





INTEGRATIVE LITERATURE REVIEW ARTICLE

NUTRITIONAL CONDITION AND FOOD BEHAVIOR IN SHIFT WORKERS

ESTADO NUTRICIONAL E COMPORTAMENTO ALIMENTAR EM TRABALHADORES EM TURNOS

CONDICIÓN NUTRICIONAL Y COMPORTAMIENTO ALIMENTARIO EN TRABAJADORES EN TURNOS

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ABSTRACT

Objective: to systematize the knowledge about the effects of shift work on nutritional status and eating behavior in shift workers. **Method:** this is a bibliographic study, integrative literature review, with double collection in MEDLINE, Web of Science and Science Direct databases applying the controlled descriptors in health: “Shift Work Schedule” and “Nutritional Status” And “Food Behavior”, for papers published between 2014 and 2019. **Results:** six articles were found and the association between shift work, overweight / obesity and inappropriate eating habits was found. **Conclusion:** it was concluded that overweight and inadequate eating behavior are risk factors for health problems, and nutrition education and sleep hygiene during the work schedule are recommended to improve the quality of life of these workers. **Descriptors:** Shift Work Schedule; Nutritional Status; Feeding Behavior; Circadian Rhythm; Sleep Deprivation; Healthy Diet.

RESUMO

Objetivo: sistematizar o conhecimento acerca dos efeitos do trabalho em turnos no estado nutricional e comportamento alimentar em trabalhadores em turnos. **Método:** trata-se de um estudo bibliográfico, tipo revisão Integrativa da literatura, com coleta em dupla nas bases de dados MEDLINE, Web of Science e Science Direct aplicando-se os descritores controlados em saúde: “Shift Work Schedule” and “Nutritional Status” and “Feeding Behavior”, para trabalhos publicados entre 2014 e 2019. **Resultados:** encontraram-se seis artigos e se verificou a associação entre trabalho em turnos, sobrepeso/obesidade e hábitos alimentares inadequados. **Conclusão:** concluiu-se que o excesso de peso e o comportamento alimentar inadequado são fatores de risco para agravos à saúde, e ações de educação nutricional e higiene do sono durante a escala de trabalho são recomendadas para melhorar a qualidade de vida desses trabalhadores. **Descritores:** Jornada de Trabalho em Turnos; Estado Nutricional; Comportamento Alimentar; Ritmo Circadiano; Privação do Sono; Dieta Saudável.

RESUMEN

Objetivo: sistematizar el conocimiento sobre los efectos del trabajo por turnos sobre el estado nutricional y el comportamiento alimentario en los trabajadores por turnos. **Método:** este es un estudio bibliográfico, tipo de revisión de literatura integradora, con doble recolección en las bases de datos MEDLINE, Web of Science y Science Direct que aplican los descriptores controlados en salud: “Shift Work Schedule” y “Nutritional Status” y “Feeding Behavior”, para artículos publicados entre 2014 y 2019. **Resultados:** se encontraron seis artículos y se encontró la asociación entre el trabajo por turnos, el sobrepeso / obesidad y los hábitos alimenticios inapropiados. **Conclusión:** se concluyó que el sobrepeso y el comportamiento alimentario inadecuado son factores de riesgo para problemas de salud, y se recomienda la educación nutricional y las acciones de higiene del sueño durante la escala de trabajo para mejorar la calidad de vida de estos trabajadores. **Descritores:** Jornada de Trabajo en Turnos; Estado Nutricional; Comportamiento Alimentario; Ritmo Circadiano; Privación de Sueño; Dieta Saludable.

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INTRODUCTION

It is known that the contemporary society, increasingly accelerated and hyperconnected, develops economic activities, production and communication without interruption, being called 24/7¹ or "24 hour society"², condition that brings behavioral change and effects on the lives of people, especially workers.

