalized yoga that will help with symptoms like hormonal imbalance, insulin resistance, and stress. The study results show that regular yogi practice not only helps in improving other body functions such as BMI and hormone production but also enhances psychological wellbeing. It has an easy-to-use interface that enables continuous assessment and focused measures. Particularly, this solution presents a comprehensive, long-lasting and free of side effects means of treating PCOS thus elevating the life standard of women who are suffering from the condition.

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