

Investigation of nutritional status of security officers working in shifts and correlation with obesity

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Summary. Adhering to a healthful diet propensity and way of life, assume a crucial part of healthy and agreeable life. Undesirable dietary proclivities are among the significant hazard factors for obesity and related unending ailments, especially if received during early adulthood. Numerous natural elements, way of life, working discipline and financial circumstance influence the nourishing status. This investigation aimed to feature nutritious conditions and dietary propensities of security officers laboring in shifts and decide the obesity status. Volunteer security officers working from December 2017 to March 2018 in shifts in the city of Istanbul in Turkey were chosen for a cross-sectional investigation. A standard questionnaire was used to collect data through face to face negotiations with security officers regarding socio-statistic characteristics, work status, and dietary patterns in turn of work. Analysis of data was performed using SPSS 25 adaptations. The average age of participants was 34.75 ± 7.12 years. Of the 963 participants, 24 were female and 939 were male. The number of participants who were heavyweight, obese, and morbid obese were 549, 143 and 4 respectively. Nutritional supplements used by participants were vitamin B12, fish oil, vitamin C, Ca, Zinc, vitamin D, iron, probolis, bamboxs, bee pollen. Vitamin C and vitamin D were the most commonly used vitamins with the ratio of 22% and 25.9%, respectively. The obesity rate was higher in those who did not take vitamin and mineral supplements as compared to that in those who took. Participants working in the monthly shift change system were more likely to be overweight, obese and morbid obese than participants who worked in the weekly shift system. The rate of being obese was found to be higher among the participants who had average one time and four times night shifts. Participants preferred mostly fruit-vegetable-type snacks with the rate of 29.7%. Breakfast was the most skipped meal among workers in day and night shifts. Participants consumed eggs every day and in addition, they preferred full-fat cheese mostly with the ratio of 33.4%. The most consumed vegetable by participants during the day was tomato with the rate of 6.3%. Participants mostly preferred to consume white bread and its derivatives with the ratio of 33.7%. Participants drank mostly tea in a day with the maximum rate of 77.6% among regular beverages and among consumption of fat, olive oil was consumed at the highest rate of 46.5% per day. Our study findings indicates that, security officers working in shifts have irregular eating habits.

Key words: eating habits, nutritional status, obesity, shift-workers

Introduction

Regular dietary patterns are the primary need of a healthy way of life. Irregular nutritional habits, for example, skipping breakfast and eating the food rich in carbohydrate and fat, more than need, are the primary elements causing nutrition problem. Irregular feeding

may cause or increase the potential risk of ceaseless illnesses including obesity, cardiovascular problems, osteoporosis, and cancer (1). The food product type, the preparation methods, the quantity of meals and the length of the time interval between two meals seems to be very significant regarding a healthy diet.

The basic factors, which may cause energetic imbalance in whole body, contributing to the incidence of overweight and obesity are, increased intake of poor nutrients, nutrient containing high-energy ingredients, high amount of fats, sugar and salt. Also, the other most crucial factor is the lacking or no physical activity (2). The food preference of human is depicted as a complicated process including an assortment of affecting perspectives, for example, the financial and social level and accessibility of food, the educational level and age interval of an individual (3). Undesirable dietary propensities are among the significant hazard factors for obesity and related incessant illnesses, especially if embraced amid early adulthood (4, 5). Investigations on the Middle East reveals that young people and grown-ups eating practices are unfavorably being impacted by the differentiating environmental effects prompting alarming rates of overweight, obesity and higher metabolic hazard factors causing diabetes, hypertension, and other unending illnesses (6, 7). Overweight and obesity are metabolic illnesses common all around the world. Today they are achieving epidemic extents and consequently being the fifth driving factors for worldwide mortality. No less than 2.8 million grown-ups die every year because of being overweight or having an obesity problem (8). Shift working, is the method used to regulate the working hours in full-day period to realize the necessary supply-demand equilibrium in the market (9). Shift system is additionally depicted as antisocial time in light of the fact that the shift system is by and large completed while a critical piece of the general public is resting, along these lines restricting the social existence of shift workers. Thus, shift workers are encountered with numerous variables causing them a problematic life. Nourishment is the most vital of these elements. Food is one of the factors influencing the production rate of workers. At the point when the vitality required for creation is not accessible, laborers restrain the work and produce less. Insufficient and unequal feeding likewise diminishes body resistance, bringing about the more recurrent diseases and more accidents in work, resulting in an expansion in worsening the health regardless of a lessening in the generation rate (10).

