Optimization of Early Diagnosis of Glucose Metabolism Impairment for Patients Receiving Antipsychotic Medications at the Outpatient Psychiatric Clinic of the University Teaching Hospital, Lusaka, Zambia

Makame Haji Pandu, Anatolii Tsarkov, Petro Petlovanyi, and Ravi Paul

ABSTRACT

Introduction: Patients using antipsychotic drugs are more likely than the general population to suffer glucose metabolism dysfunctions. Patients who take antipsychotic drugs, particularly second-generation antipsychotics, are four times more likely to develop overweight, obesity, and diabetes type 2. Failing to recognize these metabolic issues puts an individual at risk of developing cardio-metabolic and others disorders that potentially worsen psychiatric problems. For controlling and enhancing potential psychiatric treatment outcomes, early diagnosis and treatment of glucose metabolism dysfunction are crucial.

Objective: To optimize the early diagnosis of glucose metabolism impairments in patients with psychiatric disorders treated with antipsychotic medications.

Methodology: This is a descriptive cross-sectional study that was conducted at the outpatient psychiatric clinic of the University Teaching Hospital (Lusaka, Zambia). A systematic sampling method was applied to all patients who were receiving antipsychotic drugs. All participants were checked for their weight, height, Body Mass Index (BMI), waist circumference, random, and fasting blood glucose levels respectively. The results were analyzed by using SPSS software (version 20), while Fisher’s exact test was used to determine the relationship between categorical variables.

Results: The proportion of individuals with impaired fasting blood glucose levels found in this study was 11.1% and that of individuals with diabetes was 10.0% respectively which is higher compared to the general population. Patients who were receiving second-generation antipsychotics showed a slightly higher proportion of impaired fasting blood glucose levels compared to those on conventional antipsychotic medications.

Conclusion: The glucose metabolism deficit in patients with psychotic disorders was found to be high. Patients of both sexes had an equal chance of developing the problem, though females had a higher proportion as compared to males, and it is not time-dependent. Older patients showed a higher proportion of impaired fasting blood glucose levels compared to younger ones. It is recommended that basic screening measures of glucose metabolism parameters that are simple and cost-effective, like checking weight, BMI, waist circumferences, and regular checking of blood glucose levels, be routine practice in all psychiatric settings before starting antipsychotic medications.

Keywords: Antipsychotic medications, antipsychotic-induced metabolic disturbances, impaired glucose metabolism, psychotic disorders.

I. INTRODUCTION AND THE RATIONALE OF THE STUDY

Psychosis is a group of psychotic disorders. Their manifestations depend on the specific type of dysfunction. However, all of them are characterized by a gradual increase in signs of changes in behavior. We can recognize the symptoms of psychosis by the following manifestations: hallucinations, delusional ideas, motor disorders, mood, and emotional disorders [1]-[3].

During the course of psychosis, the mind loses some contact with reality. An affected person can have an experience that is confusing and frightening not only for themselves but also for others.
Symptoms of psychosis vary, but two common symptoms are hallucinations and delusions. Someone with hallucinations will hear, feel, see, smell, or taste something that is not actually happening.

There are a number of factors that can lead to the development of psychosis [1], [4]:

- Hereditary factor - transmitted by a group of genes in inheritance, from parents to their children. These genes are responsible for the sensitivity of brain cells to external influences, which can trigger mental trauma;
- Brain injuries - including birth injuries, concussions, open and closed craniocephalic injuries (the more severe the injury, the higher the probability of developing the disorder);
- Intoxication - chemical intoxication of the brain can be provoked by harmful working conditions, alcohol consumption, drugs, medicines, and other substances.

In addition to the factors listed above, the development of psychosis can be provoked by: brain tumors, pathologies of the nervous system (e.g., Parkinson’s disease, stroke), bronchial asthma, deficiency of vitamins B1 and B3, infectious diseases, and some others [5]-[8].

Antipsychotics are drugs that restore the imbalance of dopamine in the mesocortical, mesolimbic, nigrostriatal, and tuberoinfundibular pathways of the brain, causing psychotic symptoms. The drugs in this group are also called antipsychotics. Antipsychotics act on the dopaminergic system in such a way that they eliminate psychotic symptoms - first of all, perceptual delusions (auditory, visual, tactile hallucinations), delirium, and psychomotor agitation.

