

## Original article

### Blood glucose level and its association with night shift nurses performances

Farzane Farokhi<sup>1\*</sup>, Javad Razaviyan<sup>2,3</sup>, Mostafa Kakouie<sup>4</sup>

1. Dep. of Biology, Azad University of Sari Branch, Mazandaran, Iran.
2. MSc Student of Clinical Biochemistry, Medical School, Tehran University of Medical Sciences, Tehran, Iran.
3. Student Scientific Research Center, School of Allied Medicine, Tehran University of Medical Sciences, Tehran, Iran.
- 4- MSc Student of Psychiatric Nursing, International Branch, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Corresponding author: Farzane Farokhi

Email: farzane.farokhi@gmail.com

#### Abstract

**Objective:** The performance of nurses, especially at the end hours of night shift depends significantly on their blood glucose levels. This study aimed to determine blood glucose level in night shift nurses and its related factors affecting the nurses performance it.

**Methods:** the design of the study was cross-sectional descriptive-analytical and the participants who accepted to enter the study were 60 night shift nurses working in Juybar Azizi Hospital. Sampling was done to measure their blood glucose levels was done during 4 to 6 am. The information required for the study was recorded in predetermined checklists by the individuals. The researchers used For data analysis, independent t-test, one way ANOVA, Pearson correlation coefficient and SPSS software version 18 to analyze the data were run. The level of significance was considered as  $P < 0.05$ .

**Results:** Among the study sample, 46 of the participants were individuals (76.7%) were female and 14 ones (23.3%) were male. Their mean age was  $28.8 \pm 5.2$  years. The average work experience and night shift working hours were  $4.9 \pm 4.1$  year and  $6.8 \pm 2.7$  nights per month, respectively. The average measured blood glucose was  $96.7 \pm 7.8$  mg/dl. The difference between the blood glucose levels was not statistically significant between men and women ( $P=0.75$ ). There was a significant relationship among blood glucose level and age ( $r=0.33$ ), Body Mass Index (BMI) ( $r=0.31$ ) and work experience ( $r=0.26$ ) ( $P < 0.05$ ) that by increasing age, BMI, and work experience, the blood glucose level increased, while no significant relationship was observed between the number of night shift per month and blood glucose level ( $P > 0.05$ ).

**Conclusion:** The results obtained from the current study revealed that blood glucose levels in night shift nurses were in the range of fasting individuals, while blood glucose levels in older nurses and with more work experience and BMI were higher.

**Keywords:** Nurse, Blood Glucose, Night Shift, BMI, Age.

#### Introduction

Nurses play an important role in health care system in any society. (1) Nurses make up Nearly 40% of the personnel in a hospital and are paid about 55% of the total cost for the employees. The optimal performance of nurses at various work shifts particularly at night is crucially important (2). Working in shift is a work schedule in which individuals work at irregular or unusual hours (3).

Over the last few decades, shift work has been widely increased especially in developed countries; however, developing countries have not been an exception where the number of people with shift work has also been increasing (2, 4). Approximately 15% to 20% of people in the world work as shift work (5). more than 25% of American employees serve in shift work. In

Europe, 17.6% of employees have to work in night shifts in 25% of their service periods. In health care sector, the proportion of people working at night shift is more in fact 36.9% of hospital employees, most of them nurses work at night shift (6). Approximately 75% of nurses work at night shifts in Japan (1). Shift work is one of the requirements for nursing and an important requisite for providing continuous and effective care to patients (7). More than any other job, nursing has various shift works, particularly night shifts (1). Nightshift working has adverse effects on the physiology of the human body to work, in other words, working at night is in contrary to human nature and causes disturbances in the circadian rhythm (1). For most nurses working without rotation shift hours, nightshift working will have unpleasant and unavoidable consequences on their normal life. Nightshift working has negative physical, psychological and social effects on personal life of nurses and these can ultimately affect their families. Due to long working shifts and fatigue, nurses are always prone to health threats in different dimensions (8). It is assumed that shift work leads to the cardiovascular and metabolic diseases and as a result disorder in circadian rhythm, lifestyle changes, work stress and social pressure (3). Nurses, doctors and hospital personnel who work in nightshift or without rotatory or flexible work shift hours often have irregular sleep-patterns (9). In this regard, it can be observed that hardship and stress in workplace and night shifts lead to endocrine disorders in nurses that this increases the risk for diseases such as mental disorders, cardiovascular disorders, obesity and diabetes in this group of staff in the health system (3). These changes may be due to changing in sleep patterns in nightshift nurses that somehow causes changes in the metabolism of Glucose stimulating to respond to endocrine stress and enhancing cortisol secretion. Although an increase in cortisol level in stressful situations seems natural, it can have damaging effects in nurses with chronic stress (7). Getting Little sleep decreases alertness and increases general fatigue in nurses which can result in minimal performance at about 4 to 5 a.m. (9). The brain exclusively depends on glucose for energy production Brain cells have no ability for the storage of glucose and receive them from circulatory system. Glucose is effective in cognitive performance (accuracy) and since inaccuracies and errors in nurses impose heavy losses on lives of individuals and economy of their families and country, therefore, paying attention to blood glucose level of nurses, especially those who work at night shifts and its affecting factors are especially important (10). The results of various studies showed that despite the presence of consciousness in individuals, a severe impairment in the ability of individuals' accuracy emerges

