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Original Research Article

Evaluating the Correlation between CRP and S. Ferritin with Diabetes Management

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Abstract:

Objectives: This study aimed to analyze the correlation between serum ferritin (S. Ferritin) and C-reactive protein (CRP) ranges with the control of Diabetes Mellitus (DM) amongst individuals in Jharkhand.

Materials and Methods: A cross-sectional study was performed regarding 150 participants diagnosed with diabetes mellitus. Blood samples have been collected to measure S. Ferritin and CRP levels. Glycated haemoglobin (HbA1c) was used as a marker to assess the regulation of diabetes. Correlation analysis was achieved using appropriate statistical techniques using S. Ferritin, CRP, and HbA1c ranges.

Results: The study revealed a statistically significant positive correlation between S. Ferritin and CRP levels ($p < 0.05$). Furthermore, a positive association was observed between elevated S. Ferritin and higher HbA1c levels ($p < 0.05$). Similarly, increased CRP levels have been associated with poor glycemic control in individuals with diabetes mellitus.

Conclusion: Our findings suggested a potential association between elevated S. Ferritin and CRP levels with poorer regulation of diabetes mellitus among individuals in Jharkhand. Monitoring these biomarkers could help assess and manage glycemic control in diabetic patients, potentially contributing to improved health results.

Keywords: Serum Ferritin, C-reactive Protein, Diabetes Mellitus, Jharkhand, Glycemic Control, Biomarkers.

Introduction

Diabetes Mellitus (DM) is a chronic metabolic disease characterized by improved blood sugar levels due to insufficient insulin production or impaired insulin utilization [1]. It makes a tremendous international physical operation, with its prevalence enhancing globally, including in regions like Jharkhand, India [2]. In Jharkhand, a state recognized for its various populations and ranging socio-economic situations, the level of diabetes has been gradually growing, elevating problems about its management and associated complications [3]. Understanding the factors influencing DM's regulation and progression is essential for developing powerful techniques to mitigate its impact [4].

The study of diabetes, emerging research has highlighted the ability role of serum ferritin and C-reactive protein (CRP) in influencing the management and consequences of this metabolic disease [5]. Serum ferritin, a trademark of iron level within the frame, and CRP, a marker of inflammation, have drawn attention because of their manageable association with insulin resistance and the inflammatory methods implicated inside the pathogenesis of diabetes [6]. Understanding the correlation between those biomarkers and glycemic control in the context of Jharkhand's population should offer valuable insights into the complexities of diabetes management within this demographic [7].

The research into the interaction between S. Ferritin, CRP, and the control of DM assumes importance due to the capability implications for medical exercise and public health interventions [8]. Unravelling the relationship between those biomarkers and the control of diabetes in Jharkhand may not be underlying the disease; however, it also sets the way for strategies in disorder management [9]. This study seeks to contribute to the present knowledge by exploring the correlation between S. Ferritin, CRP stages, and glycemic control among individuals with diabetes in Jharkhand, thereby aiming to provide valuable insights into factors influencing diabetes consequences in this vicinity.

Materials and Methods

Study Design and Participant Selection

This cross-sectional observation was performed in Jharkhand, India, involving a large cohort of individuals diagnosed with Diabetes Mellitus. A purposive sampling method was employed to recruit people elderly 18 years and above, recognized with either Type 1 or Type 2 diabetes, from diverse healthcare centres across unique districts of Jharkhand. All participants are required to provide informed consent before their enrollment commences. Relevant demographic information, clinical records, and information concerning diabetes management have been collected and scientific statistics overview to ensure comprehensive participant characterization.

Biomarker Measurement

Blood samples were collected from every participant with individuals diagnosed with diabetes Mellitus. Serum ferritin levels were measured using popular laboratory techniques, measuring the iron level inside the blood samples. C-reactive protein (CRP) levels were also quantified as a marker of systemic inflammation using demonstrated assays. Stringent quality control measures were implemented during the sample collection and analysis processes to guarantee the accuracy and reliability of the biomarker measurements.

Assessment of Glycemic Control

Glycated haemoglobin (HbA1c) levels have been used as a trademark of long-term glycemic management amongst individuals with diabetes. HbA1c levels had been measured from venous blood samples using standardized techniques, reflecting average blood sugar stages over the preceding 2 to 3 months. The association among S. Ferritin, CRP levels, and HbA1c as a marker of glycemic control was analyzed statistically to discover capability correlations.

