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Original article

ASSESSING SALIVARY CORTISOL IN RESEARCH OF SHIFT WORK RISKS AMONG CASINO EMPLOYEES IN BULGARIA

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ABSTRACT

Although the effects of shift work on casino employees have been documented, no data exists describing the effect of stress on the hormone secretion. The present quantitative study evaluates the use of salivary cortisol concentration as a biomarker of the stress level among casino employees in Bulgaria. This new data emphasize the need to examine the circadian rhythm of cortisol in a casino environment.

Keywords: salivary cortisol, casino employees, shift work

INTRODUCTION

Shift work is an inseparable part of nowadays life. The constant need for different services requires day and night labour. More than 20% of the working population in developed countries is involved in shift work [1]. People have to work at night and sleep during the day when their biological clock is set for the awakening phase [1, 2]. Rotating day and night shifts are prerequisites for disruptions in the circadian rhythm of the organism [2]. This is a 24 hour daily cycle of physiological changes in the body. Its regulatory centre is located in the suprachiasmatic nuclei of the hypothalamus. Light and dark cycles play a major role in the synchronization of the cycle. Circadian disorders are associated with psychological stress, sleep problems, fatigue and cardiovascular diseases [1].

Cortisol is a steroid hormone produced by the adrenal glands. It has a circadian rhythm with highest levels in the morning that decline throughout the day and reach the lowest point at night [3, 4, 5]. It is widely used in medical studies as an indicator for the stress response of the organism. The human body reacts to stressful situations with an increase in cortisol secretion. Occupational stress is associated with high levels of cortisol [6, 7]. The transition from day to night shift work has an impact on this hormone. Circadian rhythm of cortisol is also linked to sleep. Insufficient and poor quality sleep patterns could influence the circadian dynamic of the glucocorticoid [1, 6]. Disturbances in cortisol secretion may lead to fatigue, depression, obesity and immune dysfunction [8].

Salivary cortisol represents the free fraction of the hormone in the body, which is believed to be the active form of cortisol [1, 2, 3, 4, 9]. It is the preferred method for stress assessment in studies among different occupations [5]. This is due to its non-invasiveness and advantage of taking samples not just in laboratories, but also in work and home environments. The procedure is easy, and it doesn't require specialized support [5] It can be performed many times without major inconveniences and difficulties for the examined person.

Working in a casino is a demanding job that could attract a lot of stress [10,11,12]. Shift work during day and night time is involved which inevitably impacts the lives of these employees [13]. They need to adapt to this way of living. Proper organization of shift work is essential for sustaining good health and workability. If not managed carefully it could become a major stressor in one's life and lead to negative health consequences [4,13]. Most of the studies associated with this occupation are directed to the employee's perception of work stress, his or hers relationship with the work environment and coping mechanisms such as smoking, drinking and gambling problems [10, 11, 13]. There is no research about the influence of shift work on the circadian rhythm of these people.

The aim of our study was to assess the circadian patterns of cortisol among casino employee's working day and night shifts.

MATERIALS AND METHODS.

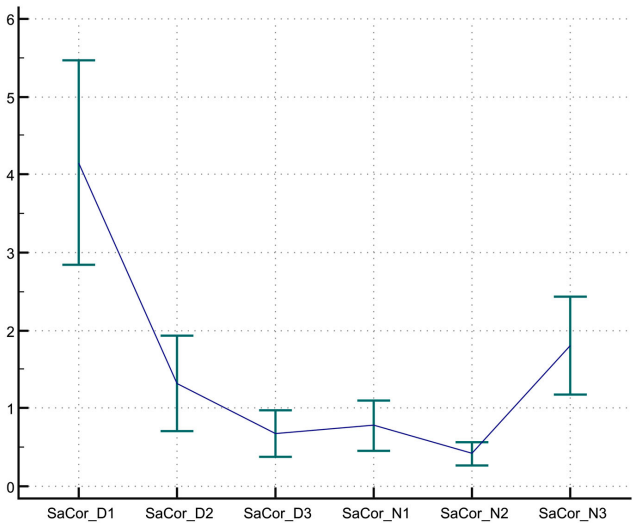
Fifteen healthy employees (9 women and 6 men) from four casinos in Sofia were included in the present study. All of them were working rotating day and night shifts. The duration of work time was 12 hours. The shift rotation included 2 day and 2 night shifts with 2 rest days between the shifts. The participants gave salivary samples for determination of cortisol levels during their shift work. Samples were taken 3 times during one day shift

