ISSN 2063-5346

# AN ANALYTICAL STUDY OF COMPUTATIONAL METHODS FOR OBSESSIVE COMPULSIVE DISORDER DETECTION

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**Article History: Received: 10.05.2023 Revised: 29.05.2023 Accepted: 09.06.2023**

**Abstract**

Obsessive-Compulsive Disorder (OCD) is a long-lasting mental sickness described by unwanted thinking and impulse to carry out frequent tasks. These compulsive thoughts and behaviour seriously disturb people and hamper everyday life. Anybody can experience OCD, with the common beginning age being 19 years. Fifty percent of OCD sufferers first experience sensations in their early adolescence or childhood. Psychotherapy (talk therapy) and medication make up the majority of OCD treatment. OCD cannot be avoided. However, early detection and treatment can lessen the disease's symptoms and negative impact on life. The quality of life and functioning in social, academic, and occupational settings are frequently improved in OCD patients who receive proper care. This article provides a taxonomy of computational methods designed for different aspects of OCD and provides some distinguished approaches. These approaches mostly focuss on OCD detection, OCD treatment response analysis, and OCD severity detection. Further, this article aims to highlight the research gap that indicates machine learning and data analytics for the early detection of OCD using Oxidative stress biomarkers.

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**DOI:10.48047/ecb/2023.12.9.129**

## 1. Introduction

Anxiety is a frequent feeling when struggling with everyday issues and challenges. Anxiety becomes a condition when these feelings are frequent, overwhelming, and irrational, and it interferes with a person's capacity to perform. Anxiety disorders are classified into several kinds, including panic, phobias, stressful disorders, and, obsessive-compulsive disorder [1].

OCD is a kind of anxiety and OCD is a combination of both obsession and compulsion, where obsession is repeated thoughts, for example, fixed on cleanliness, which may worry that their hands are contaminated with germs even after repeated hand washing. Additionally, compulsive action is taken to relieve obsession related tension or to stifle distress [2]. It reduces the quality of life significantly and produces significant distress and functional impairment in daily life [3].

Several approaches have been proposed in the literature addressing different aspects of OCD, such as OCD detection [4–7], OCD treatment response analysis [8–10] and, OCD severity analysis [5, 6] etc. Most of the approaches use neuroimaging biomarkers and oxidative stress biomarkers for OCD detection.

Traditionally OCD is detected through symptom analysis. Cognitive Behavioral Therapy (CBT) is one of the most effective processes for OCD treatment [11]. In general, the patient doesn't accept the OCD illness even though there are primilanary symptoms available in the initial stage. They start accepting when the OCD disease affects their day-to-day life in an advanced stage. By that time CBT treatment becomes less effective and lengthy. Therefore laboratory detection of OCD disease can put extra faith in the mind of the OCD patient to go for the treatment in the initial stage.

Further, a recent study performed [12] found out that there is a genetically linked age in OCD patients. A preventive major can be suggested for the genetically linked individual to stay away from OCD. Therefore in this article, OCD detection is defined as the categorization of an individual into one of the three classes such as genetically OCD-affected individual (GAI), healthy individual (HI), and OCD-affected individual (OAI).

Recently several researchers showed their interest in OCD detection and related studies. The primary goal of the article is to make a thorough review of the computational methods proposed in the literature on OCD detection, OCD treatment response, and OCD severity analysis. Most of the computational approaches in the literature use the biomarkers that are neuroimaging and oxidative stress biomarkers in their studies.

Neuroimaging biomarkers are techniques used to study the structure and function of the nervous system present in the brain. There are several types of neuroimaging biomarkers used for OCD such as Electroencephalogram (EEG), Diffusion Tensor Imaging (TDI), Magnetic Resonance Imaging (MRI), and Functional Magnetic Resonance Imaging (fMRI) signals have gradually grown in popularity. In general, the nerve cell and a complex neural network of the brain are examined by DTI biomarkers [13]. Where the brain signal is taped by using the

electroencephalogram (EEG) [14]. Many studies have used DTI, EEG, MRI, and fMRI for detecting OCD [5, 6, 13, 14].

