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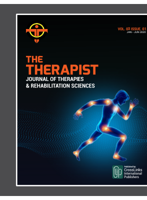

Original Article

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Prevalence of Restless Legs Syndrome in Patients with Type 2 Diabetes and Its Impact on Daytime Sleepiness

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ABSTRACT

The sleep-related sensorimotor disorder is known as restless legs syndrome (RLS) and may impair the continuity of sleep and lead to impairment of daytime functioning. **Objectives:** To measure the prevalence of restless legs syndrome among adult patients with type 2 Diabetes Mellites and to explore the relationship that exists between restless leg syndrome and daytime sleepiness. **Methods:** A non-probability convenience sample was used to recruit 400 adults (40-59 years) with T2DM and HbA1c level exceeding 6.5 percent in both hospitals, which are called the participants of the study (District Headquarter Hospital, Lodhran, and Bahawal Victoria Hospital, Bahawalpur). The RSL-Diagnostic Index (RLS-DI) was used to screen RLS, and the Epworth Sleepiness Scale (ESS) was used to classify daytime sleepiness. The Pearson chi-square test was used to test the association between RLS and daytime sleepiness; Cramer's V was used to summarize the effect size. The presence of excessive daytime sleepiness (ESS > 10) was also estimated by an unadjusted logistic regression (2×2) using exploratory estimation. **Results:** 72 had positive results for RLS, and the prevalence was 18.0 (95% CI 13.323.9). ESS categories were: normal 39.0%, mild sleepiness 25.5%, moderate sleepiness 8.5%, and severe sleepiness 27.0%. Distribution of ESS categories did not differ significantly by RLS status (χ^2=0.976, p=0.807; Cramer's V=0.070). Exploratory analysis dichotomizing ESS suggested no increased odds of excessive daytime sleepiness among participants with RLS. **Conclusions:** Restless leg syndrome was relatively common among adults with type 2 Diabetes Mellitus in this region, but RLS status was not significantly associated with ESS-derived daytime sleepiness.

INTRODUCTION

Restless legs syndrome (RLS), also referred to as Willis-Ekbom disease, is a common sleep-related sensorimotor disorder characterized by an urge to move the legs, typically accompanied by unpleasant sensations, which worsen at rest and in the evening and improve with movement. RLS is clinically important because it may cause sleep-onset and sleep-maintenance problems, fragmented sleep, and reduced health-related quality of life, with downstream impairment in daytime functioning and mood [1, 2]. Treatment guidance emphasizes careful diagnostic confirmation, evaluation for iron deficiency, and evidence-based pharmacologic and non-pharmacologic management, particularly due to concerns such as augmentation with some dopaminergic therapies [3, 4]. In type 2 diabetes mellitus (T2DM), sleep problems are clinically important because sleep disruption is linked to poorer cardiometabolic outcomes and can complicate self-management. Systematic reviews indicate that short sleep, poor sleep quality, and sleep fragmentation may adversely influence glycemic control and metabolic health

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[5, 6]. Observational studies among adults with T2DM also report substantial prevalence of excessive daytime sleepiness (EDS) and daytime fatigue, which may reflect chronic sleep insufficiency, comorbid sleep disorders (e.g., obstructive sleep apnea), depressive symptoms, and diabetes-related symptoms [7, 8]. Because EDS can reduce work productivity, increase accident risk, and impair adherence to lifestyle interventions, its identification in T2DM clinics is clinically relevant [9]. Multiple studies have reported an increased frequency of RLS in individuals with diabetes compared with non-diabetic controls, though estimates vary by case definition, population, and clinical setting. For example, clinical studies in T2DM samples have reported RLS prevalence in the range of ~10–30%, and RLS has been associated with sleep quality, depressive symptoms, and quality-of-life measures in some cohorts [10, 11]. In Pakistan, a recent multi-center report has highlighted the burden of RLS among people living with T2DM and suggested that demographic and clinical characteristics may influence risk [12]. More broadly, pooled evidence indicates that RLS prevalence is elevated in diabetes relative to general populations, but heterogeneity remains substantial [13]. Mechanistically, several pathways could connect T2DM with RLS and daytime impairment. It has been suggested that diabetes-related microvascular disease, low-grade inflammation, and disturbed iron homeostasis are the factors contributing to RLS pathophysiology, whereas diabetes complications (and especially neuropathic pain and nephropathy) could worsen sleep disruption and subjective sleepiness [1, 7]. Besides, RLS has been associated with cardiovascular risk and cardiometabolic comorbidity, especially in T2DM populations [14]. Even though iron therapy is a proven modality of RLS treatment in iron-deficient RLS and has the potential to decrease the severity of symptoms, diagnostic workup and guideline-concordant care may be out of reach in routine outpatient practice [15, 16]. Although the possibility of the role of RLS in fragmented sleep and daytime dysfunction is plausible, relationships between RLS and daytime sleepiness are not consistent across studies, and could vary depending on the severity of symptoms, comorbid sleep disorders, and contextual variables (age and complications of diabetes). Hence, the local estimates of prevalence and simple association analyses can be very important in informing the screening strategies and in coming up with hypothetical conclusions to be used in more detailed studies.