In addition, in Brazil, the number of workers totaled approximately 104.7 million in 2018, an increase of 816 thousand (or 1.7%) compared to 2017.³ It is detailed that part of these workers work the weekly shift beyond the daytime, ie, atypical hours, called shift workers, irregular or night hours.² According to the National Continuous Household Sample Survey (NCHSS), 6.933 million people worked full-time (from 10 pm to 5 am the following day) or part-time (day and night hours) in 2016, compared to 5.948 million in 2015.⁴

It is reported that shift work can change the circadian rhythm with consequences on worker health.⁵ It was pointed out in a recent study that 15% of the Brazilian adult population has sleep disorders,⁶ which constitute important risk factors in the etiology of chronic and nutritional diseases, including gastric diseases, sleep disorders, cancer,⁷ Diabetes Mellitus,⁸ dyslipidemia,⁹ cardiovascular diseases,¹⁰⁻² metabolic syndrome,¹³ decreased blood glucose tolerance, increased blood pressure, obesity and poor diet.¹⁴⁻⁶

In this sense, two aspects were considered relevant for this study: first, the growth of work demands and the advance of unconventional working hours; second, the finding, by searching databases, that there is a limitation of investigations that compiled scientific evidence describing or pointing associations between changes in sleep pattern, nutritional status and eating behavior in shift workers.¹⁷

OBJECTIVE

- To systematize knowledge about the effects of shift work on nutritional status and eating behavior in shift workers.

METHOD

This is an integrative literature review (ILR) study, which provides the synthesis of scientific knowledge about an object of study that, through a combination of scientific evidence and reflective critical analysis, contributes to broaden their dissemination and point and discuss knowledge gaps, an investigation that corroborates evidence-driven clinical practice.¹⁸

The process of this ILR was conducted by six steps as follows: establishment of the hypothesis or research question; sampling or literature search; categorization of studies; evaluation of studies included in the review; interpretation of results; knowledge synthesis and review presentation.¹⁹

The guiding question of this study was based on the PICO strategy, which guides the construction of questions that include the following aspects: P - patient or population studied; I - intervention or condition to be evaluated; C - comparison or group to compare intervention and O - expected results.²⁰ It was chosen to prioritize the studied population (P: shift workers), the condition to be evaluated (I: nutritional status), the comparison (C: workers' eating behavior in the different shifts) and the expected results (O : effects on worker health). Thus, the guiding research question was: "What is the evidence from scientific studies on the effects of shift work on nutritional status and eating behavior in shift workers?".

Data was collected in May 2019, in which researchers systematically searched for articles in a combined manner in the following databases: Medical Literature Analysis and Retrieval System (MEDLINE), Web of Science, and Science Direct, using the following descriptors, controlled in health (DeCS): "Shift Work Schedule" and "Nutritional Status" and "Feeding Behavior".

Scientific articles indexed in these databases, with full original texts, published between January 1, 2014 and May 9, 2019, available electronically in Portuguese languages, English and Spanish, with available abstract, that used exclusively epidemiological model and that portrayed the theme of study were included. Duplicate articles found in databases and those not performed in humans were excluded.

Initially, six publications were identified in MEDLINE; 966 in WEB OF SCIENCE and 3012 in SCIENCE DIRECT, totaling 3984 publications, eliminating three duplicate studies. The abstracts were then read, and 3924 studies were excluded because they were not primary articles and did not address the research theme. Then, 57 articles were read in full and, after careful analysis, 53 were excluded because they did not meet the inclusion criteria.

A hand search was performed on the four selected articles, ie, manual search of scientific articles based on the references of previously selected articles, which added two more articles to the previously selected, totaling six articles, as represented in the flowchart (Figure 1).