However, the collection of such biomarkers involves high-end machines which may not be available in most places. A recent study suggests the role of oxidative stress biomarkers in OCD and these biomarkers can be measured from blood samples [12]. As blood samples may be taken anywhere throughout this process, several studies have discovered that oxidative stress biomarkers are preferable to neuroimaging biomarkers for the analysis of OCD patients. In this method, the patient does not have to be physically present in the laboratory. A few techniques that have been discovered to be genetically linked to the ages of OCD patients can be quite effective in treating OCD sufferers. The oxidative stress biomarkers considered for the study are superoxide dismutase (SD), Glutathione Peroxidase (GP), Catalase (CAT), Malondialdehyde (MDA), and serum cortisol (SC). Here the MDA level is high and the levels of SD, GP, CAT, and SC are different in [12, 15–17].

## 2. Biomarkers for Obsessive Compulsive Disorder (OCD) Analysis

A psychiatric illness known as obsessive-compulsive disorder (OCD) is defined by the presence of both obsession and compulsion. In contrast to obsessions, obsession is the current unpleasant concern with an often irrational concept or feeling. Compulsions are rigidly prescribed rituals, repetitive behaviors, or mental activities that the patient feels obliged to engage in. This sickness causes a lot of problems at different times, including at work, at home, and while doing social work [18]. This illness has been ranked as one of the ten most debilitating conditions by the world health organization because it affects people's ability to earn money and their ability to live quality [19]. Even if a patient has multiple symptoms but is unable to identify them because of their OCD, they remain untreated in the early stages of the condition. It is already too late when they admit they have OCD and seek laboratory treatment. When they accept that they are heaving in OCD and go for laboratory treatment it's too late. Several methods were performed in the literature to handle different OCD-related issues such as detection of OCD, OCD treatment response analysis, OCD severity analysis, etc. Most of these methods used biomarkers for analysis such as neuroimaging biomarkers and oxidative stress biomarkers.

### 2.1 Neuroimaging Biomarkers

The structure and function of all nerve systems present in the brain are identified as an image by using neuroimaging biomarkers [20]. These biomarkers are mainly used in abnormal patients as a treatment. OCD is one of the abnormalities. The OCD patient can get treatment by using neuroimaging biomarkers where these biomarkers include DTI, EEG, MRI, and fMRI.

Peter Basser created Diffusion Tensor Imaging (TDI) in 1994. These methods look at the brain's intricate neural network and nerve cells. Observing the movement of water molecules in the brain constructs the image. Diffusion refers to the movement of water molecules. The diffusion tensor computes the comparison between the loss signal and the original signal. Fractional anisotropy (FA) Axial diffusivity (AD) and radical diffusivity are the three main parameters that define the

function of a nerve cell. Where FA designates the fraction of the tensor's magnitude, AD designates the primary axis's diffusivity, and RD designates the structure's perpendicular diffusivity [13].

The brain signal is captured using the electroencephalogram (EEG) signal. The patient must close their eyes, declare they are in a relaxed condition, sit comfortably in a quiet room, and refrain from any motions of the body, such as blinking or eye movement. The occipital lobe, the temporal lobe, the parietal lobe, and the frontal lobe are the four regions. These regions aid in the capture of EEG signals of superior quality. The term "occipital" refers to the back of the brain. The frontal region of the brain contains the "temporal lobes," which are responsible for movement, speech, and emotion. The top back of the brain, or behind the parietal regions, contains the "frontal lobes," which are responsible for the senses such as pain, touch, and taste, among other things. The temporal region of the brain, which is located above the ears on both sides, is known as the temporal region [21].

