SHORT COMMUNICATION

Effect of night shift work on risk of diabetes in healthy nurses in Albania

Erinda Zoto[1] · Fabian Cenko[1] · Pranvera Doci[2] · Stefano Rizza[1,3]

Introduction

Incorrect lifestyle behaviours such as poor nutrition quality and increased sedentary are the key determinants in the burden of non-communicable diseases such as type 2 diabetes (T2D). This real epidemic affects both industrialized countries and, alarmingly, developing continents such as Africa and Asia. Even in the European context and especially in countries rapidly transitated from a totalitarian regime to a free, marked-oriented economy, and in part hit by the economic crisis, such as Albania, the prevalence of diabetes has increased rapidly [1]. Beyond classic risk factors, shift work, largely progressed in response to changes in economic pressure and consumer demand, has been associated with a higher risk of several chronic diseases, such as T2D and cardiovascular disease [2].

In this report, we explored the hypothesis that night shift work and poor quality of sleep were jointly associated with risk of T2D in a sample of night shift nurses employed in two Albanian hospitals. To the best of our knowledge, this is the first study observing this relationship among Albanian individuals.

Managed by Massimo Federici.

✉ Stefano Rizza
stefano.rizza@uniroma2.it

1 Department of Medical Science, Catholic University of Tirana "Zoja e Këshillit të Mirë", Tirana, Albania

2 Department of BioMedical Science, Catholic University of Tirana "Zoja e Këshillit të Mirë", Tirana, Albania

3 Department of Systems Medicine, University of Rome Tor Vergata, Rome, Italy

Methods

Subjects' characteristics

The study was performed in two different hospitals, the Universital hospital "Shefqet Ndroqi" in Tirana and Regional Hospital of Durres (Spitali Rajonal Durrës), Albania. Hospital workers were eligible if they had been working for a minimum of 2 years. Participants from both the hospitals communities responded to advertisements inviting healthy employers to participate in a research study.

Between March 2017 and August 2018, we enrolled 137 night shift workers (NSW), carrying out a shift schedule of seven up to ten 12 h nights per month, as cases and 49 hospital day workers as controls (C). After provided written consent, they underwent clinical examination and a standardized interview. Inclusion of volunteers was performed according to the principles expressed in the Declaration of Helsinki. This work was approved from local Ethical Commitees.

Exclusion criteria included diagnosis of diabetes, liver disease, renal insufficiency, heart failure, coagulopathy or any other severe systemic disease. We also excluded subjects with a history of any form of cancer or if they had positive blood tests for HIV, hepatitis B, or hepatitis C.

Waist, hip circumferences, blood pressure measurement and blood samples were obtained between 8:00 and 9:00 AM in fasting condition.

Each participant provided detailed information about their sleep quality completing the Pittsburgh Sleep Quality Index (PSQI), a validated and widely used scale to identify elements of sleep over the past 30 days reflecting the individual's perception of sleep [3], and underwent Findrisc questionnaire, the most valid and inexpensive tool preferred for diabetes risk calculation [4].

Statistical analysis

Quantitative variables were expressed as means ± standard deviations. Categorical variables were presented as percentages. All continuous variables reached the normal distribution and therefore are presented as natural variables. We used the unpaired *t* test for comparisons of NSW and controls, and multivariate logistic regression for analysing the association between the risk of diabetes and study covariates.

A *p* < 0.05 was considered significant. We performed statistical analysis using SPSS for Windows, version 23.0 (SPSS, Inc., Chicago, IL).

Results

Table 1 shows anthropometric and clinical characteristics of study participants according to working status (NSW vs controls). The two Albanian cohorts had a similar number of participants (no. 98 for the Universital hospital "Shefqet Ndroqi" vs no. 95 for the Regional Hospital of Durres); therefore, we grouped them together. No appreciable differences in age, sex, smoking habits, lipids and blood pressure levels were apparent across night workers and controls. Compared with controls, night shift workers tended to have a higher waist circumference and to be more frequently females, although the differences did not reach statistical significance. As expected, NSW exhibited a worse quality of sleep than day workers. Interestingly, while fasting glucose levels were similar regardless of working status, Findrisc questionnaire ascribed a significant higher risk of diabetes development to night workers. Dividing the study population upon Findrisc, we found that subjects with high risk for diabetes (Findrisc > 11, no. 53), as expected, showed strong differences in clinical and biochemical characteristics than others (Findrisc < 12, no. 140) (Supplementary Table 1). With respect to subjects with low risk of diabetes, they were older (37.0 ± 9.0 vs 48.8 ± 8.9, *p* < 0.001) with higher levels of fasting glucose (88.5 ± 9.6 vs 92.5 ± 12.7 mg/dl, *p*: 0.020), higher values of systolic and diastolic blood pressure (108.9 ± 14.9 vs 117.9 ± 14.9, *p* < 0.001 and 72.8 ± 9.6 vs 78.9 ± 11.0, *p* < 0.001), higher cholesterol (199.1 ± 36.2 vs 214.3 ± 34.6, *p*: 0.018) and triglycerides (149.2 ± 77.8 vs 215.4 ± 84.6, *p* < 0.001). By contrast, we did not observe any difference in terms of sex and smoking habits distribution between groups (*p* > 0.05 for both).