Treatment with antipsychotics is prescribed (for children and adults) for psychotic conditions that occur against the background of different disorders, for example: schizophrenia, schizoaffective disorder, bipolar disorder, mania of various etiologies, depression, brain damage (for example, TBI, stroke), neurological diseases (for example, epilepsy, Parkinson's disease), and dementia [6]-[12]. Treatment with antipsychotics is usually long-term. Depending on the type of disorder, the course of taking antipsychotics can last from several months; in the presence of a chronic condition, they are taken for life. Psychostimulants are the most commonly used medicine for attention deficit hyperactivity disorder (ADHD) [13]. However, atypical antipsychotics have been shown to treat ADHD symptoms [14]. Specifically, risperidone was shown to improve attention and hyperactivity, and aripiprazole has been shown to improve cognitive functioning.

Antipsychotic drugs revolutionized the lives of many patients with psychiatric disorders and other forms of mental illnesses since introduced in the 1950s, but they were hampered by the emergence of crippling and stigmatizing extrapyramidal side effects and movement disorders [15]. However, due to widespread concerns about the link between atypical antipsychotics and metabolic side effects, psychiatrists are questioning whether the shift to atypical antipsychotic medications have simply resulted in the substitution of one set of problems for another, potentially leading to generalized deterioration of patients' physical health and poor psychiatric outcome [16], [17]. These metabolic side effects are sometimes linked to genetics and other modifiable factors such as sedentary lifestyles, physical inactivity, and patients' lack of dietary knowledge [18].

Furthermore, patients receiving treatment with the most efficacious antipsychotic drugs such as clozapine and olanzapine are associated with an increased risk of weight gain, obesity, and other forms of glucose metabolism impairment like reduced insulin sensitivity which all signify the glucose metabolism derangement and can lead to other life-threatening cardiovascular morbidity [19], [20]. People with psychiatric disorders have an increased risk of developing persistent hyperglycemia, leading to diabetes type 2 which is the main contributing factor to cardio-metabolic abnormalities [21].

While it is known that there are multiple causality and risk factors for these problems, some of the newer antipsychotic drugs like olanzapine have been singled out as the major cause of glucose metabolic irregularities [22].

Several modalities and approaches have been applied to study these medications’ specific risk for detrimental effects on glucose metabolism impairments during treatments, while an abnormal increase in waist circumferences and body mass index has been identified as a good predictor of these metabolic side effects [23], [24].

It is now well established that, people with serious mental illness, have excess morbidity and mortality leading to a reduced lifespan by about twenty years compared with the general population [25]. The increased mortality is largely attributable to physical illness, including glucose metabolism abnormalities and cardiovascular disease, rather than factors that are directly associated with psychiatric illness such as suicide or homicide [26]. Generally, metabolic abnormalities occur in about 20 to 60% of patients with chronic psychiatric disorders which increases the three-fold risk of developing diabetes type 2 in those patients treated with antipsychotic medications [27].

The abnormalities not only confer an elevated risk of cardio-metabolic illnesses and increased mortality but are also associated with poor psychiatric and functional outcomes for the patients [28].

These metabolic abnormalities vary between different agents, with patients receiving atypical antipsychotic drugs which are known as second-generation antipsychotic medications like olanzapine and clozapine being much more likely as compared to those on first-generation antipsychotic drugs [29].

It was found that about 30% of cases of glucose metabolism impairments resulting from reduced insulin sensitivity developed as a result of antipsychotic drugs tend to be undiagnosed, and approximately 10% of patients treated with antipsychotics are at risk of developing glucose metabolism impairment and diabetes type 2 [30], [31].

Over the last three decades, the prevalence of metabolic diseases has dramatically risen worldwide. About 4.8% of people are estimated to be living with impaired glucose metabolism, and the risk of glucose metabolism effects are higher in patients with mental disorders than in the general population [32]. In sub-Saharan Africa, approximately 75% of people living with glucose metabolism irregularities, including diabetes type 2, remained undiagnosed, resulting in a large number of untreated cases, poor glycemic control, and the consequences of poor psychiatric treatment outcomes.
In 2011, the prevalence of glucose metabolism impairment was 4.0% among the Lusaka adult population aged 25-34 years, and diabetes mellitus was 3.5% in the Zambian general population, though no data have been published for patients with psychiatric disorders in particular, and the proportion is likely to be unknown [34], [35].

