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To determine the correlation of random blood sugar level and magnesium level in HIV-treated patients in the Bundelkhand region of India: A Case Control Analysis

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Background: The impact of HIV on glucose and magnesium levels in HIV-affected patients in the early stages of the disease have received less attention. Because to the lack of research into the potential negative effects of these factors, we aimed to analyze the sex and age differences in the Random Blood Glucose (RBS) and magnesium levels of patients with HIV disease. **Methods and components:** Fifty human volunteers without HIV were included as a comparison group. Fifty people living with HIV who were all undergoing treatment made up the HIV group. The HIV infection was identified using criteria established by the National AIDS control program. The HIV diagnosis for the study group was performed by medical department consultants. **Results:** Finding no significant difference in age characteristics between HIV and control group patients but finding a significant difference in RBS and magnesium mean values. When we compared HIV patients to healthy controls, we observed that the HIV patients' RBS levels were almost 40% higher. **Conclusion:** Since magnesium insufficiency was found to promote hyperglycemia in HIV patients, it may be wise to routinely monitor magnesium levels in this population. As for the link between magnesium and HIV, additional study is required to fully grasp it.
Key words: HIV; RBS; Hyperglycemia; Magnesium.

Introduction:

Human Immunodeficiency (HIV) disease is caused by HIV virus and it is acquired disease [1]. HIV and hyperglycemia (raised blood glucose level) are linked for many reasons; nonetheless, recent studies show that the two disorders share specific risk factors [2,3]. When it comes to insulin resistance, tumor necrosis factor is linked to serine phosphorylation of the insulin receptor substrate [4]. TNF blockers increased insulin sensitivity and decreased blood glucose levels in a trial of people with HIV [5]. These disorders have been linked to improvements in blood glucose and blood pressure after patients lose 5 to 10 percent of their starting weight [6]. Another link between the two diseases is a shared genetic basis. HIV and high blood sugar were reported to go hand in hand with cytokine variation [7,8]. Finally, the auto-immune hypothesis is thought to have a role in the development of both illnesses [1,9]. Considering the works, a deep relationship between hyperglycemia with HIV; yet, further study into the understanding of regulating HIV will assist reduce the risk of developing hyperglycemia. According to the internet, the first study to link HIV with hyperglycemia was conducted in 1970, and the results of other study showed that the fasting blood glucose levels of HIV patients were comparable to those of a control group without HIV [10, 11,12].

If obesity and a family history of hyperglycemia are assumed to be common to both the HIV group and the control group, then 29% of the HIV group patients will have abnormal blood sugar levels compared to the participants in the control group in the following year's retrospective research [11]. Hyperglycemia is more common in HIV patients, according to later cross-sectional studies [12,13]. The increased prevalence of hyperglycemia in HIV patients was shown to be unrelated to traditional risk factors such as obesity and abnormal lipid profile [14], according to a study of the same type. An additional study [15] confirms the link between HIV and insulin resistance. Magnesium's potential in the field of medicine has garnered more attention in the past decade. Many metabolic reactions rely on steady levels of magnesium, suggesting its importance to human health. Diabetes, anemia, depression, slowed regeneration, decreased libido, and cardiovascular disease have all been linked to magnesium shortage [16,17]. The noteworthy risk factor in hyperglycemic people is magnesium bioavailability. Taking into account the concept between hyperglycemia and HIV, the research shows that magnesium is lost during hyperglycemia (see references

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[18–20]). Frequent urination, insulin resistance, poor absorption, and inadequate intake could all play a role in this loss [21,22]. There is a lack of understanding of magnesium's function in HIV, especially in this region of India (Bundelkhand region). In addition, there is a dearth of research on people with HIV during the early stages of the disease, and existing studies have not taken into account blood glucose and magnesium levels as a damaging factor. Because of this, we set out to investigate these variables in people with psoriatic disease, and we compared our findings to those of a sex- and age-matched control group.