during hypoglycemia and many complex activities of accuracy in everyday life are moderately disrupted with declining blood glucose level (9). Different studies indicated different results from the blood glucose level of nurses working in working shifts (11). So, this study aimed to determine the blood glucose level of nurses on the night shift and the factors affecting it, the study was completed in Juybar Azizi Hospital affiliated to Mazandaran University of Medical Sciences.

### Methods

This is a cross-sectional descriptive-analytic study. The study population was composed of nurses working at night shifts in Juybar Azizi Hospital affiliated to Mazandaran University of Medical Sciences in 2014. The sample size included 60 nurses of the population who were determined based on similar studies and the number of personnel working in the desired hospital (11). The inclusion criteria were having at least one night shift work per week, lack of mental and physical diseases, normal BMI, no diabetes and no drug consumption affecting blood glucose level. To conduct the study in the desired place, the required coordination was done with the hospital authorities. Then, the researcher was present in the research place during the hours of 4 to 6 am and explained the study objectives to the volunteers. To measure blood glucose level, EmpErOr made in Korea was used. Before sampling from the subjects; the device was controlled using serum and calibrated by the glucose level determined by Monday BS200 made of Germany. The blood samples were taken from the fingertips of the nurses and their blood glucose levels were recorded in a predetermined checklist that was completed by the participants. The checklist contained the following information: age, sex, height, weight, workplace ward, education level, work experience, the average number of night shift working per month, if the nurse was a supervisor and if any sugar was taken within two past hours. The collected data was first coded and then entered into Excel software. The data was statistically analyzed using independent t-test, one-way ANOVA and correlation coefficient in SPSS software version 18. The level of significance was considered as  $P < 0.05$  for all the calculations.

### Results

In this study, 80 (80%), 8 (13.3%) and 4 people (6.7%) were nurses, nurses' aid, and nursing students, respectively among which 46 ones (76.7%) and 14 ones (23.3%) were female and male, respectively and their age range was between 22 to 44 with the mean age of  $28.8 \pm 5.2$  years. The mean work experience and night shift working hours were  $4.9 \pm 4.1$  years and  $6.8 \pm 2.7$  nights per month, respectively in the studied samples. The

mean blood glucose level measured in the studied samples was  $96.7 \pm 7.8$  mg/dl and its lowest and highest level were 80 and 121 mg/dl, respectively and using independent t-test, no significant difference was observed among women and men in terms of the amount of blood glucose level ( $P=0.75$ ). Among nurses, only 3 nurses had taken sugar 2 hours before the measurement of blood glucose level that their blood glucose level was higher than that of other nurses, the difference was not statistically significant using independent t-test ( $P=0.18$ ). Also, in half of nurses participating in the study who were responsible for the shift, their blood glucose level had no significant difference

with nurses who were not responsible for the shift ( $P=0.56$ ) (Table 1).