Antipsychotic drugs have been used as a mainstay of treatment in psychiatric practice for a wide range of psychotic disorders despite the fact that they are the leading cause of glucose metabolic irregularities in this group of patients [36]. It is clearly known that there is an increased awareness among mental health providers of the increased chance of glucose metabolism syndrome in psychiatric patients due to antipsychotic medications, though rates of screening, diagnosis, and treatment remain poor [37].

The diagnosis of glucose metabolism disorders in these patients, on the other hand, is extremely rare. This could be due to ineffective clinical practices that do not prioritize early screening and diagnosis of the problems, or it could be related to the complexity of psychiatric illnesses themselves. Failure to recognize these risk factors linked with aberrant glucose metabolisms, such as impaired fasting blood glucose and reduced insulin sensitivity, leads to the early onset of diabetes type 2 and its consequences, such as heart disease and others [33].

Therefore, this study was intended to optimize the early diagnosis of glucose metabolism impairment in Zambian patients with psychotic disorders who were receiving antipsychotic medications at the outpatient psychiatric clinic of the University Teaching Hospital in Lusaka, Zambia.

Patients with psychotic disorders who are taking antipsychotic drugs have a significant rate of developing glucose metabolism impairment. It is also possible that the prevalence of this problem is very high in this population group. However, the impact of this problem is underestimated since psychiatrists and medical professionals working in mental health services are not regularly involved in routine screening and diagnosis of these problems at the appropriate time. While various reviews have suggested and concluded that patients receiving antipsychotic drug treatment require active routine physical health screening, this practice has not been prioritized in our daily practice [38].

Therefore, the results of this study can later be used to measure the burden of the problems of glucose metabolism impairment in patients with psychiatric disorders in Zambia, which will facilitate improvement in the practicing habits of medical professionals in psychiatric practices and improve the outcomes of patients as well. The main task of this study was to optimize the early diagnosis of glucose metabolism impairments in patients with psychiatric disorders treated with antipsychotic medications.

II. METHODOLOGY

This was a cross-sectional descriptive study aimed at optimizing the early diagnosis of glucose metabolism impairment in the adult population with psychiatric disorders attending an outpatient psychiatric clinic of the University Teaching Hospital in Lusaka, Zambia.

The study was conducted at the psychiatric outpatient clinic of the University Teaching Hospital in Lusaka. This is the tertiary level hospital that is located in the capital city of the country. It is the largest public catchment specialized clinic in the country.

The study was targeted at patients who were attending an outpatient psychiatric clinic at the University Teaching Hospital in Lusaka, Zambia from June to September 2021. All patients who were receiving antipsychotic medications, both first and second-generation antipsychotics, and who were on treatment for three months or more were screened for eligibility to participate in this study.

The sample size calculation was computed by the following formula:

\[
N = \frac{Z^2 \cdot P \cdot (1 - P)}{e^2}
\]

Where:
- \(N\) = Sample size
- \(Z\) = 1.96 standardized normal deviate for 95% confident interval;
- \(P\) = prevalence of patients with glucose metabolism impairments in previous study which was 6.2% = 0.062
- \(e\) = maximum error allowed (5%)

\[
N = \left(\frac{1.96^2 \cdot 0.062}{(1 - 0.062)}\right) \cdot (0.05) = 90
\]

The minimum size required by using the above formula was 90.

A random systematic sampling technique was used to select the participants for this study. An estimated 160 patients were attending the outpatient psychiatric clinic at the University Teaching Hospital every month. This means the sampling interval was computed by 160/90 = 1.77. Therefore, every second patient on antipsychotic drugs was picked and screened for the inclusion criteria to participate in the study until the sample size was archived.

A systematic random sampling technique was used to select participants who were attending an outpatient psychiatric clinic. The selected individuals who met the required inclusion criteria were given an inclusion number and were recorded on an individual questionnaire. The researcher or research assistant explained the nature and aim of the study to every person who participated in the study. Consent forms were provided to the patients, who agreed to participate in the study, and they were requested to sign, and those who were not able to write were requested to sign using their thumbs and ink.