and 3 times during their next night shift. The collection time points were at 7:30 a.m. (SaCor_D1), 14:00 p.m. (SaCor_D2), 19:30 p.m. (SaCor_D3) for one day shift and 19:30 p.m. (SaCor_N1), 00:30 a.m. (SaCor_N2) and 7:30 a.m. (SaCor_N3) for one night shift. Saliva was collected in a suitable for the purpose tubes - Sallivette (Sarstedt, Rommelsdorf, Germany). All participants were instructed beforehand to abstain from eating, smoking, brushing their teeth or drinking any kind of liquid except water for at least 30 minutes before giving their samples. After the collection of all samples for one work shift, they were transported to a laboratory, centrifuged (2 minutes, 1000 g) and stored at -20º C until assayed. Salivary cortisol levels were obtained by liquid chromatography-tandem mass spectrometry (LC/MS/MS). The results for salivary cortisol were presented in ng/ml. All employees signed informed consent before taking part in the project. The project was approved by the ethics committee, Medical University-Sofia. Statistical analysis of the collected data was done with MedCalc 16.4.3.

RESULTS

Data from 12 participants (8 women and 4 men) was used in the study. Results from three of the participants were excluded due to corrupted samples or missing data. The small sample size required the use of nonparametric statistical methods. Cortisol levels followed their normal direction of rising and fall during day and night (Fig. 1). Highest values of the hormone were present in the morning (SaCor_D1) of the day shift, and they declined throughout the end of the workday. There was a decrease in cortisol from the beginning of the night shift (SaCor_N1) to the second sampling time (SaCor_N2) and a strong final increase in the third (SaCor_N3).

Fig. 1. Dynamics of cortisol levels during the day (SaCor_D1, SaCor_D2 and SaCor_D3) and night (SaCor_N1, SaCor_N2 and SaCor_N3) shift.



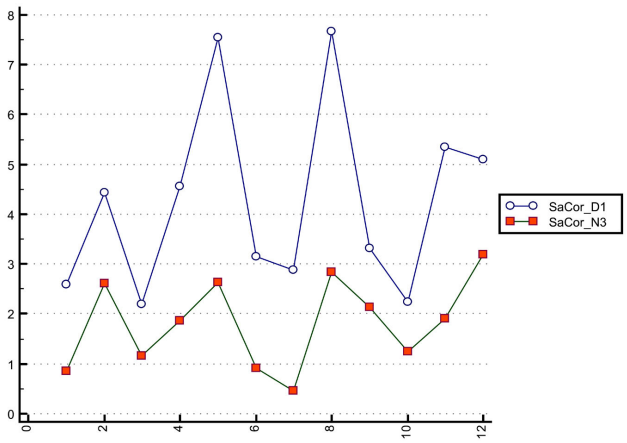
Mean (+/– SD) for dayshift salivary cortisol levels (Mean 4,254 ng/ml, +/– SD 1,8978ng/ml) were higher than those of the night shift (Mean 1,819 ng/ml, +/– SD 0,8906 ng/ml). The data from the descriptive statistics of salivary cortisol levels are shown in Table 1.

Table 1. Descriptive statistics for cortisol levels in the day and night shifts.