**Table 1:** Comparison of mean blood glucose level in terms of sex, using sugar materials and responsibility of shifts in the studied sample

	Sex			Using sugar materials 2 hours before measuring blood glucose level			responsibility of shifts		
	Female	Male	Level of significance	Yes	No	Level of significance	Yes	No	Level of significance
Blood glucose mg/dl (mean and SD)	$96.6 \pm 8.5$	$97.3 \pm 5.4$	p-0.75	$102.7 \pm 1.5$	$96.4 \pm 7.9$	P-0.18	$96.1 \pm 8.2$	$97.3 \pm 7.5$	P-0.56

**Table 2:** Correlation among age, BMI, work experience and number of night shift working per month with the studied blood glucose level

		Age	BMI	Work experience	Nightshift working
Blood glucose level	Correlation coefficient	0.331	0.315	0.265	-0.026
	Level of significant	$P < 0.05$	$P < 0.05$	$P < 0.05$	$P = 0.84$
	Number	60	60	60	60

### Discussion

One of the requirements for nursing and requisite of providing continuous and effective care to patients is shift work. Studies have revealed that

continuous and long nightshift working contradicts with the natural physiology of the human body and changes in the sleep patterns of these people, may cause changes in the metabolism of Glucose that can associate with various complications (5). Also, the results of the studies indicated that nightshift working decreases blood glucose levels, especially in the late hours of night and early in morning can affect the accuracy of the performance of the nurses; although, there is no consensus regarding this issue (12). In this study, the blood glucose levels of nurses working at night shift were measured from 4 to 6 a.m. The results also indicated that the blood glucose levels of nurses examined in the study are in the fasting range (13). The results of another research study conducted by Ebrahimian et al (2009) entitled "Check plasma glucose and related factors in nurses working night" indicated that the blood glucose level of most of those working at night shifts in the fasting range which is in consistency with the results of the present study (13). In the study by Shokrollahi et al (2011) entitled "The effect of glucose on the accuracy of nurses at nightshift working" on the two (treatment and control) groups of nurses in a semi- experimental study, the results showed that using glucose increases the accuracy of nurses at nightshift working ( $P<0.001$ ) compared with that in the control group ( $P=0.530$ ) (12). During near to morning hours when the study was done, the blood glucose and insulin levels of a healthy person reach to its minimal amount within 24 hours of day and night (6). So, in individuals who have to be awake during these hours due to the working conditions, the blood glucose level and the amount of sugar available to the brain cells will reduce which can lead to human errors that are considered critical in the field of health care. Although in this study, the blood glucose levels of people were obtained in fasting range. Al-Naimi et al (2004) concluded in another study that the blood glucose level of people who work at night shifts is greater than that of people working in other shifts ( $p=0.080$ ) (14). Unfortunately, in this study, the blood glucose level in nurses who work at day shifts was not examined to compare this variable between two different shift works; however, in the study by Biggi et al (2008), no significant difference was observed in blood plasma glucose level between nurses working at night and those working at day shifts (16). The reason for inconsistencies in the obtained results can be attributed to lifestyle, diet of the individuals and their adaptation to Circadian rhythm (13). Researchers identified three reasons for the drop in glucose level in nurses working at nightshifts in Iran: first, longer nightshift working hours in Iran compared to that in other countries, second, getting little percentage of energy required for 24 hours from dinner and third, Iranian eating

habits at dinner with regard to their culture (13). The findings indicated that only 3 of 60 studied subjects ate food during the hours of 2 to 4 a.m. whose blood glucose level was higher than others; however, the difference was not statistically significant ( $P=0.18$ ). This may pertain to the fact that the type of food consumed by these individuals had no significant and important impact on increasing their blood glucose levels. Other results from this study indicated that there was a statistically significant relationship between blood glucose level and age, BMI and work experience ( $P<0.05$ ) in a way that by increasing these variables, the blood glucose level increased in individuals too. These results are inconsistent with the results of the study by Ebrahimian et al (2009) (13). Also, in their study, Rodrigus and Canani (2008) showed that there is no significant difference between age, sex, and BMI and glucose level in diabetic people working at nightshifts compared to those working at dayshifts (17). However, the statistical analyses indicated that there is no statistically significant association between the number of night shifts and the fact that the desired person is in charge of shift or not with blood glucose level of nurses working at night shifts ( $P>0.05$ ) which is consistent with the study by Ebrahimian et al (13). The blood glucose level did not show statistically significant difference in male and female groups. In line with the cases mentioned, the results of several studies indicate that there is no statistically significant difference in blood glucose level between two sex groups during nightshift working (13). According to what was stated in this study, it can be concluded that there must be another factor except for staying awake and sleeplessness at night shifts which contributes to lowering the consciousness in nurses and health care personnel and reduce the blood glucose levels in them during early hours in the morning. On the other hand, since their bodies permanently deal with conditions of low blood glucose levels, it may make the ground for metabolic disorders in these individuals in the long-run. Since nightshift working is inevitable in health sector; it is recommended that a more comprehensive research be done in this area and the necessary measures be carried out in order to minimize the possible damages and to increase employees' efficiency as well as patients' sense of satisfaction.