The nurses at the psychiatric clinic (who were research assistants) on the day of recruitment screened the patients for inclusion criteria, and were tested for their random blood sugar, and checked for their anthropometric measurements including weight, height, waist circumference, and estimation of body mass index of individual participants were calculated by weight against their height in square meters, then the results were recorded in the participant questionnaire.

The participants were allowed to go home and were instructed to come back the next day for testing of fasting blood sugar (FBS) while fasting for at least 8 hours. FBS was checked on the morning of the test before the patients take...
their breakfast. Results of fasting blood glucose were recorded in an individual participant questionnaire and the interpretations were performed using American Diabetic Association criteria.

For each participant in the study, data were collected using a patient structured questionnaire. Participants’ information obtained was collected using a structured questionnaire. At the end of each participant's screening, the completeness and consistency of the questionnaires were checked. The data obtained was stored by the principal investigator in a well-secured environment. The correctly completed questionnaires were considered for analysis. Data entry, clearing, and analysis were done by the principal investigator using the Statistical Package for Social Science (SPSS) version 20.

Descriptive statistics were conducted to generate frequency tables of relevant variables, and cross-tabulations were conducted to explore the association between dependent and independent variables. Fisher’s exact test was used to assess the associations involving the categorical variables. A P-value of less than or equal to 0.05 was considered to be statistically significant in the association being examined.

The data obtained from this study is stored at the University of Zambia Medical Library for academic purposes and was presented to the Department of Psychiatry of the University Teaching Hospital and the University Teaching Hospital management team.

III. RESULTS

The first objective of this study was to determine the demographic characteristics and proportions of patients with the psychotic disorders who developed early glucose metabolism impairment when receiving antipsychotic medications.

In this study, a total of ninety 90 adult patients with psychotic disorders were enrolled for participation. Large numbers of participants 62 (68.88%) were on treatment with the diagnosis of schizophrenia and 28 (31.11%) were having other psychotic disorders. Forty-three (47.8%) of the participants were male while forty-seven (52.2%) were females. Forty (44.4%) were aged 18-35 years, 29 (32.2%) participants were aged 36-55 years, and 21 (23.3%) were aged 56 years and above. Fourteen (15.6%) participants had been on antipsychotic medication for not more than three months, 29 (32.2%) had been on antipsychotic medication for more than six months, and 47 (52.2%) had been on antipsychotic medication for more than six months.

Further analysis revealed that 24 (26.7%) participants were taking typical antipsychotic medication, 51 (56.7%) participants were taking atypical antipsychotic medication, and 15 (16.7%) were taking both typical and antipsychotic medication. Lastly, the results revealed that 61 (67.8%) participants had normal blood pressure while 29 (32.2%) had high blood pressure.

The summary of this data is presented in Table I (Demographic characteristics of the study participants) below.

The participants were tested to establish their fasting blood glucose. 71 (78.9%) participants’ fasting blood glucose was normal, 9 (10.0%) participants’ fasting blood glucose was impaired and 10 (11.1%) met the criteria for diabetes mellitus. The summary is presented in Fig. 1 (proportion of fasting blood glucose levels among the study participants) below.

The proportion of impaired fasting blood glucose was higher among male patients 6 (6.67%) than female 3 (3.33%) where the proportion diabetes was higher in female 7 (7.78%) than male 3 (3.33%), the differences were statistically non-significant $\chi^2 (2, n = 90) = 2.455, p = 0.333$. The summary is presented in Fig. 2 (proportion of fasting blood glucose by sex of the participants) below.

In this study, it was found that patients aged 36 and above had higher levels of impaired fasting blood glucose 5 (5.56%) higher proportion of diabetes 5 (5.56%); these results were statistically significant $\chi^2 = 10.323, p\text{-value}=0.020$.

The summary is presented in Fig. 3 (Relationship between age and levels of fasting blood glucose among the study participants) below.
A Fishers Exact test was performed to examine the relation between waist circumference (WC) and fast blood glucose (FBG), at a significance level of 0.05. The relation between the two variables was significant, $\chi^2 (2, n = 90) = 6.612, p = 0.030$. Participants who had higher waist circumference were more likely to have impaired fasting blood glucose levels and diabetic. The summary is presented in Fig. 4 (proportion of fasting blood glucose levels in relation to the waist circumferences of the study participants) below.