This study aims to approximate the rates of RLS among adult patients with T2DM who visit tertiary institutions in South Punjab and to test whether the state of RLS was linked to the categories of daytime sleepiness derived through the ESS.

METHODS

This cross-sectional study was conducted at a hospital to approximate the prevalence of restless legs syndrome in adults with type 2 diabetes mellitus and to determine its relationship with sleepiness in the daytime. This research was carried out at District Headquarter Hospital Lodhran and Bahawal Victoria Hospital (BVH) at Bahawalpur, Pakistan, and was done from January 2025 to June 2025. The participants were recruited using a non-probability convenience sampling technique. The target population of 400 adults with T2DM was intended. The sample size was estimated to determine the prevalence of restless legs syndrome with sufficient precision. Based on the assumed prevalence of 20, a confidence level of 95, and absolute precision of 4, the minimum sample size according to the single-proportion formula was 384 participants. The final sample size was enlarged to 400 participants in order to compensate for the potential non-response and missing data. The inclusion criteria included age (40-59 years), T2DM, willingness to participate, and HbA1c greater than 6.5%. Type 1 diabetes, nephropathy, known heart disease, history of trauma, or musculoskeletal (MSK) conditions that may confound leg discomfort, and diabetic neuropathy were the exclusion criteria. The Restless Legs Syndrome Diagnostic Index (RLS-DI) was used to screen RLS, which is a structured diagnostic algorithm to operationalize diagnostic characteristics of RLS and assist with consistent identification of cases [17]. The Epworth Sleepiness Scale (ESS) was used to measure daytime sleepiness, and it is an eight-item self-report scale that measures the tendency to experience dozing during common daytime events [18]. In the current research, the ESS total scores were divided into four clinical bands commonly used, namely normal, mild sleepiness, moderate sleepiness, and severe sleepiness; another exploratory analysis dichotomized EDS into ESS > 10. SPSS (version 23) was used to analyze the data. Sample size and categories were summarized using descriptive statistics. The Pearson chi-square test was used to test association between categorical RLS status (RLS vs no RLS) and ESS categories (four levels); the effect size was summarized by Cramer V. The sensitivity test was used to ensure that the chi-square assumptions were reasonable (a larger proportion of the expected counts is not below 20 percent and the expected count is at least 1). An exploratory unadjusted odds ratio (OR) with 95% confidence interval (CI) was calculated to obtain a measure of association that is interpretable, that is, ESS will be dichotomized as ESS > 10. The research study was carried out under the ethical principles provided in the Declaration of Helsinki. Data collection was only carried out under informed consent written by all the participants, with confidentiality guaranteed by data anonymization.

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Appropriate guidance on exercise was also given to same-gender employees to participants where necessary, based on local cultural factors.

RESULTS

A total of 400 adults with T2DM were included in the analysis. Using the RLS-DI screening algorithm, 72 participants met criteria for RLS, corresponding to a prevalence of 18.0%. The 95% confidence interval for this proportion using Wilson's method was 13.3% to 23.9%, indicating that RLS represented a non-trivial clinical burden in this outpatient hospital sample. Bar chart showing the prevalence of RLS in the study sample (Figure 1).