When using the MRI machine to produce brain images, fMRI records all activity and functional activity. By using the functional connectivity (FC) method the connection of fMRI is established the two different neural activations in the brain are analyzed by FC these are temporal connection and time series data [22]. The cerebral cortex has a rich blood supply, which enables fMRI to have a good resolution of about 1mm. The hemodynamic response is the name of this process. As a result of this process, the blood transfers glucose to neurons and astrocytes more quickly than it does in the region of dormant neurons. A surplus of oxyhemoglobin is produced in the local population as a result, and the local ratio of oxyhemoglobin to deoxyhemoglobin, which serves as the "marker" of the BOLD (Blood Oxygen Level Dependent) signal for MRI, noticeably changes.

### 2.2 Oxidative Stress Biomarkers

Antioxidants have been found to play the main role in obsessive-compulsive disorder (OCD). By using the biological markers or pathological process we reduce the disproportion among the creation and assemblage of oxygen reactive space (ROS) in cells and tissues which is known as oxidative stress. Many types of neurological diseases are associated with oxidative stress like bipolar disorder [23], depression [24], memory loss, Alzheimer's disease (AD), etc. There are several antioxidant molecules are present in the OCD patient. These antioxidants are divided into two categories enzymatic and non-enzymatic. Catalase(CAT), Glutathione Peroxides (Gpx), Superoxide dismutase (SOD), Malondialdehyde (MDA), and Serum cortisol belong to enzymatic antioxidants, on the other hand, the non-enzymatic antioxidant is lipoic acid. copper, zinc, iron [25]. SOD assists like a compound of stress protein in oxidative stress [26]. We already defined the SOD as an antioxidant but it assists in cell damage [27]. Where hydrogen-peroxide was separated by using the catalase antioxidant [28]. Glutathione assists to preserve biomarkers for oxidative attack and reduces the need for hydrogen peroxide H2O2 free radicals of the OCD patient are rhythmic by oxidative stress. This oxidative stress is either enzymatic or non-enzymatic antioxidant, In [29] they

write about how the free radicals are examined in the pathological process of the OCD patient.

**Catalase prediction**

Catalase predicts by using 2.0ml of phosphate buffer and 1ml of diluted $H_2O_2$ with the formation of hyperchromic acid. This prediction can measure in absence at 240nm and certified using a Spectro photo meter in a different time interval. The prediction was expressed as ac unit/mg protein.

**Superoxide Dismutase**

Prediction By the electrolytic reduction of $O_2$ in an aprotic solvent, dimethylformamide, and superoxide dismutase were generated. The superoxide decrease Nitro-Blue-Tetrazolium (NBT) to a formazan with a dark blue colour and contained 0.38% copper this slows down the decrease of NBT and provides a measure of superoxide dismutase activity in the lysed. The prediction was expressed as U/mg protein.

**Gultathione peroxidase Prediction**

A relatively stable, no dialyzable, heat-labile intracellular element that can be separated from haemoglobin by alginate purification and ammonium sulphate precipitation is associated with glutathione peroxidase activity. The quantity of glutathione used or changed into oxidized glutathione serves as an indicator of enzyme production. The prediction was expressed as Unit/min/mg protein.

**Malondialdehyde Prediction**

By substituting the feature of the cellular membrane of superoxide ions and constructing lipid peroxidation. This lipid peroxidation can be regulated quantitatively or qualitatively by a variety of methods. The lipid and proteins can be identified by Acetic acid. This lipid peroxidation can be measured by losses of fatty acids, amounts of primary and secondary products, and hydrocarbon gases. Cellular membrane lipids represent most often substrates of oxidative attack. The prediction was expressed as Unit/mg protein.

**Cortisol Prediction**

Cortisol tests can be happened by using a blood sample, urine, or saliva. Some parts of the body like different organ tissue are affected by cortisol.