The second objective of this study was to determine the association between glucose metabolism impairment and the type of antipsychotic medication used. A Fishers Exact test was performed to examine the association between the two variables at a significance level of 0.05. The relation between the two variables was significant, $\chi^2 (4, n = 90) = 9.616, p = 0.029$. Patients who were taking atypical antipsychotic medication were more likely to be diabetic, while patients who were taking both atypical and typical antipsychotic medications were more likely to be impaired than those who were taking typical antipsychotic medication alone. A large percent (8.89%) of patients who met the criteria for the diagnosis of diabetes mellitus were using second-generation antipsychotics.

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### Table I: Demographic Characteristics of the Study Participants

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
<th>Frequency (N=90)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-35</td>
<td>40</td>
<td>44.4</td>
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<tr>
<td>36-55</td>
<td>29</td>
<td>32.2</td>
<td></td>
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<tr>
<td>56+</td>
<td>21</td>
<td>23.3</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Male</td>
<td>43</td>
<td>47.8</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>47</td>
<td>52.2</td>
<td></td>
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<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Schizophrenia</td>
<td>62</td>
<td>68.8</td>
<td></td>
</tr>
<tr>
<td>Other psychotic disorders</td>
<td>28</td>
<td>31.1</td>
<td></td>
</tr>
<tr>
<td>Normal (18.5-24.5Kg/m2)</td>
<td>43</td>
<td>47.8</td>
<td></td>
</tr>
<tr>
<td>Overweight (25-29.5Kg/m2)</td>
<td>24</td>
<td>26.7</td>
<td></td>
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<tr>
<td>Body Mass</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Obese (30+Kg/m2)</td>
<td>13</td>
<td>14.4</td>
<td></td>
</tr>
<tr>
<td>Low BMI (&gt;18.5Kg/m2)</td>
<td>10</td>
<td>11.1</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>55</td>
<td>61.1</td>
<td></td>
</tr>
<tr>
<td>Waist circumference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(if &lt;80cm for women or &lt;90cm for men)</td>
<td>Increased</td>
<td>35</td>
<td>38.9</td>
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<tr>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Fasting blood glucose</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impaired</td>
<td>09</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>02</td>
<td>02.2</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>01</td>
<td>11.1</td>
<td></td>
</tr>
<tr>
<td>Blood pressure measurements</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Normal BP (&lt;140/90mmHg)</td>
<td>61</td>
<td>67.8</td>
<td></td>
</tr>
<tr>
<td>High BP (&gt;140/90mmHg)</td>
<td>29</td>
<td>32.2</td>
<td></td>
</tr>
</tbody>
</table>

### Table II: Relationship between Types of Antipsychotic Medications used and Fasting Blood Glucose Levels

<table>
<thead>
<tr>
<th></th>
<th>Normal, N (%)</th>
<th>Impaired, N (%)</th>
<th>Diabetes, N (%)</th>
<th>Total, N (%)</th>
<th>$\chi^2$</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical anti-psychotics</td>
<td>21 (23.33)</td>
<td>02 (2.22)</td>
<td>02 (2.22)</td>
<td>25 (27.78)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atypical anti-psychotics</td>
<td>38 (42.22)</td>
<td>02 (02.22)</td>
<td>08 (8.89)</td>
<td>48 (53.33)</td>
<td>9.614</td>
<td>0.029</td>
</tr>
<tr>
<td>Both typical and atypical anti-psychotics</td>
<td>12 (13.33)</td>
<td>05 (5.56)</td>
<td>00 (0.00)</td>
<td>17 (18.89)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>71 (78.89)</td>
<td>09 (10.00)</td>
<td>10 (11.11)</td>
<td>90 (100)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 3.** Relationship between age and levels of fasting blood glucose among the study participants.

**Fig. 4.** Proportion of fasting blood glucose levels in relation to the waist circumferences of the study participants.
antipsychotics compared to 2.22% who met the same diagnostic criteria were using first-generation antipsychotics ($\chi^2 = 9.614, p = 0.029$). The summary of this data is presented in Table II (relationship between types of antipsychotic medications used and fasting blood glucose levels) above.

