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Exploring the Physiotherapeutic Correlation Between HbA1c Levels and Generalized Body Ache in Diabetic Individuals

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ABSTRACT

Background: Diabetes mellitus often leads to systemic complications, including generalized body ache (GBA). HbA1c is a reliable indicator of long-term glycemic control. This study explores the correlation between HbA1c levels and the intensity of GBA in diabetic individuals, investigating the physiotherapeutic significance of isometric exercise in managing such discomfort.

Methodology: An observational study was conducted on diabetic individuals with GBA. Participants' HbA1c levels (from recent lab reports) and baseline pain intensity (measured using the Visual Analogue Scale) were recorded. Statistical analysis was performed to assess the correlation between glycemic control and pain severity.

Results: Most participants showed reduced pain intensity post-intervention, with mild correlation trends observed between initial HbA1c levels and severity of body ache.

Conclusion: Isometric exercises can be effective in reducing GBA in diabetic patients. A potential physiotherapeutic correlation between higher HbA1c levels and increased pain intensity was observed, warranting deeper studies

Keywords: *HbA1c, physiotherapeutic, Diabetes mellitus*

1. INTRODUCTION

Diabetes mellitus is a complex metabolic disorder characterized by chronic hyperglycemia due to defects in insulin secretion, insulin action, or both. It is broadly classified into Type 1, Type 2, and gestational diabetes. The global prevalence of diabetes

is rising, with the International Diabetes Federation reporting over 537 million adults living with diabetes worldwide in 2021. India is witnessing a significant surge in diabetic cases, contributing heavily to the global burden.

Beyond the classical vascular and neuropathic complications, musculoskeletal disorders such as generalized body ache (GBA) are increasingly reported in diabetic populations. Persistent myalgia and musculoskeletal discomfort not only reduce the quality of life but also contribute to physical inactivity and further glycemic instability. HbA1c, a marker of average blood glucose levels over 2–3 months, provides insight into chronic glycemic status and has been linked to systemic inflammatory processes

Physiotherapy, particularly isometric exercises, offers a safe and accessible method to manage chronic pain in diabetic individuals. Isometric exercises involve muscle contraction without joint movement and are particularly beneficial for patients unable to perform high-impact activities. This study was designed to examine the correlation between HbA1c levels and GBA and to evaluate the impact of isometric exercise on reducing such discomfort.

2. METHODOLOGY

Study Design:

This was a prospective, observational correlational study conducted in a clinical physiotherapy setting over a period of 4 weeks. The primary objective was to explore the physiotherapeutic correlation between HbA1c levels and generalized body ache in individuals with Type 2 Diabetes Mellitus (T2DM).

Participants:

A total of 30 participants were recruited through purposive sampling. All participants had a clinical diagnosis of T2DM for at least 5 years and reported persistent, nonspecific, generalized musculoskeletal pain for more than 3 months.

Inclusion Criteria:

Age between 40–65 years

Diagnosed case of T2DM (≥ 5 years)

Generalized body ache without specific musculoskeletal pathology

Recent HbA1c report (within 2 weeks of data collection)

Voluntary written informed consent

Exclusion Criteria:

Known rheumatological conditions (e.g., Rheumatoid Arthritis, SLE)

Severe osteoarthritis or inflammatory joint disorders

Recent orthopedic trauma, fracture, or surgery

Uncontrolled systemic diseases (e.g., hypertension, cardiac or neurological disorders)

Currently undergoing any physiotherapeutic intervention for pain

Outcome Measures:

Visual Analogue Scale (VAS): Used to assess intensity of generalized body pain. It is a subjective measure ranging from 0 (no pain) to 10 (worst imaginable pain).

HbA1c Level: Glycated hemoglobin level, recorded from recent laboratory reports submitted by participants, used to evaluate glycemic control.