## 3. OCD Analysis by using Neuroimaging Biomarkers

In this research, there are several aspects of OCD such as OCD detection, OCD treatment response analysis, and OCD severity analysis are analyzed by using the neuroimaging biomarker such as DTI, EEG, MRI, and fMRI. Several studies focus on the diagnosis of OCD severity by using DTI and MRI biomarker [30], here the combination of DTI, MRI, and genetic data to predict the severity of OCD patients in an early stage they use the two supervised machine learning approaches and get 90% of accuracy in classified child and adolescent of OCD patients. Again MRI biomarker in [31] the author predicts the severity combined with neuroimaging using the machine learning technique. Here they use the support vector regression (SVR) for measuring the symptom severity of the Obsessive-Compulsive Disorder (OCD) patient. The SVR analysis gives a better result for identifying the neurobiological markers to identify the OCD symptom severity get from after the

MRI. The disadvantage of this is that only identifies the severity of symptoms within the OCD patient. They don't predict OCD in the patient or healthy control. In [33], the author predicts Obsessive-Compulsive Disorder (OCD) and also calculates the symptom severity in the patient heaving with MRI data. Here they use the statistical method for classifying the patient. In this study, they don't use any machine learning approach and are not classified as genetically related.

In general, the treatment response of the OCD patient can be diagnosed by using analysis i.e CBT In [8] the author describes the treatment response of the OCD patient between the age of 18 to 65. Here they take the mixed data type and use the ensemble classification technique for the prediction of treatment response. For building the ensemble classifier they combine both the decision tree and support vector machine (SVM) and take it as the base classifier for continuous data. The main advantages of this ensemble classification are it can take both mixed categorical and numerical data. This ensemble classification method is based on a decision tree and SVM which give good results for the mixed data. In [9], the author uses Cognitive Behavioral Therapy (CBT) as a biomarker for treatment response to Obsessive-Compulsive Disorder (OCD). They apply the feature selection machine learning approach to identifying the treatment response of OCD patients. They also get a better result from this CBT test but this treatment takes more time for treatment. Then after [10] Here the author aims to predict treatment response in Internet-delivered Cognitive Behavior Therapy (ICBT) using the logistic regression machine learning approach. They get 83% accuracy in the prediction of treatment response. This method fails to classify issues such as AOI, HI, and GAI. But neuroimaging biomarkers have also taken an important role in the diagnosis of treatment response by using EEG [32] they assess the result of both the EEG complexity and yellow-Brown obsessive compulsive scale (YBocs) and compare them. They take 29 treatment-resistant and 28 treatment-responsive OCD patient data for examination. They get the 89.66% accuracy as a result by using the beta band EEG segments.

In [5] magnetic resonance imaging method and diffusion tensor imaging method both two biomarkers are used to predict the OCD patient and healthy control. They take 48 OCD patients with MRI data and DTI data and 45 healthy control data. Use the support vector machine for examined Gray Matter Volume (GMV), White Matter Volume (WMV), Fractional Anisotropy (FA), and mean diffusivity (MD). SVM gets the highest accuracy for identifying between the healthy control and OCD individual. In [6] the author classifies two types of class among Obsessive-Compulsive Disorder (OCD) patients and healthy control (HC) using the different types of brain images to get the outcomes from the fMRI treatment. Here they use the multivariate pattern classification for classifying the two-class. They get 100% results by using the move type of classification technique. The advantage is that they get a successful result for classifying. The main limitation of this paper is they don't use any machine learning algorithm for classifying. Secondly, they classify only two types of classes not classify the genetically affected individual-related patient. In [4] the

neuroimaging biomarker EEG defines OCD as a branch of anxiety disorder. The EEG complexity and two-channel interhemispheric dependency both two-channel is used for identifying the OCD patient. They use the support vector machine as a classifier for the classification of OCD patients and healthy control. They use 19-channel EEG signal heaving with eye closed condition of OCD patient. They also use the 2-fold cross-validation for batter classification. They are not able to identify a genetically affected individual.

Table-1 summarises the neuroimaging biomarkers research on OCD and its limitations. However, these types of biomarkers like DTI, EG, MRI, and, fMRI are so expensive and not available at every place for the treatment. By using such types of biomarkers patients have to go to the laboratory so few researchers are finding out that patient uses oxidative stress biomarker for their treatment.