It was also found that patients who were using atypical antipsychotic medications and a combination of both typical and atypical antipsychotics were more likely to have impaired blood fasting glucose levels and to be diabetic compared to those who were taking first generation antipsychotic medications alone; the differences was statistically significant $\chi^2 (4, n = 90) = 9.616, p = 0.029$.

Patients taking antipsychotic medication for more than a 6-month period duration demonstrated a higher proportion of impaired fasting blood glucose level as well as had higher proportion of diabetes compared to those who were on medication for less than 6 months. Fisher’s exact test was performed to examine a relation between duration of using antipsychotic medication and fasting blood glucose (FBG), at a significance level of 0.05. The relation between the two variables was not significant. $\chi^2 (4, n = 90) = 1.930, p = 0.792$.

The summary from two paragraphs above are presented in Fig. 5 (the type of antipsychotic used by the patients and levels of fasting blood glucose), and Fig. 6 (the duration of antipsychotic use in relation to the fasting blood glucose levels among the study participants) below.

### Fig. 5. The type of antipsychotic used by the patients and levels of fasting blood glucose.

<table>
<thead>
<tr>
<th>Types of antipsychotic used</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical antipsychotic</td>
<td>22</td>
</tr>
<tr>
<td>Atypical antipsychotic</td>
<td>38</td>
</tr>
<tr>
<td>Both typical and atypical</td>
<td>13</td>
</tr>
<tr>
<td>Diabetes</td>
<td>6</td>
</tr>
</tbody>
</table>

### Fig. 6. The duration of antipsychotic use in relation to the fasting blood glucose levels among the study participants.

<table>
<thead>
<tr>
<th>Duration of using antipsychotic medication</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not more than three months</td>
<td>10</td>
</tr>
<tr>
<td>Up to six months</td>
<td>33</td>
</tr>
<tr>
<td>More than six months</td>
<td>5</td>
</tr>
</tbody>
</table>

### IV. Discussion

This is the first kind of study to be conducted at Clinic Six, Department of Psychiatry at the University Teaching Hospital. The study used simple and basic screening methods aimed at optimizing the early diagnosis of glucose metabolism impairment for patients with psychiatric disorders who were receiving antipsychotic medications at the outpatient psychiatric clinic of the University Teaching Hospital in Lusaka. Specifically, this study described the demographic characteristics and proportion of patients with glucose metabolism impairment who were receiving antipsychotic medications. It also described the relationship between glucose metabolism impairment and the types of antipsychotic medications used. The focus on glucose metabolism impairments was given special consideration because it is closely associated with other medical conditions such as cardio-metabolic disease and its related co-morbid conditions, which worsen psychiatric treatment and outcome.

In this study, it was found that a large proportion of the participants were aged between 18-35 years (44.4%) and a smaller proportion (23.3%) was aged 55 years and above. Among all participants 24 (26.7%) were taking typical antipsychotic medications, 51 (56.7%) atypical antipsychotics, and 15 (16.7%) were taking both typical and atypical antipsychotic medications at the same time. 11.1% were underweight, 26.7% overweight and 14.4% were obese, while 38.9% had higher waist circumferences. Increased in age were associated with impaired fasting blood glucose levels and diabetes $\chi^2 (4, n = 90) = 10.323, p = 0.022$. A Fishers Exact test was performed to examine the relation between Body Mass Index (BMI) and fasting blood glucose levels (FBG), at a significance level of 0.05. The relation between the two variables was not significant, $\chi^2 (6, n = 90) = 3.691, p = 0.730$. However, increase in waist circumferences was highly associated with impaired fasting glucose levels $\chi^2 (2, n = 90) = 6.612, p = 0.030$. The overall proportion of impaired fasting blood glucose levels was 10% and diabetes at 11.1%, female participants had a higher proportion compared to males though statistically were nonsignificant $\chi^2 (2, n = 90) = 2.455, p = 0.333$. Second-generation antipsychotics were highly associated with impaired fasting blood glucose levels and diabetes. Duration of antipsychotic medication use was not associated with the development of impaired fasting blood glucose levels (FBG), $\chi^2 (4, n = 90) = 1.930, p = 0.792$.