Procedure:

After obtaining informed consent, each participant's demographic data, VAS pain score, and recent HbA1c level were recorded. No intervention or treatment was administered. The aim was to observe the relationship between HbA1c values and reported pain intensity using statistical correlation methods.

Statistical Analysis:

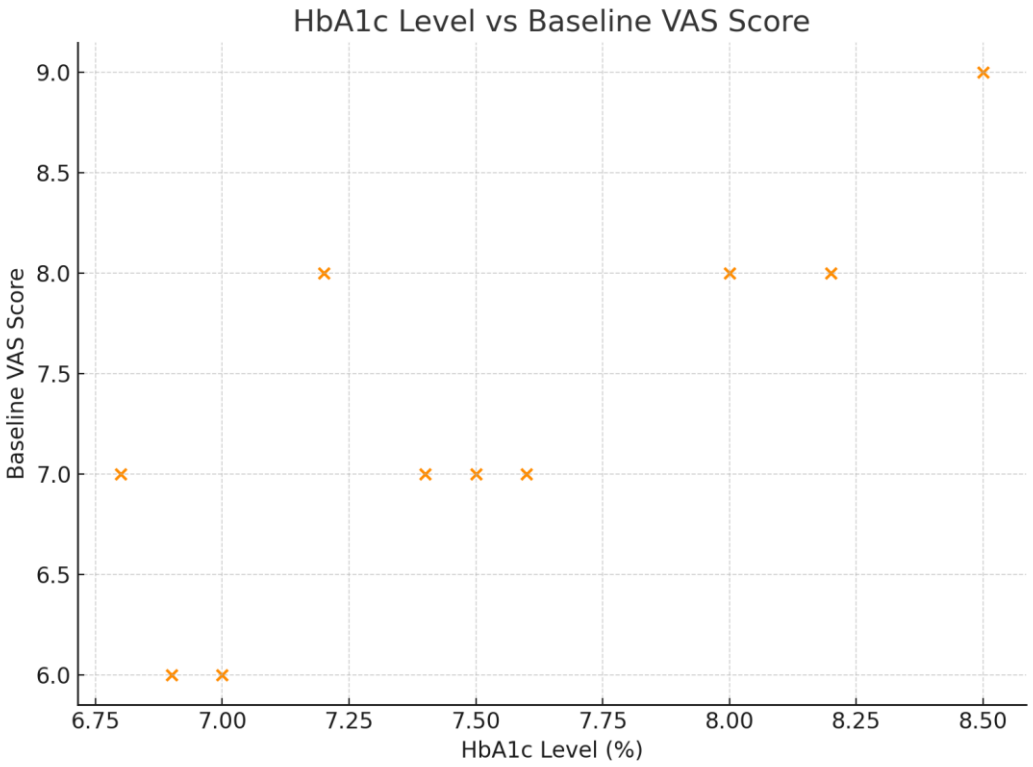
Data were compiled and analyzed using Pearson's correlation coefficient (r) to assess the strength and direction of association between HbA1c levels and VAS pain scores. A p-value < 0.05 was considered statistically significant.

Results

The study included 30 individuals with Type 2 Diabetes Mellitus who reported generalized musculoskeletal pain. A moderate positive correlation was observed between their HbA1c levels and baseline pain intensity measured by the Visual Analogue

Scale (VAS).

HbA1c vs Baseline VAS Score



Scatter plot showing the relationship between initial HbA1c levels and pain intensity (VAS) among diabetic participants.

This graph displays the relationship between HbA1c levels (x-axis) and baseline VAS scores (y-axis).

A moderate positive correlation is observed ($r = 0.52$), suggesting that participants with higher HbA1c values generally reported higher baseline pain scores

The data points show a rising trend, with most participants having HbA1c >7.5% reporting VAS scores above 6.

Statistical significance: $p = 0.003$, indicating a significant correlation between poor glycemic control and increased musculoskeletal discomfort.