#### **Acknowledgement**

This study is a research project approved by Islamic Azad University, Sari Branch has the number 2895.

We wish to express our sincere thanks to all the people who helped us to conduct this study

especially the nursing staff ,for their generous contributions and also, Doctor Mostafa Bakhshi, the head of the hospital, who provided us with all the necessary facilities for conducting this research study .

### References

1. Bagheri M, N. VZ. Nightshift working and its effects on the health of nurses. *Journal of Research Development in Nursing & Midwifery*. 2006;3(1):44-9.
2. Ghaljaei F, Naderifar M, Ghaljeh M. Comparison of general health status and sleep quality between nurses with fixed working shifts and nurses with rotating working shifts. *Zahedan Journal of Research in Medical Sciences*. 2011;13(1):47-50.
3. Ulhôa M, Marqueze E, Burgos L, Moreno C. Shift Work and Endocrine Disorders. *International journal of endocrinology*. 2015;2015:11 pages.
4. Gu F, Han J, Hankinson S, Schernhammer E, Group NHS. Rotating night shift work and cancer mortality in the nurses' health study. *Cancer Research*. 2014;74(19 Supplement):2178.
5. Soleimany M, Ziba FN, Kermani A, Hosseini F. Comparison of sleep quality in two groups of nurses with and without rotation work shift hours. *Iran Journal of Nursing*. 2007;20(49):29-38.
6. M. DT. Textbook of Biochemistry with Clinical Correlations. 6th ed. USA, Wiley-Liss: AJOHN WILEY & SONS Publisher; 2006.
7. Elaine Lewis N, Anthony Moscar N, Carly King N, Kelly Hogan N. Shift Work and Development of Chronic Disease. *CAND Vital Link*. 2012:17-22.
8. Amiri H., Mahmoudi H., Daneshmandi M., Ebadi A., Sirati Nir M., Jafari M. Effect of oral glucose consumption on cortisol level of night-work nurses. *Journal of Military Medicine*. 2012;14(1):57-61.
9. McAulay V, Deary IJ, Ferguson SC, Frier BM. Acute hypoglycemia in humans causes attentional dysfunction while nonverbal intelligence is preserved. *Diabetes Care*. 2001;24(10):1745-50.
10. Wang X, Armstrong M, Cairns B, Key T, Travis R. Shift work and chronic disease: the epidemiological evidence. *Occupational medicine*. 2011;61(2):78-89.
11. Ebrahimian A A. The accuracy of the nurses at work. *Payesh*. 2006;5(2):123-30.
12. Shokrollahi F, Mahmoudi H, Ebadi A, Najafi Mehri S, Jafai M. The effect of glucose on the accuracy of nurses at work. *Jornal of Nursing & Midwifery Faculty, Shahid Beheshti University of Medical Sciences*. 2011;21(75):22-9.
13. Ebrahimian A A, Ghorbani R, Bibak B. Check plasma glucose and related factors in nurses working night. *NKUMS*. 2009;2, 3 (1):23-8.
14. Al-Naimi S, Hampton S, Richard P, Tzung C, Morgan L. Postprandial metabolic profiles following meals and snacks eaten during simulated night and day shift work. *Chronobiology international*. 2004;21(6):937-47.
15. Lund J, Arendt J, Hampton S, English J, Morgan L. Postprandial hormone and metabolic responses amongst shift workers in Antarctica. *Journal of Endocrinology*. 2001;171(3):557-64.
16. Biggi N, Consonni D, Galluzzo V, Sogliani M, Costa G. Metabolic syndrome in permanent night workers. *Chronobiology international*. 2008;25(2-3):443-54.
17. Rodrigues TC, Canani LHS. The influence of the work shift in patients with type 2 diabetes. *Revista da Associação Médica Brasileira*. 2008;54(2):160-2.