The demographic features of the study participants revealed that there were more females than males attending outpatient psychiatric clinic services during the study period. These findings are consistent with the study done in Uganda. A higher percentage of females (55.63%) were seen in a study to determine the prevalence of metabolic syndrome in patients with psychiatric disorders [39]. This could be owing to the perception that females are more likely to seek medical help than males. In terms of body mass index, 14.4% and 26.7% of the participants were obese and overweight, respectively. Although females were more likely to have a higher percentage of overweight than males, statistically, this was not significant. This finding does differ from the one that was found in a study done by Kwobah and colleagues, which showed that 45% of the patients with a psychiatric disorder...
were obese as compared to normal individuals who were not suffering from psychotic disorders [40]. In terms of waist circumferences, 42.2% of the study population had higher waist circumferences. Female participants also had a higher proportion as compared to male participants, but this was statistically not significant. However, this result again is similar to the one which was found in patients with psychotic disorder who exhibited higher waist circumference than control in a study which was conducted by Kwobah and colleagues in Kenya. Patients receiving antipsychotic medication are significantly at risk of developing glucose metabolism impairment compared to the general population. The overall proportion of impaired fasting blood glucose found in this study was 10% and diabetes was 11.1%, respectively. These results are higher compared to one observed in the general Zambian population as reported in a study by [34] reported a prevalence of impaired glucose levels of 4.0% in the general Zambian population [34]. Reference [41] reported a prevalence of diabetes type 2 of 2.1% among men and 3.0% among women, based on a population survey study that was conducted in 2012 in the Zambian general population. However, the finding of this study is in line with other studies which were conducted in a different part of the world. Reference [21] did a study in Sweden to evaluate the prevalence of diabetes and prediabetes in patients with psychosis and found the prevalence of 10% and 10% respectively. The results are higher compared to the one which was found in Zambia, differences in environmental exposures and standard of life exhibited by these two different nations could be the reason for this discrepancy. The results of this study also found that patients who were 55 years and older showed a higher proportion of diabetes compared to the younger ones, which was statistically significant (p = 0.022). This should be an alarm to psychiatrists and other health professionals working in psychiatric settings, as degenerative changes that occur with aging could be another risk factor of glucose metabolism impairment in conjunction with antipsychotic medications, though this finding contradicts the one reported in a study by [32] that reported young adolescent exhibited higher levels of impaired glucose tolerance and at higher risk of diabetes than adults when starting treatment with antipsychotic medications. Another important observation that was found in this study is that an increase in waist circumference was significantly associated with impaired fasting blood glucose levels (P-value = 0.030). However, there were a small proportion of the participants with low waist circumference and even low BMI who also demonstrated same degree of impaired fasting blood glucose, and some met the criteria for the diagnosis of diabetes mellitus. Increasing body mass index was not significantly tested to be associated with glucose metabolism impairments. On the other hand, sex was not a significant risk factor for glucose metabolism impairment, unlike the findings of another study like that was done in Ethiopia that reported female sex has a significant risk of impaired glucose metabolism including hyperglycemia and diabetes [33]. The study's second objective was to determine if there was a link between impaired glucose metabolism and the type of antipsychotic drugs used. It was found that patients who received long-term treatment with the newer generation of antipsychotic drugs were more likely to have impaired fasting blood glucose levels and diabetes than those who received conventional antipsychotic medications alone, according to this study. This finding is in line with a meta-analysis study indicate that patients with severe mental illnesses like schizophrenia who were treated with second-generation antipsychotics like olanzapine had significantly higher blood glucose levels than those who were on typical antipsychotics [36]. It was also in line with the findings of a big study that compared the effects of eighteen different drugs which also concluded that those who were in the newer generation of antipsychotic medications had a higher proportion of glucose metabolism impairments compared to the conventional one [42]. Patients with psychotic disorders who took antipsychotic medications for more than six months had a higher proportion of diabetes and impaired fasting blood glucose levels than those who were taking antipsychotic drugs for less than six months however, this difference, were not statistically significant. Thus the length of antipsychotic medication had no bearing on the findings of fasting blood glucose levels that were impaired. This finding contradicts Ethiopian research which found a substantial link between long-term antipsychotic usages to be linked to the development of undetected diabetes in a patient with psychotic illnesses [33].