## 4. OCD Analysis by using Oxidative stress Biomarkers

While studying CAT, GPX, SOD, MDA, and serum cortisol of oxidative stress are included in the research. Where in [29] the author evaluates the oxidative or antioxidant like MDA, SOD, and catalase levels in the OCD patient. Here they take 20 healthy control and 20 OCD patient in age from 20 to 40 years. They get a higher Malondialdehyde (MDA) level and Superoxide Dismutase (SOD) level in OCD patients ($P<0.05$). They use statistical analysis to comparing between healthy control and OCD patient and used Leven's test to examine the grade of difference.

In [34] the author checks the urinary free cortisol(UFC) level in OCD patients. They take seventeen OCD patients and 25 healthy individuals and collect the urine specimens within 24 hours for examining the urinary free(UFC). The results are analyzed in the statistical method. After the UFC examination, they found that OCD patients have higher UFC as compared to a healthy individual. In [15] the author evaluates the free radicals in the pathogenesis of OCD. They evaluate the different antioxidant levels of the OCD patient like Malondialdehyde (MDA), Superoxide Dismutase (SOD), Glutathione Peroxidase (GSH-px), and Catalase (CAT). For finding this level they take 34 patients with 22 females and 12 males as a specimen. They collect 5ml of blood from the OCD patient one night on empty stomach for laboratory treatment. They use different types of enzymes, chemicals, and instruments for their treatment

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| Symptom analysis [8] | Data Analysis: They take mixed data type of OCD patient. Use machine learning technique. Result: The value of true positive (TP) for decision tree. | This method fails to solve the OCD classification issue and fails to pin point The patient is genetically related, HI, and OAI. |
| Symptom severity [9] | Data Analysis: They take OCD treatment data before and after four weeks. Use machine learning with cross-validation technique. Result: They achieved 67% success in their treatment. | This method fails to solve the OCD classification issue and fails to pin point the patient is genetically related, HI, and OAI. |

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| Severity of OCD [30] | Data Analysis: They take MRI and DTI data. Use machine learning techniques. Result: They get 0.90 accuracy in the testing se and 0.70 in the validation sample. | This method fails to solve the OCD classification issue and fails to pin point the patient is genetically related, and also MRI and DTI instrument are not available in every place. |
| Severity of OCD patient [31] | Data Analysis: MRI data. The technique used: Support vector regression (SVR). Result: Finds the correlation coefficient between predicted and observed symptom severity. | This method fails to solve the OCD classification issue and fails to pin point The patient is genetically related and HI, without MRI now alternative treatment are available. |
| Symptoms analysis [10] | Data Analysis: Use multivariate logistic regression with in the ICBT data. Result: Observed the prediction of treatment response with 83% accuracy | This study only analysis the symptoms of OCD and This method fails to solve the OCD classification issue and fails to pinpoint the patient is genetically related and HI. |
| Treatment response of OCD patient [33] | Data Analysis: EEG data. The technique used: Random forest Result: Get 89.66% accuracy. | This biomarkers so expensive and also This method fails to solve the OCD classification issue such as HI, and OAI fails to pin point the patient is genetically related. |
| Predict the OCD patient [5] | Data Analysis: High resolution of MRI and DTI The technique used: SVM is used Result: SVM gets the highest accuracy for identifying between the HI and OAI. | This biomarkers are so expensive so This instrument are not available at every place. |
| Detection of OCD [6] | Data Analysis: fMRI data, The technique used: Multivariate pattern classification technique. Result: Neurobiological markers providing reliable diagnostic information about OCD. | These instrument are not available at every place. So the alternative biomarkers are used nowadays. |
| Detection of OCD [4] | Data Analysis: EEG data. The technique used: Three embedding's entropy measurements (approximate entropy, sample entropy, permutation entropy) are used to estimate the EEG signal. Result: The highest classification accuracy of 85% is provided by permutation entropy. | These instrument are not available at every place and also this approach is not able to classified HI, OAI, and GAI. |
| Detection of OCD [14] | Data Analysis: EEG data. The technique used: Artefact Result: It helpful for interested researchers who will develop and apply artefact handling algorithm. | This instrument is not available at every place and the alternative biomarkers are used by using the collection of blood sample only. |