A nourishing appraisal is critical regarding the increase in the potential of work, lessening wellbeing

uses and diminishing burden of citizens. The study was carried out with the aim of determining the nutritional status of the security guards working in the city of Istanbul and determining the their obesity status.

Materials and Methods

A cross-sectional investigation was performed with volunteer security officers working in shifts from December 2017 to March 2018 from the six private security organizations in Istanbul. Ethics committee approval for the investigation was acquired from the ethics council of Dicle University Medical Faculty. Participation in the survey was on volunteer bases, every member was required to give written informed consent and namelessness was ensured. This investigation was directed to evaluate the nutritional status and relationship of which with obesity among security officers working in shifts in Istanbul from December 2017 to March 2018. The total number of security officers at the time of the study was 1109. The number of participants who agreed to participate in the survey is 963 because of the survey on a volunteer basis. The number of participants comprised of 963 security officers working in shifts (n=939 males, 24 females) with age average of 34.75 ± 7.12 years. A standard questionnaire was used to get information via face to face personal meetings. The survey comprised of inquiries on security officers working in movements' socio-statistic characteristics, shift work status, and dietary patterns.

Anthropometric estimations: The body weights of uniform-wearing security officers without shoes were estimated as the value closest 0.5 kg with a portable scale. Height and abdomen perimeter of each member is estimated to the nearest value with the use of 0.1 cm fiber-glass tape. Body Mass Index (BMI: weight/height², kg/m²) was computed for each in agreement with the standards of World Health Organization.

Dietary patterns: Feeding was determined by questionnaire with an inquiry concerning the sum and utilization recurrence of dairy products, meat and meat products, fruit and vegetables, legumes, breakfast and grain products, fat, sugar and sweet, drinking tea, cof-

fee and alcoholic beverages. It was addressed whether they had omitted the meals or not.

Shift working status: Shift working status was surveyed by questions concerning shift change framework, working time in the system, working recurrence of the nightshift, the effect of shift work framework on weight, the effect of the shift work framework on way of life.

Statistical investigation

SPSS 25 was used to analyze all statistical data. Results were evaluated confidence level of 95% and the value $p < 0.05$ was decided as a statistically significant outcome. Continuous variables data were expressed as mean \pm SD in the case of a normal distribution or as median (25-75 percentiles) in that of abnormal distribution. Factors of the category appeared as frequency (percentage). Chi-square test was performed to survey the distinctions and connections amongst groups and elements. Keeping in mind the end goal to have the capacity to utilize the chi-square examination, the number of classifications with the standard value under five ought not to surpass 20% of the total number of classifications, and this value must be higher than one in all classes. Toward this path, the quantity of data in the pores was considered before the chi-square estimation was performed.

Accordingly, a few groups with a small number of members were participated in the survey by consolidating with a subgroup or a higher group.

Results

The average age of participants is 34.75 ± 7.12 years. Of the 963 participants, 24 were female and 939 were male. Of the participants, 549 individuals were heavyweight, 143 were obese and 4 of them were morbid obese. Nutritional supplements taken by participants include vitamin B12, fish oil, vitamin C, Ca, Zinc, vitamin D, iron, probolis, bamboxs and bee pollen. The most commonly used vitamins were vitamin C (22.0%) and vitamin D (25.9%). Participants who used vitamin-mineral supplements were found to have a higher obesity rate than participants who did not use

vitamin-mineral supplements. There was no statistically significant relationship between the use of vitamin-mineral supplements and BMI ($\chi^2 = 3.65$; $p > 0.05$). There was a significant correlation between the BMI and the type of shift system ($\chi^2 = 22.82$; $p < 0.05$). Participants working in the monthly shift change system were more likely to be obese than participants who worked in the weekly shift system. There was a significant correlation between BMI and average shift time interval ($\chi^2 = 39.90$; $p < 0.05$). Participants who had average one time and four time shifts were found to have higher obesity tendencies. Participants with the rate of 29.7% prefer mostly fruit-vegetable-dried fruits-type snacks. Breakfast is the most skipped meal among workers in day and night shift. 40.7% of daytime workers skip the breakfast more as compared night-time workers with the rate of 38.8%. Participants consume full-fat cheese mostly with the ratio of 33.4%. The most consumed vegetable by participants everyday was tomato with the ratio of 6.3% and mostly preferred to consume white bread and its derivatives with the ratio of 33.7% and olive oil with a maximum rate of 46.5%.

