

Assessment of Sleeping Patterns of Saudis with Type 2 Diabetes Mellitus in Ramadan and Non-Ramadan Periods Using a Wearable Device and a Questionnaire

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Abstract : Background: Quantity and quality of sleep have been reported to be significant risk factors for obesity and development of metabolic disorders such as type 2 diabetes mellitus (T2DM). The relationship between diabetes and sleep quantity was reported to be U-shaped, which means increased or decreased sleeping hours can increase the risk of diabetes. The plasma glucagon levels were found to continuously decrease during night-time sleep in healthy individuals, independently of blood glucose and insulin levels. The disturbance of the circadian rhythm is also important and has been linked with an increased chance of diabetes incidence. There is a lack of research on sleep patterns on Saudis with T2DM and how this is affected by Ramadan fasting. Aim: To assess the sleeping patterns of Saudis with T2DM (before, during, and after Ramadan), using two different techniques and relate this to their HbA1c levels. Method: This study recruited 82 Saudi with T2DM, who chose to fast during Ramadan, from the Endocrine and Diabetic Centre of Al Iman General Hospital, Riyadh, Saudi Arabia. Ethical approvals for the study were obtained from De Montfort University and Saudi Ministry of Health. Their sleeping patterns were assessed by a self-administered questionnaire (before, during, and after Ramadan). The assessment included the daily total sleeping hours (DTSH), and total night-time sleeping hours (TNTSH) of the participants. In addition, sleeping patterns of 36 patients, randomly selected from the 82 participants, were further tracked during and after Ramadan by using Fitbit Flex 2™ accelerometer. Blood samples were collected in each period for measuring HbA1c. Results: Questionnaire analysis revealed that the sleeping patterns significantly changed between the periods, with shorter hours during Ramadan ($P < 0.001$ for DTSH, and $P < 0.001$ for TNTSH). These findings were confirmed by the Fitbit data, which also indicated significant shorter sleeping hours for the DTSH, and the TNTSH during Ramadan ($P < 0.001$ and $P < 0.001$, respectively). Although there were no significant correlations between the questionnaire and Fitbit data, the TNTSH were shorter among the participants in all periods by both techniques. The mean HbA1c significantly varied between periods, with lowest level during Ramadan. Although the statistical tests did not show significant variances in the mean HbA1c between the groups of participants regarding their hours of sleeping, the lowest mean HbA1c was observed in the group of participants who slept for 6-8 hours and had longer night-time sleeping hours. Conclusion: A short sleep duration, and absence of night-time sleep were significantly observed among the majority of the study population during Ramadan, which could suppress the full benefits of Ramadan fasting for diabetic patients. This study showed that there is a good agreement between the findings of the questionnaire and the Fitbit device for evaluating sleeping patterns in a Saudi population. A larger study is needed in the future to investigate the impact of Ramadan fasting on sleep quality and quantity and its relationship with health and disease.

Keywords : Diabetes, Fasting, Fitbit, HbA1c, IPAQ, Ramadan, Sleep

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