

A LITERATURE REVIEW ON THE RISING PHENOMENON PCOS

Vikas B¹, Sipra Sarangi², Manaswini Chilla², K. Santosh Bhargav² and B S Anuhya²

¹Assistant Professor, Department of Computer Science & Engineering, GITAM Institute of Technology, GITAM University, Visakhapatnam, India

²UG Student, Department of Computer Science & Engineering, GITAM Institute of Technology, GITAM University, Visakhapatnam, India

ABSTRACT

Polycystic Ovarian Syndrome (PCOS) is a condition which leads to growth of ovarian cysts. It is a prevalent endocrine disorder in child-bearing women, which can lead to infertility. A recent study has revealed that about 18% of the women in India, mostly from the East, suffer from this syndrome. PCOS is characterized by weight gain, irregularity in menstrual cycle, oily skin and darkened acne marks, hypertension and metabolic abnormalities/dysfunction. These can lead to dangerous illness like Type 2 Diabetes-Gestational Diabetes, Cardiovascular and Cerebrovascular dysfunction and higher risk of mood and anxiety disorders which can cause depression independent of BMI. Data Mining techniques and algorithms like clustering, classification, SVM and Naive Bayes algorithm have been used previously for early diagnosis of chronic diseases and to predict heart diseases, and liver problems. They have also been used for diagnosis and prognosis of breast cancer and in the predictive analysis of diabetic treatment leading to prominent results. In this view, Data Mining can be used to work on past records of patients, analyze the data, and identify general trends and, possible solutions of treatment can be obtained, to help in diagnosis and analysis of PCOS. In this paper, the authors have presented a study on the symptoms of PCOS and its treatment. The research on PCOS is comparatively new and yet to be explored. Thus, the authors have attempted to study the various applications of data mining techniques in medical field which could be later extended towards future research on PCOS.

KEYWORDS: PCOS, data mining, symptoms of PCOS, polycystic syndrome

I. INTRODUCTION

Polycystic ovary syndrome (PCOS) is a very common endocrinopathy mainly affecting women. It was first described in 1935 by Stein and Leventhal. They were first to recognize an association between the presence of polycystic ovaries and signs of hirsutism and amenorrhea [1]. PCOS is a collection of symptoms caused due to elevated male hormones in women. It is caused due to the combination of factors like genetics and environment. These factors include obesity, lack of physical exercise or family history of the condition. Cysts can be detected using ultrasound [2]. The risk of heart attack is 4 to 7 times higher in women with PCOS than the women of the same age without PCOS. Women with PCOS are at greater risk of having high blood pressure. Women with PCOS have high levels of LDL (bad) cholesterol and low levels of HDL (good) cholesterol. Women with PCOS can develop sleep apnea [3]. The long term consequences of PCOS include type 2 diabetes, and hormone-dependent cancers among women [72]. The treatments for PCOS include change in lifestyle, use of birth control pills to improve regularity of periods and the use of drugs like Metformin and anti-androgens [2]. PCOS affects 6% to 10% of women worldwide, generally those between the ages of 18 and 44 [4]. It is the main cause for infertility. Data mining is a process to extract information required from a given data set. Data mining tasks and techniques can help in analyzing the costs and symptoms of PCOS and can be used to predict whether a patient is diagnosed with the syndrome or not. This can be done using tasks like classification, clustering, pattern recognition and prediction.

This paper is organised as follows: In section 2, various symptoms for PCOS have been listed. In section 3, a few known treatments for PCOS have been briefly discussed. This is followed by a description of data mining tasks in section 4 and data mining techniques in section 5. In section 6, numerous applications of data mining in the medical field have been described. The paper is concluded in section 7.

II. SYMPTOMS OF PCOS:

After referring various papers, some of symptoms for PCOS and their related issues have been identified as follows [27]:

1. Hyperandrogenism-hirsutism, acne, male pattern baldness [11] [15] [16] [19]
2. Irregularity in menstrual cycle [5] [27]
3. Oily skin and darkened acne marks [4] [27]
4. Inability to respond to ovulation induction
5. Weight gain identification [15] [16] [19]
6. Abnormal ovaries with multiple cysts [27]
7. Anovulatory infertility [11] [24]
8. Metabolic abnormalities/dysfunction
9. Thyroid disorders [15]
10. Hyperprolactinemia [15]
11. Non classical adrenal hyperplasia [15]
12. Hyper insulinemia-insulin resistance [2] [16] [19] [20]
13. Endocrine abnormalities [16]
14. Excess APA production [18]
15. Lipid abnormalities- elevated LDL and decreased HDL [19]
16. Higher OHSS rates
17. Dyslipidemia [2] [16] [19]
18. Systemic inflammation [2]
19. Increased oxidative stress [2]
20. Endothelial dysfunction [2]
21. Type 2 Diabetes-Gestational Diabetes [2][6]
22. Hypertension [2]
23. Mellitus [2]
24. Cardiovascular and Cerebrovascular dysfunction/failure [2]
25. Variable amounts of estrogen exposure [2]
26. Co-morbidities [4]
27. Higher risk of mood and anxiety disorders [4]
28. High risk of depression independent of BMI [4]

III. TREATMENT FOR PCOS

A few known treatments of PCOS have been listed below:

1. Metformin therapy [2] [33] [34] [35]

Metformin is responsible for the depletion of free fatty acid oxidation and hepatic gluconeogenesis while increasing the glucose uptake. Recent studies have shown that Metformin indirectly decreases the insulin level, dyslipidemia and systemic inflammation.