	N	Mean	95% CI	SD	Minimum	Maximum
SaCor_D1	12	4,254	3,048 to 5,460	1,8978	2,188	7,669
SaCor_D2	12	1,228	0,642 to 1,814	0,9223	0,255	3,093
SaCor_D3	12	0,655	0,380 to 0,929	0,4319	0,207	1,584
SaCor_N1	12	0,88	0,517 to 1,243	0,5707	0,32	2,135
SaCor_N2	11	0,419	0,267 to 0,571	0,2262	0,191	0,971
SaCor_N3	12	1,819	1,253 to 2,385	0,8906	0,45	3,194

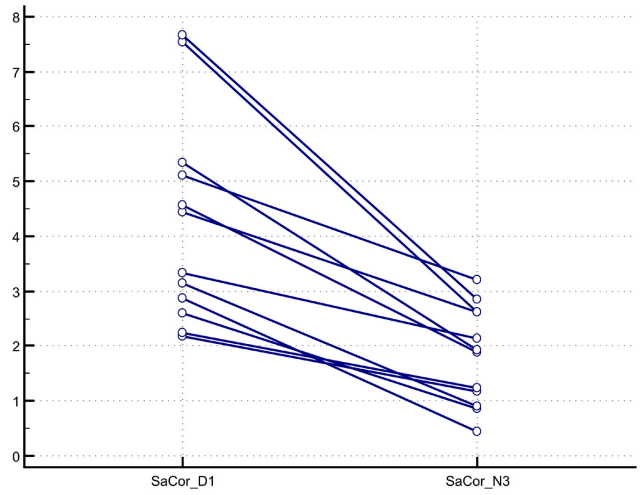
Spearman's coefficient of rank correlation (R) was used to evaluate the strength and direction of correlation. There is a strong (R = 0.595) statistically significant (p = 0.003) positive linear correlation between the values of the first day shift (SaCor_D1) and the third night (SaCor_N3) shift. There is a strong synchronization between the data from both measurements (Fig. 2, Fig. 3). Cortisol values at the beginning of the day shift dominate over those at the end of the night shift.

Fig. 2.
Graph representation of the data from SaCor_D1 and SaCor_N3 of the 12 participants in the study.



Wilcoxon test was used for comparison of mean salivary cortisol levels at the beginning of the day shift (SaCor_D1) and the end of the night shift (SaCor_N3). The strong statistically significant difference is present in the means of the two variables (p=0,0005). Salivary cortisol levels are systematically reduced at the end of the night shift compared to those of the beginning of the day shift (Fig. 3). This reduction varies from 1,007 to 4,924 with Mean 2,435 and standard deviation of 1,339.

Fig. 3. Correspondence between the values †of the first day (SaCor_D1) and the third night (SaCor_N3) measurements of salivary cortisol levels.



DISCUSSION

Salivary cortisol levels of people working 12 hour shifts in casinos showed normal dynamics in both of their day and night shifts. The results show normal diurnal cortisol dynamics. Cortisol levels had highest values in the morning and lowest at night. There were decreased levels of cortisol at the end of the night shift compared to the beginning of the day shift. This reduction is probably due to alternation of the circadian rhythm after the night shift. Other studies about the effect of shift work on cortisol showed similar results [8].

The gambling industry is associated with stress and addictive behaviour. There are many studies about stress and cortisol secretion among casino gamblers [14,15], but no information about the people who work in this environment. This is the first research assessing cortisol levels in casino employees. More studies and deeper analysis of the health risks in this occupational area are needed.

CONCLUSION

Shift workers are a large portion of the working society. People who work on both day and night time have a higher risk of developing circadian disorders and occupational stress. This new data emphasize the need for exploration of different shift styles and their effects on the employee's health and proper implementation of good practices that reduce the psychosocial risks in the workplace.

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REFERENCES:

1. Anjum B, Verma NS, Tiwari S, Fatima G, Naz Q, Bhardwaj S, et al. Altered Circadian Secretion of Salivary Cortisol During Night Shift. Int J Health Sci Res. 2014; 4(2):46-52.