Materials & methods:

The Human ethics committee of the research institution gave their assent to the study's protocol. The sample size of 100 HIV-infected people has been set low because there is no computerized data available and collecting the data is a time-consuming and laborious process. The control group consisted of 100 people who were considered to be healthy. Those who are HIV positive fall into one of three categories. There were 51 people in grouping I (CD4 count > 500 cells/cubic mm), 42 people in subgroup II (499-200 cells/cubic mm), and 7 people in subgroup III (199). Diabetes mellitus types 1 and 2, HIV infection, and pathological sequelae were all disqualifiers. The non-HIV control group requires subjects who are otherwise healthy, including those who adhere to a regular diet, are not diabetic, do not take supplements, have no other health problems, do not smoke, and do not drink. Subjects with HIV must be on HAART. Subjects' venous blood was collected in vials containing 5 ml after obtaining their informed written consent (red top). Serum will be separated from blood by centrifuging it at 3000 rpm for 20 minutes, and then refrigerated until tested.

Glucose oxidase-peroxidase method was used to estimate random blood sugar in the present study, bought from Tulip Diagnostics. Zasoski et alestimation .'s of serum magnesium (1977). The concentration is calculated by measuring the amount of light absorbed by excited atoms as they travel through a flame. Nitric acid was used to soak glassware for 24 hours before it was rinsed five times in milli-Q water, dried, and put to use. Definition of Magnesium: Calibration curve concentrations (0.5, 1.0, 2.0, 3.0, and 5.0 mg/dL) were freshly produced by serial dilution from magnesium stock solutions. Atomic absorption spectrophotometer readings were used to calculate the sample absorbances. The sample absorbencies were measured and compared to industry norms.

Statistical analysis:

Statistical analysis was carried out using Microsoft Excel. The means of the variables were compared between the two groups using an unpaired t-test. The percentages were determined as well. The cutoff for significance was set at $P = 0.05$.

Results:

HIV-infected & treated: Biochemical Markers Compared to a Healthy Reference Group

Figures 1-3 display average serum magnesium levels together with age, random blood sugar (RBS), and RBS. While there was no statistically significant difference in age between HIV-infected and treated and control group patients (Figure 1), there were significant differences in RBS ($t=6.425$; $df=98$; $P < 0.001$) and magnesium mean levels ($t=6.812$; $df=98$; $P < 0.001$) (Figures 2 & 3). Although the mean RBS level of healthy controls was rather high, we nevertheless found that people with HIV-infected and treated had levels about 40% greater than controls. Serum magnesium levels were nearly 60% lower in people with HIV-infected and treated compared to healthy controls. Because we used age- and sex-matched participants in both groups, we were able to calculate the rise in percentages.

Discussion:

Several studies in the last twenty years have discovered changes in the magnesium status of patients with various diseases, demonstrating [16,17] the function of serum minerals in diseases and the association between nutrition and disease being suspected as early as the 16th century. Magnesium insufficiency has been linked to both the presence of disorders and the development of problems associated with those diseases in various research [16-18,23-25]. Several enzymes in the glycolytic process require magnesium as a cofactor in order to function properly [26]. Magnesium is essential for improving insulin action on the cell surface of insulin-dependent tissues, as has been proven experimentally [17]. Another study found that low magnesium levels reduced tyrosine kinase activity, which in turn reduced glucose transport into cells [27]. Tyrosine kinase is the enzyme responsible for phosphorylating insulin receptor substrate tyrosine residues [28]. Magnesium that is not absorbed by the body is eliminated in the

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feces [26]. This includes magnesium from biliary excretion and intestinal secretion. The kidneys filter out some of the magnesium you take in as waste [26].