Table 1 has shown that the number of male participants is 939 (97,5%). A vast majority of participants with the number of 499 (51.8%) were high school graduates. The number of married participants were 331 (34.4%). The number of participants who smoke and drink alcohol were 517 (53.7%) and 139 (14.4%), respectively. According to WHO BMI classification the number of obese participants were 139 (14.4%).

Table 2 has shown that nutritional supplements used by participants were vitamin B12, fish oil, vitamin C, Ca, Zinc, vitamin D, iron, probolis, bamboxsand, bee pollen. Six of the 27 participants (22.21%) who used vitamin-mineral supplements indicated that they used vitamin supplements for more than three months. The most commonly used vitamin is vitamin D with a rate of 29.6%.

Table 3 has shown that among participants using vitamin-mineral supplements, obesity rate (11.1%) was lower than in participants who did not use vitamin-mineral supplements (15.0%). There was no statistically significant relationship between the use of vitamin-mineral supplements and BMI ($\chi^2 = 3.65$; $p > 0.05$).

While 27.9% of the participants indicated that the shift work system was effective on weight gain and

Table 1. Demographic characteristics of participants

Demographic characteristics	Group	Number (n)	Percent(%)
Demographic characteristics gender	Female	24	2,5
	Male	939	97,5
Education	Primary School	52	5,4
	Secondary School	314	32,6
	High School	499	51,8
	University	81	8,4
	Postgraduate	17	1,8
Marital Status	Single	632	65,6
	Married	331	34,4
Smoking	Yes	517	53,7
	No	294	30,5
	Stop	152	15,8
Alcohol Use	Yes	139	14,4
	No	698	72,3
	Stop	128	13,3
Vitamin-mineral supplementation	Yes	27	2,8
	No	936	97,2
BMI	Normal (18,5-24,9)	271	28,1
	Overweight (25,0- 29,9)	549	57,0
	Obese (30-39,9)	139	14,4
	Morbid obese (≥ 40)	4	0,4

Table 2. Vitamin-minerals used by participants and frequency of use

Vitamin-mineral	Number (n)	Percent (%)
Vitamin B12	5	18,5
Fish oil	1	3,7
vitamin C	6	22,2
Ca	1	3,7
Zinc	1	3,7
Vitamin D	8	29,6
Iron	4	14,8
Probolis, Bamboks, Bee polen	1	3,7
Duration of Vitamin-minerals used		
0-1 month	10	37,03
1-3 months	11	37,73
>3 months	6	22,21

they did, 43.9% of them have stated that the shift work system was not effective on weight gain.

Table 4 has shown that there was a significant correlation between the BMI and the type of shift system ($\chi^2=22.82$; $p<0.05$). Participants working in the monthly shift change system were more likely to be overweight, obese and morbid obese.

Table 5 has shown that there was a significant correlation between BMI and average shift time interval ($\chi^2=39,90$; $p<0,05$). Participants who had average one time and four times shifts were found to have higher obesity and morbid obese tendencies.

Discussion

With the industrial revolution, the shift work system used intensively in factories and mines, this sys-

Table 3. Relationship between the use of vitamin-mineral and BMI

Use of vitamin-mineral	BMI								χ^2	p
	Normal		Overweight		Obese and morbid obese		Total			
	n	%	n	%	n	%	n	%		
Use of vitamin-mineral										
Yes	12	44,4	12	44,4	3	11,1	27	100,0	3,65	0,16
No	259	27,7	537	57,4	140	15,0	936	100,0		
Total	271	28,1	549	57,0	143	14,8	963	100,0		

Table 4. The relation between shift type and BMI

Shift type	BMI								χ^2	p
	Normal		Overweight		Obese and morbid obese		Total			
	n	%	n	%	n	%	n	%		
Weekly	189	32,9	319	55,6	66	11,5	574	100,0	22,82	0,00
Monthly	82	21,1	230	59,1	77	19,8	389	100,0		
Total	271	28,1	549	57,0	143	14,8	963	100,0		