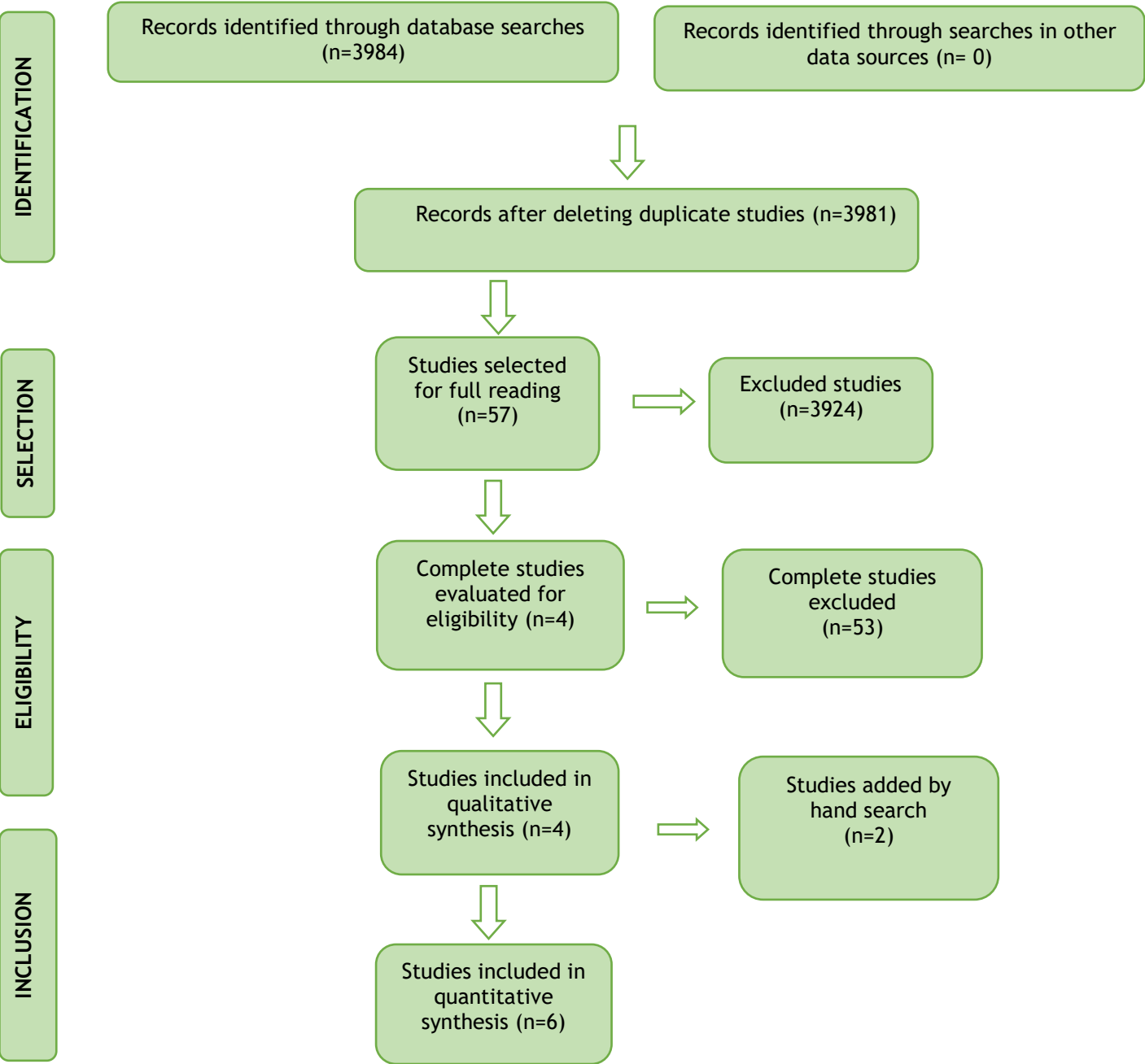


Figure 1. Flowchart of study selection adapted from Preferred Reporting Items for Systematic Reviews and Meta-Analyzes (PRISMA 2009). Catalão (GO), Brazil, 2019.

After reading the articles carefully, the information was extracted and transcribed into an instrument designed and validated for this purpose.²¹ The following data was collected from this instrument: title; authorship; year of publication; data base; level of evidence; sample (n); instrument used; key words; study design; synthesis of results and conclusions. The journal in which the study was published, the country where the research was developed and the language of the article were added (Figure 2).