**Table 1:** OCD Analysis by using neuroimaging biomarkers.

evaluation. They use the statistical method to evaluate the MDA level and free radicals of OCD patients. They get the presence of MDA level is high in the OCD patient. The limitation of this research they are not able to identify the classification of OCD patients or any genetic link between them.

In [35] the author describes about there is misleading evidence regarding how the Hypothalamic Pituitary Adrenal (HPA)

axis, the primary mammalian mechanism of the stress response, functions in Obsessive-Compulsive Disorder (OCD). They collect the blood specimen every 20min and do their experiment. They use statistical methods like mean and standard deviation. They found that the HPA axis is more than in OCD patients as compared to a healthy individual. The limitation of this is the only company between the OAI and HI did not classify the OCD patient. In [36], the author analysis the level of serum and plasma Malondialdehyde (MDA) present in Obsessive-Compulsive Disorder (OCD) patients as compared to a healthy individual. They use Cochran's test and the I-Square statistical test to identify the level of MDA. They get MDA level is high in OCD patients as compared to a healthy individual. In [37], the authors, describe the prediction of Obsessive-Compulsive Disorder (OCD) patients with oxidative stress biomarkers. The oxidative stress of OCD patients having oxidative and nitrosative is evaluated by the treatment. The result of the treatment compared with the healthy controls.

In this research, [38] To find outliers in mixed-attribute data, they provide a logical method based on the bivariate beta mixture model. Without any feature transformation, the suggested method can be used to analyze data with either single-type (numerical or categorical) attributes or mixed-type attributes, automatically distinguishing outliers from inliers. In comparison to conventional approaches, our experimental analysis supports the applicability of the suggested methodology.

In [39] a total of 591 individuals were selected from Zurich, Switzerland's general population, and they took part in 30 years of seven interviews. A better prognosis for remission for less severe illness is shown by the median duration of OCD, Obsessive-compulsive syndrome (OCS), and unimpaired OC symptoms of 16, 14, and 6 years, respectively. Longer illness duration, more years with OC load, and seeking professional care all led to considerably delayed remission in affected individuals. Additionally, the remission rates were much lower when these variables and concurrent anxiety disorders were present. Comorbid affective disorders and lower rates of remission were shown to be statistically significant in a trend.

Again In [40] they study treatment response using oxidative stress biomarkers and they use Fluoxetine therapy in the OCD patient. They identify that the antioxidant level is balanced in currently heaving OCD patients. The limitation of this is they only find the treatment response of the OCD patient.

In general, some studies describe genetically affected individuals of OCD patients like In [12] goal of this study is to examine the markers of oxidative stress such as Superoxide dismutase (SOD), Glutathione Peroxidase (Gpx), Catalase(CAT), Malondialdehyde (MDA), serum cortisol, etc in the three class patent like with OCD patient, Healthy control and genetically linkage of OCD patient. They statistically analyze this level of oxidative and get the high level of oxidative stress markers in OCD patients with the genetic linkage of OCD patients. In [41] they study three-class classification such as with OCD-affected individuals, healthy control individuals, and genetically affected individual OCD patients by using the oxidative stress biomarkers. They use SVM

machine learning approaches for classification. limitation of these is they are not able to identify how much the patient is affected or the severity of the patient. All the summaries of oxidative stress biomarkers are describe in Table 2.