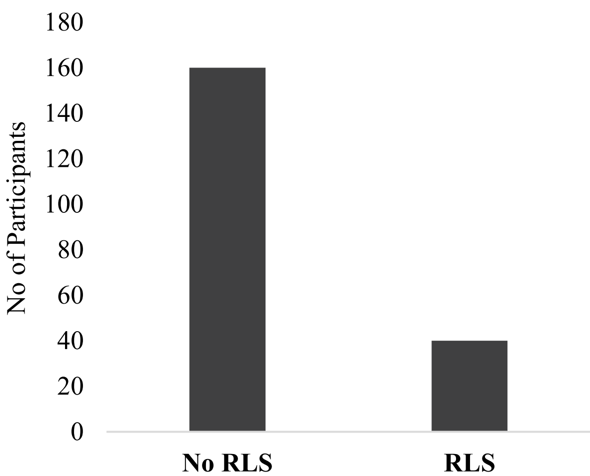

Figure 1: Prevalence of RLS in the Study Sample

With respect to daytime sleepiness, ESS category frequencies in the overall sample were: normal 156 (39.0%), mild sleepiness 102 (25.5%), moderate sleepiness 34 (8.5%), and severe sleepiness 108 (27.0%). Thus, nearly two-thirds of participants (61.0%) fell into one of the sleepiness categories above "normal," highlighting a high burden of daytime impairment symptoms in this clinical cohort. When ESS categories were stratified by RLS status, the pattern of sleepiness categories was broadly similar. Among participants without RLS (n=328), 124 were classified as normal, 86 as mild, 30 as moderate, and 88 as severe sleepiness. Among those with RLS (n=72), 20 were classified as normal, 15 as mild, 21 as moderate, and 16 as severe sleepiness (Table 1).

Table 1: Association between RLS Status and ESS Categories

RLS status	Normal, n (%)	Mild, n (%)	Moderate, n (%)	Severe, n (%)	Total
No RLS	124 (37.8%)	86 (26.2%)	30 (9.1%)	88 (26.8%)	328
RLS	20 (27.77%)	15 (20.83%)	17 (23.61%)	20 (27.8%)	72
Total	144	101	47	108	400

The association between RLS status and ESS categories was not statistically significant (Pearson's χ^2=0.976, p=0.807). The corresponding effect size was small (Cramer's V=0.070), indicating minimal deviation from independence across the 2×4 contingency table. The linear-by-linear association test was also non-significant (p=0.712), consistent with the absence of a monotonic trend across ordered sleepiness categories. In an exploratory dichotomized analysis defining excessive daytime sleepiness as ESS > 10 (mild/moderate/severe vs normal), the odds of EDS were not increased among participants with RLS compared with those without RLS (OR=0.76, 95% CI 0.37–1.58). Given the relatively small number of RLS-positive participants, the confidence interval was wide and is compatible with both a modest reduction and a moderate increase in EDS odds (Table 2).

Table 2: Inferential Statistics for the Association between RLS Status and ESS Categories

Test/Metric	Value	p-value
Pearson Chi-Square	0.976	0.807
Cramer's V	0.070	–
Exploratory OR (ESS>10 vs ≤10)	0.76 (95% CI 0.37–1.58)	–

Note: OR computed from a dichotomized 2×2 table; interpretation is exploratory.

DISCUSSION

This study estimated the prevalence of RLS and evaluated its relationship with daytime sleepiness in adults with T2DM attending tertiary hospitals in South Punjab. The observed RLS prevalence (18%) is within the range reported in several clinical T2DM cohorts and is broadly consistent with pooled estimates suggesting a higher burden of RLS in diabetes compared with general populations, albeit with substantial heterogeneity across settings and diagnostic methods [10, 11]. Pakistani data are limited, but recent evidence from Pakistan has similarly indicated that RLS is present in a meaningful proportion of adults with T2DM, supporting the clinical relevance of screening in this context [12, 19]. A key finding was the high frequency of ESS-defined sleepiness categories above normal in the overall sample. This aligns with broader evidence that sleep disturbance and subjective daytime sleepiness are common in T2DM and may be related to glycemic control, comorbid sleep disorders, and diabetes complications [8, 9]. While RLS can plausibly contribute to sleep fragmentation, the present analysis did not demonstrate a statistically significant association between RLS status and categorical ESS outcomes. The effect size was small, and the exploratory OR for EDS was close to null, with wide confidence intervals. Differences between studies in the RLS–sleepiness relationship may reflect variation in RLS symptom severity, duration, comorbid insomnia or obstructive sleep apnea, and exclusion criteria. For instance, studies that include patients with diabetic neuropathy or nephropathy may observe stronger