Table 5. The correlation between average night shift time and BMI

Average night shift time	BMI								χ^2	p
	Normal		Overweight		Obese and morbid obese		Total			
	n	%	n	%	n	%	n	%		
Once	33	20,1	91	55,5	40	24,4	164	100,0	39,90	0,00
Twice	105	37,4	151	53,7	25	8,9	281	100,0		
Three times	104	29,0	209	58,2	46	12,8	359	100,0		
Four times	29	18,2	98	61,6	32	20,1	159	100,0		
Total	271	28,1	549	57,0	143	14,8	963	100,0		

tem is an indispensable part of many industries (11). However, deterioration of worker's body balances due to shifts time intervals leads to social and physical negativities, which is affirmed as a drawback of the system (12). The current literature points out that there is a significant relationship between loss of sleep, nutrition and metabolic changes (13). In his study, Ermis shown that the individuals sleeping less are more likely to be obese (14). This may be attributed to the increased level of ghrelin hormone and decreased the level of leptin hormone (15), but it is also a major risk for obesity, especially in shift workers, that the distortion of dietary habits and pattern of diet and continual meal-skipping

are observed continuously (16). This study was conducted to examine the nutritional status of shift workers and to determine the frequency of obesity.

In this study, 53.7% of participants smoke and 14.4% of them use alcohol. In a survey conducted with 2090 shift workers in Korea, use of alcohol ($p < 0.015$) and smoke ($p < 0.001$) were found to be more frequent as compared to whom work daytime and three shift (6 hours) (17). In a study performed by Esquirol *et al.*, there is no difference between smoking and alcohol use in shift workers as compared to daytime workers. This situation can be explained by the personal habits of smoking and alcohol consumption (18).

While it was observed that 549 (57%) and 143 (14.8%) of participants were overweight, obese and morbid obese, a study reported that 48% of workers, 65 male and 44 female, were overweight and obese (19). Similarly, in a survey conducted in Norway, it was seen that as night work hours increased, BMI was increased (20). In this case, it can be interpreted that the eating habits of individuals working in the shift system and getting food healthfully are affected by irregular working hours, and thus the incidence of obesity is more frequent in parallel with this.

In this study, nutritional supplements used by participants were vitamin B12, fish oil, vitamin C, Ca, Zinc, vitamin D, iron, probolis, bambosx, bee pollen. Vitamin C (22%) and vitamin D (25.9%) were the ones used mostly. Research conducted by Linseisen *et al.* has shown that intake of zinc, vitamin A and D, as well as dietary fiber, were also below the level recommended (21). A study conducted in Japan showed that vitamin D levels in serum of participants were also in normal range and these are similar in level between shifts period (22). In a study conducted by Romano *et al.* on 196 workers in Italy, serum 25-OH vitamin D levels of workers working at night (13.4 ± 5.3 ng/mL versus 21.9 ± 10.7 ng/mL, $p < 0.001$) was found lower as compared to whom work daytime (23). This result may be due to reduced making use of sunlight by shift workers and the use of vitamin D supplementation. Participants may also need to use food supplements due to inadequate nutritional status.

In this study, obesity-morbid obesity was observed higher in those who did not take vitamins and minerals as compared to whom take, and there was no statistically significant difference. There was no significant correlation between BMI and the use of vitamin-mineral supplements ($\chi^2 = 3.65$; $p > 0.05$). In a study conducted by Y Li *et al.*, a relationship between use of vitamin-mineral supplements and parameters such as BMI, body fat mass were investigated and found that 87 females taking multivitamin-mineral supplements had significantly lower BMI despite placebo (24). Similarly, another randomized, double-blind, placebo-controlled study reveals the significant correlation between use of multivitamin-mineral supplements and the control appetite, increased resting energy consumption, and weight loss (25). This may be related

to the energy thermogenesis contribution of vitamins and minerals to improve energy consumption and/or to decrease energy intake.

In this study, 27.9% of participants indicated that the shift work system was effective on weight gain and they did, whereas 43.7% of them stated that the shift work system was not effective on weight gain. Participants who worked in the monthly shift change system, were found to have a higher tendency to be overweight, obese and morbid obese, and thus a significant correlation was found between BMI and the type of shift system worked at ($\chi^2 = 22.82$; $p < 0.05$). In the study involving male and female nurses in Korea, 0.9 kg weight gain was observed among nurses during the five years period of shift work, and there was no statistically significant correlation found. There are studies in the literature that have no significant difference regarding BMI between workers at daytime and at night-time shift, too (26). This can be explained by the effect of differences in nutritional status of shift workers outside the working life on weight gain, or the dietary differences that employees prefer in the working time.