HIV-infected patients in the current study had a significantly lower serum magnesium level than the non-HIV-infected (controls) in the study. Magnesium concentration in people with HIV-infected is an area where there is a dearth of data on the internet. So, the cause of a lack of magnesium in HIV-infected sufferers is still a mystery. Based on the findings of the current study, we conclude that HIV-infected is a condition characterized by an increase in the rate at which skin cells are produced [16, 29]. Glucose is the cells' primary fuel source, and magnesium plays a crucial role in the oxidation of glucose to produce energy. Hence, we infer that magnesium insufficiency results from excessive consumption of magnesium stores and inadequate replenishment of magnesium reserves. Another factor contributing to low magnesium is that insulin sensitivity is required for magnesium re-absorption in the renal tubules [17,30]. Magnesium deficiency impairs insulin action and insulin sensitivity, which in turn reduces magnesium reabsorption in the renal tubules. Magnesium salts have not been well studied for the treatment of HIV-infected, however there are reports on their use [28]. Several studies [26-28] also show that treating patients with magnesium alleviates their symptoms. Regarding HIV-infected, neither the cellular nor molecular relevance of magnesium nor its clinical evaluation have been addressed.

In the current investigation, we found that people with HIV-infected had higher blood sugar levels than the non-psoriatic control patients. The findings of our investigation are consistent with those of other studies [10-15]. Moreover, hyperglycemia was found in a study of south Indian HIV-infected patients. One plausible explanation for low serum magnesium levels seen in the present research HIV-infected sufferers may be a result of insulin resistance since insulin regulates the intracellular magnesium concentration by stimulating the cell membrane pumps and increasing free magnesium entry into the cells [16-24]. Thus, we conclude that the hyperglycemia in the HIV-infected participants was caused by insulin resistance.

Conclusion:

In conclusion, we have shown that reduced magnesium levels are seen in those who are HIV-positive and receiving treatment in the Bundelkhand area. Depleted magnesium levels were associated with hyperglycemia in HIV-treated patients, suggesting that regular monitoring of magnesium levels in this population may be prudent. Further research is needed to fully understand the implications of the link between magnesium and HIV infection.

Conflict of interest:

The present study authors do not have conflict of interest among themselves.

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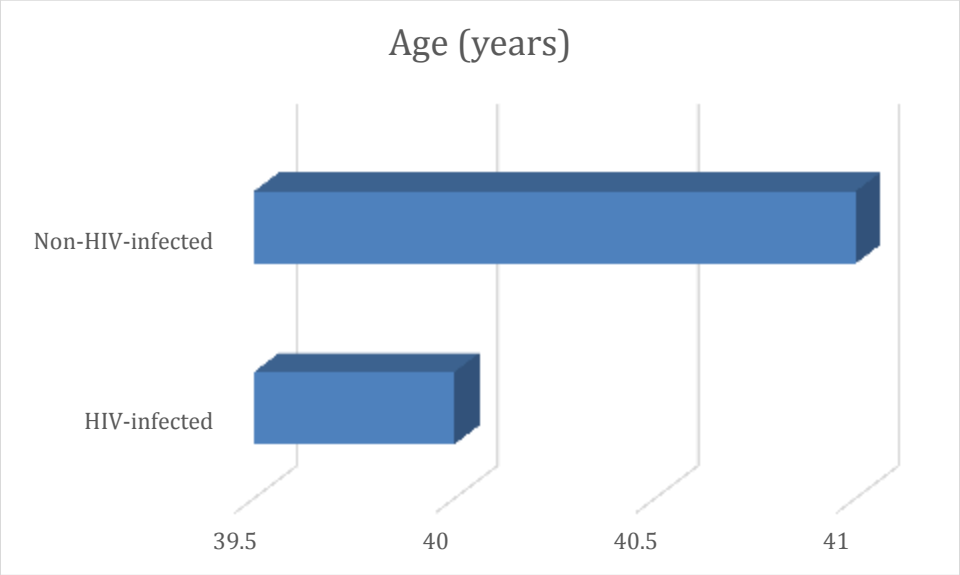

Figure 1: Age medians in in HIV-infected and non-HIV-infected populations.