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associations with sleep impairment because these complications independently worsen sleep and can overlap symptomatically with RLS [7]. In the current study, exclusion of diabetic neuropathy was intended to reduce misclassification and confounding, but it may also have limited the range of sleep impairment attributable to RLS-related discomfort. Additionally, the ESS captures a general tendency to doze rather than sleep quality per se; RLS may primarily affect sleep continuity and quality of life, which can be better captured by instruments such as PSQI or disease-specific quality-of-life measures [20, 21]. From a clinical perspective, the observed prevalence supports incorporating a brief RLS screen into routine diabetes care, particularly because evidence-based treatments exist. Guidelines recommend evaluation of iron status and consideration of iron supplementation where appropriate; pharmacologic therapy can be individualized with attention to adverse effects and augmentation risk [3]. Iron therapy has been identified to be effective in RLS treatment in the selected patients based on meta-analytic evidence, whereas randomized trials have shown that iron formulations such as ferric carboxymaltose improve the symptoms [15, 16]. Moreover, RLS has been associated with cardiovascular risk and comorbidity, and it is essential to note the need to assess all at-risk populations, including T2DM, thoroughly [14]. Covariate-adjusted regression models that explain age, sex, diabetes duration, HbA1c, BMI, depressive symptoms, and comorbid sleep disorders should be included in future studies in Pakistan and other similar settings. The objective measures of sleep (actigraphy, polysomnography) and the standardized scales of RLS severity might help to understand whether these measures of RLS severity and periodic limb movements are converted into clinically significant daytime impairment, in addition to what is estimated by ESS itself. Longitudinal design would also assist in the identification of the temporal aspect and the effectiveness of the targeted RLS treatment in enhancing sleep quality, daytime functioning, and possibly the self-management of diabetes.

CONCLUSIONS

The RLS prevalence in this hospital-based sample of South Punjab-based adults with T2DM was 18%, with subjective daytime sleepiness being commonly observed. Nonetheless, there was no significant association between RLS status and the distribution of categories of the ESS.

Authors Contribution

Conceptualization: MI
Methodology: MI
Formal analysis: NM, RR
Writing and Drafting: NM, MI, SPC, WA
Review and Editing: NM, MI, SPC, WA, RR

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

All the authors declare no conflict of interest.

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REFERENCES

[1] Gossard TR, Trotti LM, Videnovic A, St Louis EK. Restless Legs Syndrome: Contemporary Diagnosis and Treatment. Neurotherapeutics. 2021 Jan; 18(1): 140-55. doi: 10.1007/s13311-021-01019-4.

[2] Manconi M, García-Borreguero D, Schormair B, Videnovic A, Berger K, Ferri R *et al.* Restless Legs Syndrome. Nature reviews Disease primers. 2021 Nov; 7(1): 80. doi: 10.1038/s41572-021-00311-z.

[3] Winkelman JW, Berkowski JA, DelRosso LM, Koo BB, Scharf MT, Sharon D *et al.* Treatment of Restless Legs Syndrome and Periodic Limb Movement Disorder: An American Academy of Sleep Medicine Clinical Practice Guideline. Journal of Clinical Sleep Medicine. 2025 Jan; 21(1): 137-52. doi: 10.5664/jcsm.11390.

[4] Winkelman JW, Armstrong MJ, Allen RP, Chaudhuri KR, Ondo W, Trenkwalder C *et al.* Practice Guideline Summary: Treatment of Restless Legs Syndrome in Adults: Report of the Guideline Development, Dissemination, and Implementation Subcommittee of the American Academy of Neurology. Neurology. 2016 Dec; 87(24): 2585-93. doi: 10.1212/WNL.0000000000003388.

[5] Lee SW, Ng KY, Chin WK. The Impact of Sleep Amount and Sleep Quality on Glycemic Control in Type 2 Diabetes: A Systematic Review and Meta-Analysis. Sleep Medicine Reviews. 2017 Feb; 31: 91-101. doi: 10.1016/j.smrv.2016.02.001.

[6] Koopman AD, Beulens JW, Dijkstra T, Pouwer F, Bremmer MA, Van Straten A *et al.* Prevalence of Insomnia (Symptoms) in T2D and Association with Metabolic Parameters and Glycemic Control: Meta-Analysis. The Journal of Clinical Endocrinology and Metabolism. 2020 Mar; 105(3): 614-43. doi: 10.1210/clinem/dgz065.

DOI: https://doi.org/10.54393/tt.v6i4.290

[7] Raj JP, Hansdak SG, Naik D, Mahendri NV, Thomas N. Sleep among Diabetic Patients and Their Glycaemic Control (SLEDGE): A Pilot Observational Study. Journal of Diabetes. 2019 Feb; 11(2): 122-8. doi: 10.1111/1753-0407.12825.