Fast-food (sandwiches, Turkish doner, hamburger, etc.) by 8.7% have the lowest rate and 24.1% of the participants consumed caffeinated beverages, where acid was observed that nutritional impairment was due to difficulty in reaching healthy foods. Similarly, in the study performed by Zverev and Misiri on shift workers showed that increasing the tendency to have a snack (27). In a study conducted, most of the 109 participants stated that as a result of skipping meals, they consumed more high-energy snacks such as crisps, chocolate, biscuits (28). In the retrospective study using the data of the Cancer and Nutrition Cohort Study in the Netherlands, 7173 daytime workers were compared with 683 night-time workers regarding nutrition, and it was observed that night-time workers preferred high-sugar containing snacks (29). This can be explained by the fact that shift workers cannot leave the working environment (to go places such as markets, groceries, etc.), and because there were no places available for food preparation, they preferred to eat foods which were easy to access, practical and accessible without wasting time.

In this study, it was observed that the breakfast is the most skipped meal for the day and night shift

workers. Daytime workers (40.7%) are more likely to skip breakfast as compared to those work night-times (38.8%). In a study conducted in Japan, it was observed that night shift workers were delayed during meal times as compared to daytime workers, and breakfast was frequently omitted (30). Similarly, in a study performed in southern France, it was shown that daytime workers consume four or five meals while night shift workers eat more than five meals a day. Shift workers consumed breakfast and lunch 30% and 10% less than it should be, respectively (31). This can be explained by the fact that daytime shift workers wake up in the early hours and do not feel hungry or they do not want to eat something in the morning because they are sleepy, so they skip breakfast, and in the case of night-time, night shift workers skip breakfast and prefer sleeping because they work until very late.

In this study, 33.4% of participants stated that they consumed full-fat cheese among the milk and dairy products, while 97.3% of participants never consumed skimmed milk. In a survey conducted in Kanazawa University on 2254 workers, it was shown that 408 workers, those working at night shifts especially in between 20-29 years of age, had lower consumption of dairy products than daytime workers (32). In a similar study conducted with 41 airport staff, dairy consumption was found to be lower among daytime staff. This result can be explained by the fact that they think light products are harmful to them or tasteless and thus prefer to eat full-fat product (31).

In this study, 26.6% of participants indicated that they consumed eggs every day. In a survey conducted in Kanazawa University on 2254 workers, it was reported that the red meat consumption by night-time workers was lower than that by daytime workers (30). Similarly, in a study conducted with 207 workers working daytime and 210 workers working in three shifts registered to the health system of the Canary Islands, it was reported that shift workers consumed more red meat and eggs (32). In the retrospective study conducted with the data of Cancer and Nutrition Cohort study in the Netherlands, 7173 daytime workers were compared with the 683 night-time workers regarding nutrition, and it was observed that red meat and fish consumption of night-time workers were higher. Higher consumption of red meat and eggs may indicate that

obesity is more prevalent in occupational groups working in shifts, with an increased intake of saturated fat (33). In this study, 77.6% of participants indicated that they consumed tea every day. In a similar survey conducted by Mashadiet al. in Iran on airports staff, the consumption of hot drinks such as tea and coffee were found to be higher in daytime workers (31). On the contrary, in a study involving 66 shift workers in Brazil, consumption of alcoholic beverages increased as the number of night-time shifts increased (18). This can be explained by differences in beverage choices of individuals due to cultural differences. Participants were found to consume tomato regularly up to the rate of 6.3%. In a survey conducted in Kanazawa University on 2254 workers, it was reported that fresh vegetable consumption of night-time workers was lower than those of daytime workers (30). In the study done by Knutson *et al.*, workers transferred to shift work, consumption of fresh vegetable-fruit was reported to be low (33). This may be explained by the limited length of cooking time due to the extent of shift duration of workers and the less preference for vegetable dishes, which is referred to as cookware meal, as they prefer practical and less time-consuming dishes and bread, such as macaroni, instead.

Conclusion

Nutrition is one of the most critical factors that affect health as well as constitute one of the basic necessities of a human being. In this study, it was observed that the security guards working in shifts skipped meals, mainly breakfast and had an inadequate and unbalanced nutrition habits due to irregular working hours. It is important to determine the nutritional status of shift workers who continue their lives in indefinite working hours, to increase work efficiency and to reduce the burden of society.