Statistical Analysis

Statistical analyses were conducted using appropriate software to discover relationships among S. Ferritin, CRP ranges, and glycemic management. Correlation coefficients have been calculated to evaluate the power and path of institutions among those biomarkers and HbA1c levels. Furthermore, regression analyses have been carried out to become aware of capacity confounding elements and modify for covariates such as age, gender, length of diabetes, and remedy modalities to envision the independent effect of S. Ferritin and CRP on glycemic control.

Results

Table 1: Demographic Characteristics of Participants

Demographic Factors	Number (%) or Mean ± SD
Age (years)	45.2 ± 8.6
Gender	
- Male	60 (40%)
- Female	90 (60%)
Type of Diabetes	
- Type 1	40 (26.7%)
- Type 2	110 (73.3%)
Duration of Diabetes (years)	8.4 ± 3.2

The Duration of diabetes in Table 1 indicates the mean period for which individuals in the study have been diagnosed with diabetes, measured at 8.4 years with a standard deviation of 3.2 years. This metric presents the perception of the chronicity of diabetes in a few individuals. A better duration indicates an extended period of dwelling with diabetes.

A mean duration of 8.4 years indicates that, on average, participants have been connected with their diabetic situation for nearly a decade. These statistics suggest potential interpretation in sickness management reports, which include the opportunity for complications or changes made over a prolonged period to control blood sugar levels. Understanding the duration of diabetes within this age group in assessing the potential impact of long-term disease management strategies and their influence on outcomes such as glycemic control or the progression of complications associated with prolonged diabetes duration.

Table 2: Biomarker Levels in Participants with Diabetes

Biomarkers	Mean ± SD (or Median, IQR)
Serum Ferritin	78.5 ± 20.3 ng/mL
C-reactive Protein	3.2 ± 1.5 mg/L
HbA1c	7.9 ± 1.2 %

In Table 2, the biomarker levels amongst contributors with diabetes measured values. The implied serum ferritin levels of 78.5ng/mL with a standard deviation of 20.3 ng/mL show the average iron

storage inside the body. Elevated serum ferritin stages may want to advocate increased iron levels, probably related to conditions like insulin resistance or infection, that are relevant factors in diabetes pathophysiology.

The C-reactive protein (CRP) implies a level of 3.2 mg/L, with a standard deviation of 1.5 mg/L, which denotes the presence of systemic irritation. Elevated CRP levels regularly accompany inflammatory responses, which could exacerbate insulin resistance and the progression of diabetes-related headaches. The glycated haemoglobin (HbA1c) levels of 7.9% ± 1.2% signifies the average blood sugar control over the previous two to three months. This value serves as an essential indicator of long-term glycemic control. A better HbA1c level displays poorer blood sugar control, probably indicating an improved risk of diabetes-associated complications. Those biomarker values endorse a profile characterized by altered iron levels, inflammatory reactions, and HbA1c levels, indicating the need for improved glycemic management among individuals with diabetes.

Table 3: Correlation Between Biomarkers and HbA1c Levels

Biomarkers	HbA1c Levels (Correlation Coefficient, p-value)
Serum Ferritin	0.27 ($p < 0.001$)
C-reactive Protein	0.18 ($p = 0.012$)

Table 3 demonstrates the correlation coefficients among biomarkers and HbA1c levels among individuals with Diabetes. The correlation coefficient indicates the connection between the biomarkers and HbA1c, even as the p-values suggest the statistical significance of those correlations. The correlation coefficient 0.27 between serum ferritin and HbA1c ($p < 0.001$) indicates a moderately nice association. This finding means better serum ferritin levels are fairly linked with extended HbA1c levels, signifying potential effects between extended iron levels and poorer long-term glycemic control among those people. Similarly, the correlation coefficient of 0.18 between C-reactive protein (CRP) and HbA1c ($p < 0.01$) denotes a good enhancing level. This correlation shows that higher CRP levels are also undoubtedly associated with accelerated HbA1c levels, indicating that elevated inflammation may contribute, albeit to a lesser volume than serum ferritin, to poorer long-term blood sugar control in a few individuals. Overall, these correlation coefficients underscore the capacity to impact elevated serum ferritin and CRP stages on the regulation of Diabetes, highlighting the importance of things related to iron levels and inflammation in impacting glycemic control amongst people with Diabetes.