V. LIMITATIONS

This study had some limitations which were of great concern; some were identified during the process of data collection and the time of data analysis and need to be addressed in future studies.

The first study’s limitation is the way the questionnaires were developed. It was not easy to capture other factors that could have had a potential contribution to glucose metabolism impairment, such as level of education, exercise pattern, social support, the living standard of particular participants, and dietary habits, which were not inquired into during the process of data collection. Since then, education has been regarded as the most important determinant of safe living when it comes to adopting healthy lifestyle choices. Thus, it is expected of a well-educated individual to adopt a healthy, safe lifestyle in terms of eating habits and physical exercise. Similarly, regular physical exercise is crucial for regulating and balancing glucose metabolism levels. The study also involved a relatively small number of participants, so these results cannot be conclusively generalized to the total community of patients with psychiatric disorders in Zambia. This necessitates a further study which will involve a larger number of participants with the diversity of cases in both inpatient and outpatient services, which should be comprehensive and should inquire a lot of important information like the standard of living and lifestyle habits to give a true picture of the problem in the community. Lastly, the study used a cross-sectional design that has an inherent weakness in evaluating the temporal relationship between exposure and outcomes. Although it gives an insight into the problem, it is difficult for the results to clearly show the direction of the association. Thus, there is a need for future researchers to conduct longitudinal studies looking at
the association between specific antipsychotic drugs used and the development of glucose metabolism impairments.

VI. CONCLUSION

The glucose metabolism deficit in patients with psychotic disorders was found to be high. Patients of both sexes, male and female, had an equal chance of developing the problem, though females had a higher proportion as compared to males, and it is not time-dependent. Older patients showed a higher proportion of impaired fasting blood glucose levels compared to younger ones. Increased waist circumferences were significantly associated with a higher proportion of impaired fasting blood glucose levels. Body mass index was statistically not significantly associated with impaired fasting blood glucose levels, although most patients who exhibited impaired fasting blood glucose levels were overweight or obese, there was a small proportion of patients who had low body mass index and yet exhibited impaired fasting blood glucose levels or diabetes. Patients who were taking second-generation antipsychotics were potentially shown to have a higher proportion of impaired glucose metabolism compared to those who were taking only typical antipsychotic medications.

VII. RECOMMENDATIONS

It is recommended that basic screening measures of glucose metabolism parameters that are simple and cost-effective, like checking weight, BMI, waist circumferences and regular checking of blood glucose levels, be routine practice in all psychiatric settings before starting antipsychotic medications. Close monitoring of glucose metabolic parameters should be incorporated in a normal psychiatric practice especially when patients taking second generation antipsychotic medications. Appropriate measures should be taken for every patient who is at higher risk. For those who are detected with the problem, adequate care should be given, and the right choice of medication should be provided. Clinical knowledge on glucose metabolism impairments, their consequences, prevention, and management approach should be disseminated to every client visiting to the psychiatric clinic.

Dietary advice and encouraging physical activities should be integrated into psychiatric practice. Education should also be aired every time patients come into contact with a psychiatric health facility, or even the media should be used to air out information concerning psychotic disorders and their related comorbid conditions like glucose metabolism impairments. Another option for strengthening psychiatric services, especially for vulnerable patients, should be a multidisciplinary approach involving internal medicine physicians and consultant endocrinologists.

ETHICAL CLEARANCE AND CONSIDERATIONS

This research was conducted by observing several ethical considerations. Ethical clearance was sought from the University of Zambia Biomedical Research Ethics Committee (UNZABREC) and forwarded to the National Health Research Authority (NHRA) before the carrying out of the study. The participants’ autonomy was observed accordingly. All participants were informed about the voluntary nature of the study and their freedom to withdraw at any stage without any consequences to them.

Permission to conduct the study was also granted by the head of the department of psychiatry.

All consent forms were provided in English, interpreted in the participant’s local language, and all participants signed after reading, understanding, and agreeing to participate in the study.

Confidentiality was upheld during the whole period of the study, and each participant was given an inclusion number and assured that their names would not be used in the report or published.

ACKNOWLEDGMENT

We thank all our patients who participated in the study and the administration and medical team of the University Teaching Hospital (UTH) for their help and support.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

REFERENCES