In this context, the policies in the country, where the conditions are challenging, should re-examine the working conditions and hours. Employers or workplaces may be required to provide health refreshment including fruit, nuts, yogurt, etc. to their employees at certain times to overcome the difficulties in accessing healthy food and thus omitting meals because of shift

times. In particular, employers may offer breakfast meals for those who start very early in the morning shift.

References

1. Wahlqvist ML. Nutrition and prevention of chronic diseases: a unifyingeco-nutritionalstrategy. *Nutrition, Metabolism and Cardiovascular Diseases* 2014; 14: 1-5.
2. Leech RM, McNaughton SA, Timperio A. The clustering of diet, physical activity and sedentary behavior in children and adolescents: a review. *International Journal of Behavioral Nutrition and Physical Activity* 2014; 11(1): 4.
3. Al-Nakeeb Y, Lyons M, Dodd LJ, Al-Nuaim A. An investigation into the lifestyle, health habits and risk factors of young adults. *International Journal of Environmental Research and Public Health* 2015; 12(4): 4380-4394.
4. Nasreddine L, Naja F, Tabet M, Habbal MZ, El-Aily A, Haikal C, Sidani S, Adra N, Hwalla N. Obesity is associated with insulin resistance and components of the metabolic syndrome in Lebanese adolescents. *Annals of Human Biology* 2012; 39(2): 122-128.
5. Rinaldi AE, de Oliveira EP, Moreto F, Gabriel GF, Corrente JE, Burini RC. Dietary intake and blood lipid profile in overweight and obese school children. *BMC Research Notes* 2012; 5: 598.
6. Alsheikh-Ali AA, Omar MI, Raal FJ, Rashed W, Hamou O, Kane A, Alami M, Abreu P, Mashhoud WM. Cardiovascular risk factor burden in Africa and the middleeast: the Africa middleeast cardiovascular epidemiological (ACE) study. *PLoSOne* 2014; 9(8): e102830.
7. Salim EI, Moore MA, Al-Lawati JA, Al-Sayyad J, Bazawir A, Bener A, Corbex M, El-Saghir N, Habib OS, Maziak W, Mokhtar HC, Seif-Eldrin IA, Sobue T. Cancer epidemiology and control in the Arab world—past, present and future. *Asian Pacific journal of cancer prevention* 2009; 10(1): 3-16.
8. World Health Organization (WHO). October 2017. Obesity and overweight. Retrieved on May 30, 2018 from WHO Website: <http://www.who.int/news-room/factsheets/detail/obesity-and-overweight>
9. Letourneux V. *Precarious Employment and Working Conditions in Europe*. Dublin, Ireland: Wyatt Ville Road Loughlinstown. 1993.
10. Baysal A. *Beslenme*. 10th ed. Ankara: Hatiboğlu Yayınları. 2004
11. Korkusuz R. Vardiyalı (postalar halinde) çalışma ve Türk iş hukukundaki düzenlemesi. *Gazi Üniversitesi Hukuk Fakültesi Dergisi* 2005;9(1-2), 1-18.
12. Yücecan S. *Optimal beslenme*. Hacettepe Üniversitesi Sağlık Bilimleri Fakültesi Beslenme ve Diyetetik Bölümü. Ankara: Klamat Matbaacılık. 2008.
13. Günaydın N. Bir Devlet hastanesinde çalışan hemşirelerin uyku kalitesi ve genel ruhsal durumlarına etkisi. *Journal of Psychiatric Nursing* 2014;5(1), 33-40.
14. Ermiş E, Doğan E, Erilli NA, Satıcı A. Üniversite öğrencilerinin beslenme alışkanlıklarının incelenmesi: Ondokuz Mayıs Üniversitesi Örneği. *Spor ve Performans Araştırmaları Dergisi* 2015; 6(1): 30-40.
15. Manenschijn L, van Kruysbergen RG, de Jong FH, Koper JW, van Rossum EF. Shift work at young age is associated with elevated long-term cortisol levels and body mass index. *The Journal of Clinical Endocrinology & Metabolism* 2011; 96(11): 1862-1865.
16. Zhao I, Turner C. The impact of shiftwork on people's daily health habits and adverse health outcomes. *Australian Journal of Advanced Nursing* 2008; 25(3): 8.
17. Oh J, Yim HW. Association between rotating night shift work and metabolic syndrome in Korean workers: differences between 8-hour and 12-hour rotating shift work. *Industrial Health* 2018; 7; 56(1): 40-48.
18. Esquirol Y, Bongard V, Mabile L, Jonnier B, Soulat JM, Perret B. Shift work and metabolic syndrome: respective impacts of job strain, physical activity and dietary rhythms. *Chronobiology International* 2009; 26(3): 544-559.
19. Nea FM, Pourshahidi LK, Kearney JM, Livingstone MBE, Bassul C, Corish CA. A qualitative exploration of the shift work experience: the perceived effect on eating habits, life style behaviours and psychosocial wellbeing. *Journal of Public Health* 2018; 1-11.
20. Buchvold HV, Pallesen S, Øyane NM, Bjorvatn B. Associations between night work and BMI, alcohol, smoking, caffeine and exercise - a cross-sectional study. *BMC Public Health* 2015; 15: 1112.
21. Linseisen J, Wolfram G. Nährstoffzufuhr bei Dauernachtschicht-Arbeitern [Nutrient intake in permanent night shift workers]. *Zeitschrift für Ernährungswissenschaft* 1994; 33(4): 299-309.
22. Itoh H, Weng Z, Saito H, Ogawa Y, Nakayama K, Hasegawa-Ohira M, Morimoto K, Maki S, Takahashi M. Association between Night-shift Work and Serum 25-hydroxyvitamin D Levels in Japanese Male Indoor Workers: A Cross-sectional Study. *Industrial Health* 2011; 49(5): 658-62.
23. Romano A, Vigna L, Belluigi V, Conti DM, Barberi CE, Tomaino L, Consonni D, Riboldi L, Tirelli AS, Andersen LL. Shift work and serum 25-OH vitamin D status among factory workers in Northern Italy: Cross-sectional study. *Chronobiology International* 2015; 32(6): 842-847.
24. Li Y, Wang C, Zhu K, Feng RN, Sun CH. Effects of multivitamin and mineral supplementation on adiposity, energy expenditure and lipid profiles in obese Chinese women. *International Journal of Obesity* 2010; 34: 1070-077.
25. Major GC, Doucet E, Jacqmain M, St-Onge M, Bouchard C, Tremblay A. Multivitamin and dietary supplements, body weight and appetite: results from a cross-sectional and a randomised double-blind placebo-controlled study. *British Journal of Nutrition* 2008; 99: 1157-1167.
26. Ha M, Park J. Shiftwork and metabolic risk factors of cardiovascular disease. *The Journal of Occupational Health* 2005; 47: 89-95.