In Table 2, a multivariate logistic regression analysis showed that night shift work was an independent determinant of higher risk of diabetes development, after controlling for age, sex, waist and the quality of sleep.

Discussion

Shift work has many economic advantages, including increased services to customers and improved trade opportunities. Health workers make up one-third of shift workers, and nurses are the largest group. However, shift workers' behavioural and environmental cycles are typically

Table 2 Logistic regression with Findrisc > 11 (high risk for diabetes) as dependent variable

Albanian survey			
Variable	Odd ratio	CI for OR (95%)	*p*
Age (years)	1.087	1.037–1.140	< 0.001
Sex (m)	0.192	0.018–2.023	0.170
Waist (cm)	1.076	1.035–1.118	< 0.001
PSQI (bad sleepers)	1.299	0.542–3.112	0.557
Working status (NSW)	2.602	1.011–5.021	0.029

Table 1 Clinical and laboratory characteristics of patients divided upon working status

Variables	NSW (no. 137)	Controls (no. 56)	*p*
Age (years)	40.2 ± 11.1	40.4 ± 6.1	0.886
Female gender (*n*, %)	127, 93	48, 86	0.098
Current smokers (*n*, %)	20, 15	9, 16	0.527
Waist (cm)	87.5 ± 12.6	87.7 ± 13.0	0.933
Waist/hip	0.83 ± 0.07	0.86 ± 0.13	0.087
Fasting glucose (mg/dl)	89.7 ± 11.1	89.4 ± 9.8	0.866
Systolic blood pressure (mmHg)	111.6 ± 16.4	110.9 ± 12.7	0.758
Diastolic blood pressure (mmHg)	75.0 ± 10.3	73.4 ± 10.5	0.329
Triglycerides (mg/dl)	170.8 ± 80.7	152.7 ± 92.7	0.203
Total cholesterol (mg/dl)	203.5 ± 37.1	202.2 ± 34.6	0.706
PSQI (bad sleepers, *n*, %)	64, 47	16, 28	0.011
Findrisc > 11 (diabetes high risk, *n*, %)	44, 32	9, 16	0.016

Data are displayed as *n* (%) or mean (± SD)

misaligned relative to their endogenous circadian system, predisposing an individual for poor metabolic health. Our main findings confirm that the increased risk of diabetes is independently associated with night shift work. Interestingly, we also highlight that even Albanian night shift workers show a poor sleep quality as described in other populations. Albania has a long and complex history that makes it substantially different from other European ethnic groups. The genetic and isonymic structure of Albanian population seems to be mainly due to ancient migration from the East (Indo-Europeans origin) toward the coast, with radiation toward the North and South, with subsequent isolation and drift [5]. Of note, despite ethnic group differences, the risk of diabetes is increased among Albanian night shift workers. However, our data showed that increased risk of diabetes is in part explained by the night shift behaviour but not by the quality of sleep suggesting that the impact of circadian misalignment induced by rotating shift is not necessarily mirrored by sleep quality in our cohort. We might speculate that other factors, including "Western" diet which consists of processed foods enriched in sugar, salt, and saturated fats may play a role. This effect is in part suggested by the small but significant effect of waist. Furthermore, we cannot exclude that senescence may play a central role.

The leading weak point of this work is that it is mainly gathered by self-reported information obtained by the compilation of questionnaires. However, this is a pilot study with a rather small number of participants; therefore, our main finding deserves replication in larger cohorts and different ethnicities.

Compliance with ethical standards

References

1. Shapo L, McKee M, Coker R, Ylli A (2004) Type 2 diabetes in Tirana City, Albania: a rapid increase in a country in transition. Diabet Med 21(1):77–83
2. Vetter C, Dashti HS, Lane JM, Anderson SG et al (2018) Night shift work, genetic risk, and type 2 diabetes in the UK Biobank. Diabetes Care 41(4):762–769. https://doi.org/10.2337/dc17-1933. **(Epub 2018 Feb 12)**
3. Buysse DJ, Reynolds CF, Monk TH et al (1989) The Pittsburgh sleep quality index: a new instrument for psychiatric practice and research. Psychiatry Res 28:193–213
4. Saaristo T, Peltonen M, Lindström J et al (2005) Cross-sectional evaluation of the finnish diabetes risk score: a tool to identify undetected type 2 diabetes, abnormal glucose tolerance and metabolic syndrome. Diabetes Vasc Dis Res vol 2(2):67–72
5. Mikerezi I, Xhina E, Scapoli C et al (2013) Surnames in Albania: a study of the population of Albania through isonymy. Ann Hum Genet 77(3):232–243

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.