## 5. Research Finding

The on-going research examines OCD diagnosis, OCD treatment response analysis, and OCD severity detection using various biomarkers such as neuroimaging and oxidative stress biomarkers. This biomarker also employs statistical analysis and a machine learning technique for analysis. To bring attention to the dataset, the analytical method, the use of biomarkers, and the conclusions of the results. The following research gaps have been discovered, along with recommendations for further studies.

A few studies explain the early detection of OCD using symptom analysis. CBT and ICBT are the most common symptom analysis processes, however, they are time-consuming, therefore patients do not follow these treatment processes and instead seek laboratory treatment. Several studies have been proposed to detect OCD utilizing neuroimaging biomarkers such as DTI, EEG, MRI, and fMRI. However, the biomarker equipment is

| Research | Analysis and result | Limitation |
|---|---|---|
| Evaluate antioxidant [29] | Data Analysis: MDA, SOD, CAT, GPX data The technique used: Statistical Analysis Result: They get the higher Malondialdehyde (MDA) level and Superoxide dismutase(SOD) level in OCD patient($P < 0.05$) | This study analyzed the level of antioxidant but they are not able to identify the classification of OCD patient or any genetic link between them. |
| Check the urinary free cortisol(UFC) [34] | Data Analysis: Urinary free cortisol (UFC) The technique used: Stastical Analysis Result : The OCD patient have higher UFC as compared to healthy individual. | This study only check cortisol level but they are not able to identify the classification of OCD patient or any genetically link between them. |
| Evaluate antioxidant level [15] | Data Analysis: The free radicals in pathogenesis of OCD data. The technique used: Statistical Analysis Result: The present of MDA level are high in the OCD patient. | They are not able to identify the classification of OCD patient or any genetically link between them. |
| Detection of OCD patient [35] | Data Analysis: Blood specimen The technique used: The stastical methods like mean, standard deviation Result: The HPA axis is more then in OCD patient as compare to healthy individual. | They only compare between the OAI and HI they not classify the OCD patient. |
| Detection of OCD patient [36] | Data Analysis: Serum and plasma Malondialdehyde (MDA) present in OCD patient data. The technique used: Use Cochran's test and the I-Square statistical test. Result: They get MDA level is high in OCD patients as compared to a healthy individual. | They get the MDA level but not able to identify the patient is OAI or HI. |

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| Treatment Response [40] | Analysis: Use the Fluoxetine therapy in the OCD patient data. The technique used: Stastical analysis Result: The antioxidant level is balance in currently heaving with OCD patient. | Data They only find the treatment response of the OCD patient but had not detect the OCD patient. |
| Detection of OCD patient [12] | Data Analysis: OCD patient data The technique used: Statistical Analysis Result: get high level of oxidative stress markers in OCD patient with genetically linkage of OCD Patient. | They not able to identify the healthy individual. |
| Detection of OCD [41] | Data Analysis: OCD patient data The technique used: SVM machine learning | They not able to identify the how much the patient are affected or severity of patient. |

**Table 2**: OCD Analysis by using Oxidative stress Biomarkers

highly expensive, and these treatments need the patient's actual presence in the laboratory. As a result, these kinds of OCD detection analyses are less effective. There is no evidence found in this technique for identifying GAI patients.

Many studies have found that oxidative stress biomarkers are more useful for OCD analysis since blood samples may be collected anywhere and do not need to be physically present in the patient in the laboratory. Few ways have been identified that genetically link age to OCD sufferers. As a result, it can play an important role in the treatment of OCD patients.

## 6. Conclusion

Using neuroimaging and oxidative stress biomarkers, this research provides a thorough assessment of OCD treatment response, prediction, reduction, and severity of OCD patients. For investigators in this area, this work seeks to provide a thorough analysis of various elements and difficulties in identifying treatment response, predicting, reducing, and evaluating the severity of OCD patients utilizing biomarkers. The difficulties were clearly outlined in this report, which also offered directions for future research studies.

## 7 Acknowledgment

This work is supported by the Odisha Higher Education Programme for Excellence and Equity (OHEPEE) World Bank [No. 6770/GMU].

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