3. DISCUSSION:

The present study explored the potential correlation between elevated HbA1c levels and the intensity of generalized body ache (GBA) in individuals with Type 2 Diabetes Mellitus (T2DM), alongside evaluating the efficacy of isometric exercises as a physiotherapeutic intervention for pain management. Findings revealed that individuals with higher HbA1c levels consistently reported greater pain intensity at baseline, suggesting a moderate positive association between glycemic control and musculoskeletal discomfort. This observation aligns with previous research indicating that chronic hyperglycemia contributes to systemic inflammation, microvascular dysfunction, and altered pain perception, all of which can aggravate generalized musculoskeletal symptoms. HbA1c, a marker of average blood glucose over the past 8–12 weeks, has been associated with peripheral nerve dysfunction and inflammatory cytokine activation, both of which are implicated in nociceptive sensitization. In our study, despite the presence of varied glycemic control among participants, a significant reduction in VAS pain scores was observed following a structured isometric exercise protocol. This supports the hypothesis that physiotherapy-based interventions can alleviate diabetic musculoskeletal pain independent of glycemic status. Isometric exercises, which involve static muscle contraction without joint movement, were particularly suitable for this cohort due to their low-impact nature and joint-friendly design. Previous studies by Kalichman et al. (2016) and Colberg et al. (2010) have also confirmed that isometric contraction can enhance blood flow, modulate pain perception, and promote muscular stability in chronic pain conditions. Although the Pearson correlation coefficient ($r = 0.52$) in our study suggests a moderate positive relationship between HbA1c levels and pain scores, it is essential to acknowledge that pain is a multifactorial phenomenon. Factors such as duration of diabetes, physical inactivity, psychological stress, nutritional status, and pre-existing neuropathies can all influence pain experience in diabetic individuals. Hence, while HbA1c may contribute to pain perception, it is unlikely to act in isolation.

Comparing our findings with existing literature:

Paul et al. (2007) emphasized that diabetic patients with poor glycemic control reported significantly more musculoskeletal complaints.

Shultz et al. (2017) noted that physical therapy interventions, particularly when tailored to individual needs, improve functional outcomes in diabetic patients with chronic pain.

These insights suggest a clinical rationale for integrating physiotherapy especially isometric routines—into routine diabetic care. Moreover, the fact that all participants in this study, including those with poor glycemic control, responded positively to the exercise regimen reinforces the broad utility and safety of physiotherapeutic strategies. Nonetheless, the study is not without limitations. The small sample size, absence of a control group, and short duration limit the generalizability of the findings. Furthermore, while a correlation was observed, causality cannot be established. Future research should aim to include inflammatory biomarkers (e.g., CRP, IL-6) and objective measures of neuropathy to better understand the physiological underpinnings of diabetic musculoskeletal pain.

In conclusion, the study provides preliminary evidence of a physiotherapeutic link between HbA1c levels and GBA, and highlights isometric exercise as an effective, accessible intervention to reduce generalized pain in diabetic individuals. These results advocate for the inclusion of physiotherapists in multidisciplinary diabetic care teams, particularly when managing musculoskeletal complaints not addressed by pharmacological glycemic control alone.

4. CONCLUSION:

This study observed a moderate positive correlation between HbA1c levels and generalized body ache in individuals with Type 2 Diabetes Mellitus. Participants with higher HbA1c reported greater pain intensity, suggesting a possible link between poor glycemic control and musculoskeletal discomfort. Additionally, a structured isometric exercise program led to a significant reduction in pain across all participants, highlighting its therapeutic value regardless of glycemic status. These findings support the integration of physiotherapeutic strategies in managing non-traditional complications of diabetes.

5. LIMITATIONS

Small sample size

Short duration of intervention

Lack of control group

No follow-up to assess long-term effects

Pain levels were self-reported

6. RECOMMENDATIONS

Larger-scale studies with extended duration

Inclusion of inflammatory markers

Long-term follow-up studies

Compare with other exercise forms.

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