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Original research

The relationship between self-reported nocturnal sleep duration, daytime sleepiness and 24-h urinary albumin and protein excretion in patients with newly diagnosed type 2 diabetes

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ABSTRACT

Aim: In the current study the relationship between self-reported nocturnal sleep duration (NSD) and daytime sleepiness with 24-h urinary protein excretion (UPE) and 24-h urinary albumin excretion (UAE) were investigated in patients with newly diagnosed type 2 diabetes mellitus.

Methods: All patients underwent history taking, physical examination, blood pressure (BP) measurement, 12 lead electrocardiographic evaluation, routine urine analysis, biochemical analysis, 24-h urine collection to measure UAE, UPE and creatinine clearance. Self reported NSD and daytime sleepiness (using Epworth Sleepiness Scale (ESS)) were recorded for all patients.

Results: In total 110 patients (56 male and 54 female) were included. Self reported NSD was 7.17 ± 1.07 h. Mean ESS score was 5.59 ± 2.48. Stepwise linear regression of independent factors revealed that logarithmically converted 24-h UAE (as a dependent parameter) was related with clinical systolic BP (b: 0.01, p: 0.003), HbA1c (b: 0.082, p: 0.033), self reported NSD (b: −0.152, p: 0.004) and ESS score (b: 0.044, p: 0.043). Additionally, on the other hand, 24-h UPE was related with clinical systolic BP (b: 0.011, p: 0.001) and self reported NSD (b: −0.179, $p < 0.0001$) in regression analysis.

Conclusion: In conclusion, 24-h UAE were independently related with self reported NSD and daytime sleepiness where as 24-h UPE was related with only NSD in patients with newly diagnosed type 2 diabetic patients.

1. Introduction

Although sleep is one of the vital factors contributing to health, sleep duration has become shorter in modern societies. It was also noted that in recent decades and the prevalence of sleep deprivation has increased irrespective of socioeconomic status [1]. This trend is very important since multiple studies have shown that shorter sleep duration is associated with obesity [2–4], hypertension [5], cardiovascular

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diseases [6–8] and even death [7,9]. Apart from these major health issues, various studies have shown that poor sleep duration/quality has been associated with development of new diabetes [10–14]. It was also speculated that shorter sleep duration, especially 5 or fewer hours, was associated with the development of proteinuria in a stepwise fashion [15].

It is well known that increased urinary albumin and protein excretion were closely related with progression of diabetic nephropathy. It has also been demonstrated that and sleep duration was closely related both with proteinuria [15] and development of type 2 diabetes. Although all these data are known, surprisingly however; no previous study has specifically analyzed the relationship between 24-h urinary albumin excretion (UAE) and 24-h urinary protein excretion (UPE) with self reported nocturnal sleep duration (NSD) in patients with type 2 diabetes. Besides, no previous study has examined the specific relationship between daytime sleepiness with 24 h UAE and UPE in these patients. Thus the current study aimed to investigate the in the current study, the independent relationships between 24-h urinary albumin excretion UAE and 24-UPE with self reported nocturnal NSD and daytime sleepiness were evaluated in patients with newly diagnosed type 2 diabetes.

2. Methods

Study population of the current study was consisted of patients with newly diagnosed type 2 diabetes who were hitherto treated. The study was in accordance with the declaration of Helsinki and local ethical approval and informed consent was obtained before enrolment According to the American Diabetes Association criteria Diagnosis of type 2 diabetes mellitus was based on 2 fasting plasma glucose levels (after at least 8 h of fasting) using a cutoff point of 7.0 mmol/L, regardless of post-load plasma glucose concentrations [16]. All patients underwent following procedures: history taking, physical examination, blood pressure (BP) measurement, electrocardiographic evaluation, biochemical analysis, spot urine analysis, 24-h urine collection to measure 24-h UPE and UAE and creatinine clearance. During history taking sociodemographic variables (age, sex, personality traits smoking, alcohol intake, marital status, education level, and depressive behavior) and clinical and laboratory parameters were recorded. Levels of averaged fasting blood glucose, glycosylated hemoglobin (HbA1c), blood urea nitrogen (BUN), creatinine, sodium, potassium, calcium, phosphorus, albumin, total cholesterol, high density lipoprotein cholesterol (HDL-cholesterol), low density lipoprotein cholesterol (LDL-cholesterol), and hemoglobin were measured. Sleep-disturbing factors (sensations of leg "creeping" and pruritus before falling asleep, difficulty finding a comfortable sleep position and emesis) were interrogated, and patients with a moderate or severe degree of those symptoms were excluded from the study, as were those with obstructive sleep apnea syndrome (OSAS). Also, subjects routinely taking medications known to modulate central nervous system state, such as β-blockers, clonidine, methyldopa; antidepressants, sedatives, activating agents, or pain medications were not included. Patients with coronary artery disease, heart failure, cerebro vascular disease, essential hypertension, renal artery stenosis, rhythm problems, hypo or hyperhyroidism, nephrotic syndrome, urinary tract infection, urolithiasis, active infection and who did not want to participate were excluded. None of the patients reported any alcohol intake. An information leaflet along with a urine container was given to all subjects and they also received a verbal explanation about how to collect a proper 24-h urine sample. After excluding the first morning urine sample of the collection day, urine was collected over 24 h, which included the first urine sample of the next morning. During the sampling period, subjects were instructed to keep urine samples in a dark and cool place. At the end of the collection period, the urine containers were taken to the laboratory within 2–4 h. Since erroneous estimations of salt intake may occur according to problems in collecting 24-h urine samples participants with urinary creatinine out of reference levels (reference intervals for 24-h urinary creatinine were accepted as 10.7–26.0 g/kg for women and 12.1–28.9 g/kg for men) were excluded [17].

Lastly, the level of daytime sleepiness was evaluated with the Epworth Sleepiness Scale (ESS). Depressive behavior was assessed by using Beck depression Inventory (BDI). Assistance was available for patients who were illiterate. Self reported nocturnal sleep duration was assessed by self interview. Patients were divided into 5 groups according to self-reported nocturnal sleep duration.

Group I (*N*: 8 patients): patients self reported NSD approximately 5 h or fever.
Group II (*N*: 20 patients): patients self reported NSD approximately 6 h.
Group III (*N*: 35 patients): patients self reported NSD approximately 7 h.
Group IV (*N*: 38 patients): patients self reported NSD approximately 8 h.
Group V (*N*: 9 patients): patients self reported NSD approximately 9 h or higher.

2.1. *Evaluation of daytime sleepiness*

The level of daytime sleepiness was evaluated with the Epworth Sleepiness Scale (ESS), which is an 8-item questionnaire. ESS scores range from zero to 24, and a higher score indicates a greater level of subjective daytime sleepiness. Acceptable validity and test–retest reliability of the ESS have been reported [18].

2.2. *Measurement of depressive symptoms*

The Beck Depression Inventory (BDI), which was originally introduced by Beck et al., is a 21-item self-reported inventory that measures characteristic attitudes and symptoms of depression [19]. The 21 items are answered on a 4-point Likert scale, in which 0 represents the absence of a problem and 3 represents the extreme severity of a problem. The total score ranges 0–63. The BDI is documented as a valid index of depression and BDI scores correlate well with the diagnostic criteria for depression.