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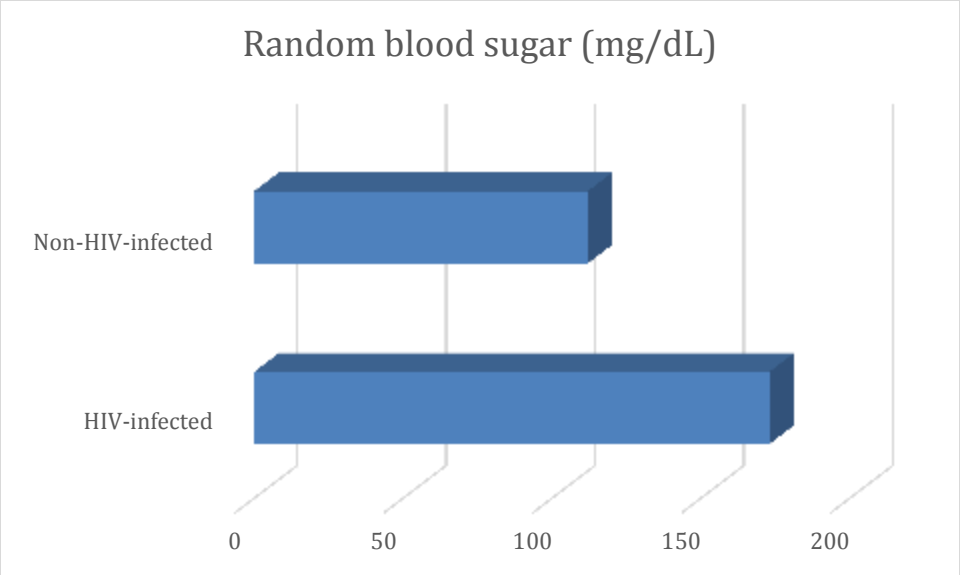

Figure 2: Random blood sugar medians in HIV-infected and non-HIV-infected populations.

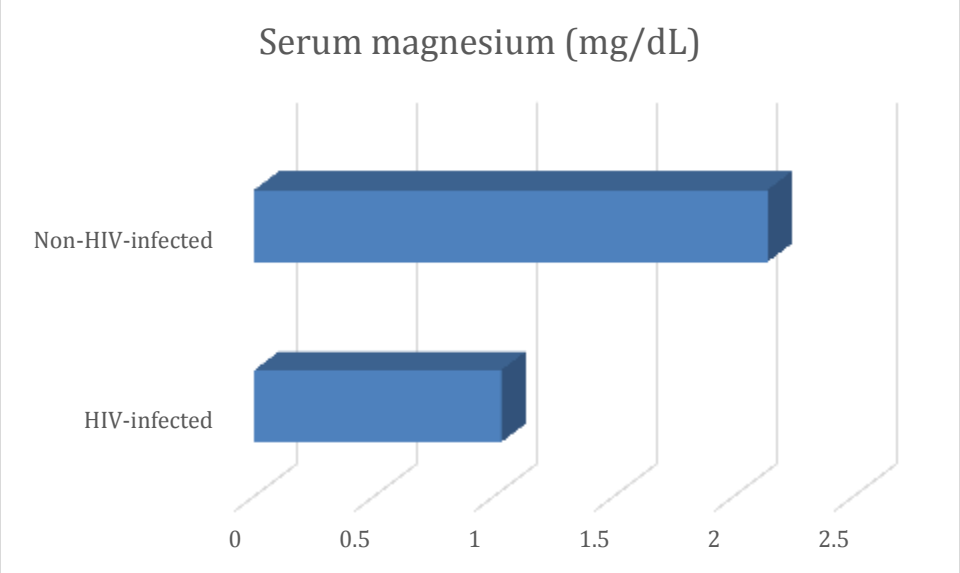

Figure 3: Serum magnesium medians in HIV-infected and non-HIV-infected populations.