2. Progesterone based oral contraceptives [25] [31] [32]

The use of these contraceptives, reverses early stage endometrial cancer into normal endometria and improves insulin resistance

3. Change in lifestyle [24] [28] [29] [30]

Benefits of incorporating exercise and diet regime include lowering of cholesterol, increasing endorphins and lower risk for heart disease. Women with PCOS struggle with weight loss therefore it is vital for women to maintain a healthy diet [2], do regular cardio and engage in strength training exercise.

4. Lamotrigine [2]

It is an anti-epileptic drug to be used instead of Valproate [15] [16] [17] for women with epilepsy. It is also known as an anticonvulsant drug and helps prevent extreme mood swings, and in restoring balance of certain natural substances in the brain.

5. Prevent, screening and management of Cardio metabolic features [20]

6. Coasting [14]

Keeps in check the OHSS rates in women with PCOS during pregnancy

7. Thiazolidinedione, Acarbose, Naltrexone, Orlistat, Vitamin D and Statins [2]

Thiazolidinedione increases the peripheral glucose uptake. Recent studies have shown that it reduces insulin resistance. But this drug's effect on dyslipidemia is disappointing and is associated with weight gain and other major complications. Acarbose reduces the digestion of polysaccharides. Studies have shown that the effect of this drug is quite inconsistent on insulin sensitivity and no significant improvement on dyslipidemia has been observed. Naltrexone reduces appetite, and is capable of modulating insulin release. It may reduce hyperinsulinemia. Decrease in Absorption of dietary fats is done by Orlistat. It has significant benefits on insulin sensitivity. Vitamin D may improve insulin sensitivity, but results obtained on lipid profile are mixed. Statins can reduce Hyperandrogenism [1] [38], improve lipid profile and reduce systemic inflammation but its use is contraindicated in pregnancy.

8. Selective Lipid lowering medications to normalize dyslipidemia [2] [16] [19]

9. Accurate diagnosis and long term implications of disorder with increasing emphasis on metabolic sequence [5]

10. Medicines for fertility such as combination of clomiphene with metformin [34] [35] [36]

IV. DATA MINING TASKS:

The various data mining activities or tasks used are as specified below: -

1. Classification:

The process of division of data inputs into different target groups is called as classification. The data inputs are classified into target groups based on similar characteristics between some of them. This technique only deals with categorical data [39].

2. Prediction:

The outputs that are achieved from the classification and estimation tasks is known as prediction. Prediction, as the name suggests, is to predict which classification a certain data entry must belong to. It only deals with generic numeric values unlike classification tasks [40].

3. Association Rule Mining:

To find interesting and unique relations and patterns between variables in databases, we use association rule mining. Apriori Algorithm is one of the most commonly used algorithms for finding the different patterns [41].

4. Cluster Analysis:

The clustering or association of documents or target groups which have similarities or having a similar concept under one label is called as cluster analysis. The difference between cluster analysis and classification is that in classification, the data is classified into target groups but here the various target groups are clustered into a single label [42].

5. Outlier Analysis:

When a data object or data input does not belong to a particular cluster and deviates from the usual data inputs, then such a task is called as outlier analysis. This technique is usually used to detect fraudulent transactions or noises in the database [50].

6. Evolution Analysis:

The task in data mining which deals in showcasing the model regularities and trends in the objects in the database over a period of time is called as evolutionary analysis. It also depicts the changing trends in the databases [52].

V. DATA MINING TECHNIQUES

From the acquired data we now have to use some kind of algorithms or methods to tackle the problem developed and hence some of the commonly used techniques are listed below. These are the broad classification under which there are numerous other algorithms which are given in brief below.

1. Fuzzy Logic:

Fuzzy Logic is a kind of logical system based on approximations rather than exact values. It is a logic system of reasoning where the data entries can partially be related to a fuzzy set unlike the classical set theory in which the member/data is either related completely or not related at all [43][67].

2. Rough Set Techniques:

By using rough set technique, the main goal is to obtain learning from the approximation of concepts. It gives us a scope to find out hidden patterns within the data provided. It can be used for extracting features and patterns and also for generation of decision rules [44].