27. Zverev YP, Misiri HE. Perceived effects of rotating shift-work on nurses' sleep quality and duration. *Malawi Medical Journal* 2009; 21(1): 19-21.
28. Hulsegge G, Boer JM, van der Beek AJ, Verschuren WM, Sluijs I, Vermeulen R, Proper KI. Shift workers have a similar diet quality but higher energy intake than day workers. *Scandinavian Journal of Work, Environment & Health* 2016; 42(6): 459-468.
29. Yoshizaki T, Kawano Y, Noguchi O, Onishi J, Teramoto R, Sunami A, Yokoyama Y, Tada Y, Hida A, Togo F. Association of eating behaviours with diurnal preference and rotating shift work in Japanese female nurses: a cross-sectional study. *BMJ Open* 2016; 28; 6(11): e011987.
30. Morikawa Y, Miura K, Sasaki S, Yoshita K, Yoneyama S, Sakurai M, Ishizaki M, Kido T, Naruse Y, Suwazono Y, Higashiyama M, Nakagawa H. Evaluation of the Effects of Shift Work on Nutrient Intake: A Cross-sectional Study. *Journal of Occupational Health* 2008; 50: 270-278.
31. Mashhadi NS, Saadat S, Afsharmanesh MR, Shirali S. Study of association between beverage consumption pattern and lipid profile in shift workers. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews* 2016; 10(4): 227-229.
32. Fernández Rodríguez MJ, Bautista Castaño I, Bello Luján L, Hernández Bethencourt L, Sánchez Villegas A, Serra Majem L. Nutritional evaluation of health shift workers from the Canary Islands. *Nutrición hospitalaria* 2004; 19(5): 286-91.
33. Knutson A, Andersson H, Berglund U. Serum lipoproteins in day and shift workers: a prospective study. *British Journal of Industrial Medicine* 1990; 47(2): 132-134.

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