2. Anjum B, Verma NS, Tiwari S, Singh R, Mahdi AA, Singh RB, et al. Association of Salivary Cortisol with Chronomics of 24 Hours Ambulatory Blood Pressure/Heart Rate Among Night Shift Workers. *Biosci Trends.* 2011 Aug;5(4):182-8. [PubMed]

3. Baba M, Ohkura M, Koga K, Nishiuchi K, Herrera LR, Matsuse R, et al. Analysis of Salivary Cortisol Levels to Determine the Association Between Depression Level and Differences in Circadian Rhythms of Shift-Working Nurses. *J Occup Health.* 2015; 57(3):237-44. [PubMed] [Crossref]

4. Garcez A, Weiderpass E, Canuto R, Lecke SB, Spritzer PM, Pattussi MP, et al. Salivary Cortisol, Perceived Stress, and Metabolic Syndrome: A Matched Case-Control Study in Female Shift Workers. *Horm Metab Res.* 2017 Jul;49(7):510-519. [PubMed] [CrossRef]

5. Bozovic D, Racic M, Ivkovic N. Salivary cortisol levels as a biological marker of stress reaction. *Med Arch.* 2013; 67(5):374-7. [PubMed]

6. Lindholm H, Ahlberg J, Sinisalo J, Hublin C, Hirvonen A, Partinen M, et al. Morning Cortisol Levels and Perceived Stress in Irregular Shift Workers Compared with Regular Daytime Workers. Sleep Disordr. 2012;2012:789274. [PubMed] [Crossref]

7. Vangelova K. The effect of shift rotation on variations of cortisol, fatigue and sleep in sound engineers. *Ind Health.* 2008 Oct;46(5):490-3. [PubMed] [Crossref]

8. Niu SF, Chung MH, Chen CH, Hegney D, O'Brien A, Chou KR, et al. The Effect of Shift Rotation on Employee Cortisol Profile, Sleep Quality, Fatigue, and Attention Level: A Systematic Review. J Nurs Res. 2011Mar; 19(1):68-81. [PubMed] [Crossref]

9. Moro A, Reis P, Santos I, Pinto A, Reis D. Salivary Cortisol Analysis in Shift Workers. In: Arezes P. (eds) Advances in Safety Management and Human Factors. Advances in Intelligent Systems and Computing, vol 491. Springer, Cham. 2016. Part IV. pp.525-32. [Crossref]

10. Wong ILK, Lam PS. Work Stress and Problem Gambling Among Chinese Casino Employees in Macau. *Asian J Gambl Issues Public Health.* 2013; 3:7:1-16. [Crossref]

11. Hu SX, Luk A, Leong C, UC, Van F. The Correlations of Work Conditions with Unhealthy Lifestyles and Occupational Health Problems of Casino Croupiers in Macau. *J Gambl Stud*. 2013, Jun29(2):255-268. [PubMed] [Crossref]

12. Vodenicharov V, Vodenicharov E, Mitov K, Stoyneva Z, Ivanova I. Stress Levels and Risks Among Casino Employees in Bulgaria. *Acta morphologica et anthropologica*. 2016; 23:111-114.

13. Wittman DC, A Day in the Night of a Casino Worker. Shift Work Culture of Mississippi Dockside Gaming Employees. In Resorting to Casinos: The Mississippi Gambling Industry. Edited by von Herrmann D. *University Press of Mississippi*. January 25, 2006. pp.121-143.

14. Guttentag D, Harrigan K, Smith S. Gambling by Ontario Casino Employees: Gambling Behaviours, Problem Gambling and Impacts of the Employment. *Int Gambl Stud*. 2012; 12(1):5-22. [Crossref]

15. Paris JJ, Franco C, Sodano R, Frye CA, Wulfert CA. Gambling Pathology is Associated with Dampened Cortisol Response Among Men and Women. *Physiol Behav.* 2010,Feb 9;99 (2):230-3. [PubMed] [Crossref]

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