[8] Kuo CP, Lu SH, Huang CN, Liao WC, Lee MC. Sleep Quality and Associated Factors in Adults with Type 2 Diabetes: A Retrospective Cohort Study. International Journal of Environmental Research and Public Health. 2021 Mar; 18(6): 3025. doi: 10.3390/ijerph18063025.

[9] LeBlanc ES, Smith NX, Nichols GA, Allison MJ, Clarke GN. Insomnia is Associated with an Increased Risk of Type 2 Diabetes in the Clinical Setting. BMJ Open Diabetes Research and Care. 2018 Dec; 6(1): e000604. doi: 10.1136/bmjdrc-2018-000604.

[10] Akın S, Bölük C, Börü ÜT, Taşdemir M, Gezer T, Şahbaz FG *et al.* Restless Legs Syndrome in Type 2 Diabetes Mellitus. Primary Care Diabetes. 2019 Feb; 13(1): 87-91. doi: 10.1016/j.pcd.2018.08.006.

[11] Bener A, Al-Hamaq AO, Ağan AF, Öztürk M, Ömer A. The Prevalence of Restless Legs Syndrome and Comorbid Condition among Patient with Type 2 Diabetic Mellitus Visiting Primary Healthcare. Journal of Family Medicine and Primary Care. 2019 Dec; 8(12): 3814-20. doi: 10.4103/jfmpc.jfmpc_463_19.

[12] Nawaz MS, Nawaz MS, Shah KU, Ul Mustafa Z, Ahmed A, Ahmed HS *et al.* Prevalence and Determinants of Restless Leg Syndrome in Type 2 Diabetes Mellitus (T2DM) in Pakistan. Diabetes and Metabolic Syndrome: Clinical Research and Reviews. 2021 Mar; 15(2): 525-8. doi: 10.1016/j.dsx.2021.02.013.

[13] Ning P, Mu X, Yang X, Li T, Xu Y. Prevalence of Restless Legs Syndrome in People with Diabetes Mellitus: A Pooling Analysis of Observational Studies. E-Clinical Medicine. 2022 Apr; 46. doi: 10.1016/j.eclinm.2022.101357.

[14] Dauvilliers Y, Chenini S, Barateau L, Somers VK. Restless Legs Syndrome, Periodic Leg Movements, Hypertension and Cardiovascular Diseases. Circulation Research. 2025 Aug; 137(5): 746-63. doi: 10.1161/CIRCRESAHA.125.325677.

[15] Trotti LM and Becker LA. Iron for the Treatment of Restless Legs Syndrome. Cochrane Database of Systematic Reviews. 2019. doi: 10.1002/14651858.CD007834.pub3.

[16] Bae H, Cho YW, Kim KT, Allen RP, Earley CJ. Randomized, Placebo-Controlled Trial of Ferric Carboxymaltose in Restless Legs Syndrome Patients with Iron Deficiency Anemia. Sleep Medicine. 2021 Aug; 84: 179-86. doi: 10.1016/j.sleep.2021.05.036.

[17] Beneš H and Kohnen R. Validation of an Algorithm for the Diagnosis of Restless Legs Syndrome: The Restless Legs Syndrome-Diagnostic Index (RLS-DI). Sleep Medicine. 2009 May; 10(5): 515-23. doi: 0.1016/j.sleep.2008.06.006.

[18] Johns MW. A New Method for Measuring Daytime Sleepiness: The Epworth Sleepiness Scale. sleep. 1991 Nov; 14(6): 540-5. doi: 10.1093/sleep/14.6.540.

[19] Borzouei S, Ahmadi A, Pirdehghan A. Sleep Quality and Glycemic Control in Adults with Type 2 Diabetes Mellitus. Journal of Family Medicine and Primary Care. 2024 Aug; 13(8): 3398-402. doi: 10.4103/jfmpc.jfmpc_118_24.

[20] Broström A, Alimoradi Z, Odzakovic E, Kaldo V, Jernelöv S, Lind J *et al.* Quality of Life among Patients with Restless Legs Syndrome: A Systematic Review and Meta-Analysis. Journal of Clinical Neuroscience. 2024 Apr; 122: 80-91. doi: 10.1016/j.jocn.2024.02.027.

[21] Wondie A, Taderegew MM, Girma B, Getawey A, Tessema Z, Emrie AA *et al*. Excessive Daytime Sleepiness and Its Predictors among Type 2 Diabetes Mellitus Patients at Central Ethiopia. Scientific Reports. 2024 Dec; 14(1): 31693. doi: 10.1038/s41598-024-81073-y.