Table 4: Regression Analysis for Factors Influencing Glycemic Control

Factors	Beta Coefficient (95% CI)	p-value
Serum Ferritin Levels	0.35 (0.25 - 0.45)	<0.001
CRP Levels	0.18 (0.08 - 0.28)	0.002

Table 4 presents the results of regression analyses evaluating the effect of serum ferritin and C-reactive protein (CRP) levels on glycemic control among individuals with diabetes. The beta coefficients and their corresponding 95% confidence interval (CI) and p-values suggest the energy, direction, and significance of the connection between those biomarkers and glycemic control, adjusted for capacity confounding factors. The beta coefficient of 0.35 (95% CI: 0.25 - 0.45) for serum ferritin stages signifies an essential association with glycemic control. This locating implies that for each unit growth in serum ferritin levels, there's an associated increase in HbA1c levels with the aid of 0.35 devices after accounting for different variables within the version. The p-value being less than 0.001 demonstrates a statistically significant, highlighting the extensive influence of serum ferritin on poorer glycemic control amongst contributors with diabetes. Similarly, the beta coefficient of 0.18 (95% CI: 0.08 - 0.28) for CRP stages is also tremendously associated with glycemic management.

For every unit increase in CRP levels, there is a related increase in HbA1c ranges through 0.18 while considering different covariates. The p-value of 0.002 suggests a statistically full-size, however relatively weaker effect among CRP levels and glycemic regulation than serum ferritin. These effects from the regression evaluation reaffirm the earlier findings, highlighting the significant impact of expanded serum ferritin stages on poorer glycemic control among individuals with diabetes. Additionally, they underscore the widespread albeit weaker impact of multiplied CRP levels on impaired blood sugar management, emphasizing the jobs of iron levels and infection in affecting glycemic management in this cohort.

Discussion

Relationship Between Biomarkers and Glycemic Control: The findings of this study align with previous research investigating the affiliation between biomarkers and glycemic management among individuals with diabetes. The enhancing correlation found between serum ferritin levels and

HbA1c levels is regular, with several studies highlighting the impact of iron metabolism on glucose homeostasis. For example, a study by Hempe et al. proved a similar satisfactory correlation between improved serum ferritin and poorer glycemic control among diabetic people [6]. Moreover, the fantastic association observed among C-reactive protein (CRP) stages and HbA1c levels is the same opinion as current literature on the hyperlink between inflammation and insulin resistance [10, 11]. This correlation is supported with the study by Jung et al., indicating that improved CRP levels are related to better HbA1c values in people with diabetes [11].

Role of Biomarkers in Diabetes Management

Understanding the function of serum ferritin and CRP biomarkers in diabetes control is essential. Elevated serum ferritin ranges should doubtlessly contribute to impaired insulin sensitivity and worsen glycemic control, as indicated in diverse studies exploring the impact of iron shops on insulin resistance pathways [12]. Similarly, the affiliation between extended CRP stages and higher HbA1c stages underscores the significance of inflammation in exacerbating insulin resistance, as established in study by Mojiminiyi et al. and Varikasuvu et al [9, 13]. These findings together emphasize the importance of tracking these biomarkers in scientific practice to evaluate and doubtlessly intervene in managing glycemic regulation amongst diabetic people in Jharkhand, aligning with the worldwide consensus on the function of those biomarkers in diabetes care [14].

Implications for Custom Interventions and Future Research

The implications of those findings make bigger past diagnoses to capacity interventions and destiny research guidelines. Considering the established correlations between biomarkers and glycemic control, personalized treatment approaches focused on iron metabolism and inflammation hold the potential for enhancing diabetes management. For example, interventions focusing on iron popularity modulation or anti-inflammatory properties are probably explored to ameliorate glycemic regulation amongst people with Diabetes doubtlessly. Future studies could delve deeper into elucidating the mechanistic pathways underlying the impact of these biomarkers on diabetes effects, likely paving the manner for targeted healing procedures. [15] Longitudinal studies inspecting the effect of interventions focused on these biomarkers on glycemic control and diabetes-related complications could be instrumental in organizing their clinical application in dealing with Diabetes inside the Jharkhand populace.

Conclusion

In conclusion, this study elucidated a significant association between serum ferritin, C-reactive protein (CRP), and glycemic regulation among individuals with Diabetes in Jharkhand. The findings corroborate previous research, highlighting the massive impact of improved serum ferritin levels on poorer glycemic regulation, indicative of capability implications in the management of Diabetes. Additionally, the located mild association between CRP levels and HbA1c emphasizes the position of inflammation in exacerbating insulin resistance and its contribution to compromised blood sugar law in this populace. These insights underscore the significance of monitoring those biomarkers in medical practice to assess the intricacies of diabetes control and probably manual interventions concentrated on iron metabolism and irritation. Further investigations specializing in mechanistic pathways and longitudinal interventions are warranted to validate those findings and doubtlessly pave the way for personalized techniques to improve glycemic control and mitigate diabetes-related headaches in Jharkhand's diabetic population.

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