3. Machine Learning:

It is an eminent part of Artificial intelligence in which the computers gain the ability to learn without being programmed. These can be supervised learning or unsupervised learning. Here, the independency of the variables and parameters are distributed [45]. The following are the few algorithms we are going to use: -

- A. Artificial Neural Network [47] [48] [52]
- B. Genetic Algorithm [43] [47] [52]
- C. Support Vector Machine [49] [52]
- D. Decision Tree [50] [52]

4. Statistics:

The abstraction of the knowledge from the provided data is done using statistical tools and a correlation between the variables are derived [51]. Some of the techniques used are:

Logistic Regression, CART, Naïve Bayes, K-Nearest Neighbor, Bayesian Network Algorithm etc. [52].

VI. APPLICATIONS OF DATA MINING IN MEDICAL FIELD:

An attempt was made by Dr. Yashpal Singh et al., to use data mining, medical history and diagnosis [52], to predict the diseases related to heart, lungs, diabetes, tumors etc using neural networks and other such techniques. S. Kiruthika Devi et al., (2016) proposed that data mining tools and techniques which can be used to predict heart disease system and also to give a suitable diagnosis for the same [57] [61].

Shiv Shakthi et al., (2014) proposed that, in the medical field, the huge stack of information produced is left unused which could be utilized efficiently by implementing data mining techniques. [58] [59] [63] Mathew Herland et al., (2014) observed that, the huge amount of data within health informatics can be converted into knowledge using Big data tools and data mining techniques [71].

The work presented by Shiv Shakthi et al., (2014) in their papers propose that, early diagnosis of chronic diseases can be done by using data mining techniques like sequential risk patterns which includes taking data from hospital and clinical records [58] [59]. In his paper, Jaimini Majali et al., (2015), proposed that, Data mining algorithms can also be used to help medical researchers in breast cancer diagnosis and prognosis [62] [65].

Deborah S. Kiddy et al., (1992) proposed that, classification algorithms of Data Mining can be used to predict liver diseases [67]. U. Rajendra Acharya et al., (2010), attempted to use regression based data mining technique, predictive analysis of diabetic treatment was done from the data acquired from WHO [66].

Jianji Yang et al., (2006) proposed that, Data mining techniques were also implemented to predict Para esophageal hernia and the diseases associated with it [64]. Abdullah A. Aljumah et al., (2012) proposed that, Data Mining is also used to predict the chances of diabetes in old and young patients [60].

A major advancement in the field of patient's safety was made by trying to predict any errors in treatment. Thus, predictive tools could be created through a simulation test environment which would forecast errors and help in making decision strategies that could lead to better treatment of patients.

VII. FUTURE WORKS

Through the applications of data mining techniques and tasks in the medical field, it can be inferred that Tasks like Classification, Prediction and Association Rule Mining have been used in the prediction and diagnosis of numerous diseases and ensure patient safety. This implies that there is a scope for advancement in identification of PCOS among child bearing women. Algorithms such as FP Tree and Apriori Algorithm can be used to analyse substantial sets of medical data to take action towards vulnerable PCOS patients, while saving valuable time.

VIII. CONCLUSIONS

In this paper, we have reviewed Polycystic Ovary Syndrome (PCOS) and have tried to list out every possible symptom of PCOS with its related treatments which are in use presently. Also, we have pointed out the various data mining techniques and tasks which could be utilized to tackle this very common syndrome amongst women. Furthermore, proceeding forward with this ideology to use data mining for the prediction of PCOS, we are looking forward to conduct a rigorous survey in the rural as well as urban areas which would act as the data sets for the opted technique, a hybridization between Case Based Reasoning (CBR) and co-relation metrics. This would indeed be a giant step towards predicting PCOS at its initial stage and following appropriate steps and treatments to curb the same.

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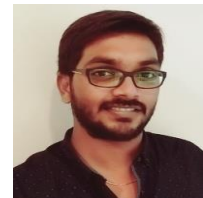
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AUTHORS

Vikas B was born in Hyderabad, India, in 1988. He received the Bachelor in IT degree from the JNTUH, Hyderabad, in 2010 and the Master in Bioinformatics degree from the JNTUH, Hyderabad, in 2012. He is currently pursuing the Ph.D. degree with the Department of Computer Science and Engineering, GITAM University, Visakhapatnam. His research interests include Datamining, Bioinformatics, Information Security, and Data Sciences.



Sipra Sarangi was born in Bhubaneswar, India, in 1995. She is currently pursuing her Bachelor degree with the Department of Computer Science Engineering from GITAM University, Visakhapatnam. Her research interests include data mining, big data and language processors.



Manaswini Chilla was born in Hyderabad, India, in 1996. She is currently pursuing her Bachelor degree with the Department of Computer Science Engineering from GITAM University, Visakhapatnam. Her research interests include big data, network security and data mining.



K. Santosh Bhargav was born in Tirupathi, India, in 1996. He is currently pursuing his Bachelor degree with the Department of Computer Science Engineering from GITAM University, Visakhapatnam. His research interests include internet security, data mining and big data.



B S Anuhya was born in Hyderabad, India, in 1997. She is currently pursuing her Bachelor degree with the Department of Computer Science Engineering from GITAM University, Visakhapatnam. Her research interests include data analytics, data mining and network security.