Title	Author, Journal, Year of publication	Country, language, database, evidence level and n	Instrument used, keywords and study design	Summary of Results	Conclusion
Nutritional status and eating habits of bus drivers during the day and night.	Balieiro, Rossato, Waterhouse, Paim, Mota, Crispim. Chronobiology 2014	Brazil English MEDLINE IV n=150	Questionnaires (sociodemographic and food frequency), anthropometric evaluation and periodic examination Abdominal obesity, bus drivers, food intake, nutritional status, obesity, shift workers Cross-sectional	Night workers had higher prevalence of being overweight and obese (BMI>25kg/m ²) than day workers (78.2% day workers versus 90.2% night workers; p=0.004) and increased WC (>94cm) (72.4% day workers versus 86.4% night workers; p=0.03). Night workers had a lower intake of vegetables than recommended compared to day workers (100 versus 92.7%, respectively, p=0.01) and higher intake of oil (40.7 versus 24.6%, p=0.03).	It is concluded that night workers had a higher prevalence and risk of being overweight/obese and increased WC compared with day workers. Night workers also presented a higher proportion of inappropriate intakes of food groups when compared to day workers.
Association of body mass index with lifestyle and rotating shift work in Japanese female nurses.	Tada, Kawano, Maeda, Yoshizaki, Sunami, Yokoyama, <i>et al.</i> BMJ Open 2014	Japan English Web of Science/hand search IV n=2758	Self-administered questionnaires and food frequency questionnaire Palavras-chave: não consta Cross-sectional	BMI was significantly (P<0.05) higher in rotating shift workers (SW) than in day workers (DW). SW consumed significantly (P<0.05) fewer potatoes and starches, green/yellow vegetables, white vegetables, fruits, algae, fish and shellfish, and meats, but more confectioneries, alcoholic beverages, and sugar-sweetened beverages than DW.	Higher consumption of sugar-sweetened beverages and shorter sleep duration were associated with rotating shift work and higher BMI.
Food and nutrient intake among workers with different shift systems.	Hemiö, Puttonen, Viitasalo, Härmä, Pelttonen, Lindström. Occup Environ Med 2015	Finland English Web of Science/hand search IV n=1478	Laboratory tests, physical measurements and food intake questionnaire Palavras-chave: não consta Cross-sectional	Shift working men were less likely to consume vegetables (p<0.001) and fruits (p=0.049) daily than male day and in-flight workers. In women, energy intake from saturated fat was higher among shift workers compared with day workers (12.6 vs 12.2%, p=0.023).	Shift workers' shift schedule may have an impact on workers' food choices.
Association of eating behaviours with diurnal preference and rotating shift work in Japanese female nurses: a cross-sectional study.	Yoshizaki, Kawano, Noguchi, Onishi, Teramoto, Sunami, <i>et al.</i> BMJ Open 2016	Japan English Web of Science IV n=162	Self-administered questionnaires Palavras-chave: não consta Cross-sectional	The scores for meal contents and temporal eating patterns (irregularity of timing and number of meals taken during the day and delay in timing of meals) significantly differed between the groups (p<0.05), indicating an unbalanced diet and more irregular timing of meals among rotating shift workers compared with day workers. In our samples, the score for temporal dietary patterns was significantly and positively associated with BMI (Pearson's correlation=0.281, p=0.005).	These results suggest that eating behaviours for rotating shift workers are associated with a more unbalanced diet and abnormal temporal eating patterns and that the associations may be explained by diurnal preference rather than by rotating shift work.
The association between anxiety, hunger, the enjoyment of eating foods and the satiety after food	Santa Cecília Silva, Lopes, Teixeira, Mendes, Borba,	Brazil English Science Direct	Questionnaire and anthropometric measurements	Linear regression indicated that, after a night shift, anxiety scores were negatively associated with hunger before breakfast (p = 0.04) and lunch	It is concluded that night shifts increase mean hunger and anxiety scores. Anxiety levels seem to

intake in individuals working a night shift compared with after taking a nocturnal sleep: A prospective and observational study.	Mota, <i>et al.</i> 2017	IV n=34	Anxiety; Hunger; Nutrition; Satiety; Shift work; Sleep Prospective and observational	(p = 0.03), the enjoyment of eating foods (p = 0.03) and the number of meals eaten during the course of the 24 h (p = 0.03)	interfere with the responses associated with food consumption.
Association of habitual dietary intake with morningness-eveningness and rotating shift work in Japanese female nurses.	Yoshizaki, Komatsu, Tada, Hida, Kawano, Togo. <i>Chronobiology</i> 2018	Japan English Web of Science IV n= 2559	Self-administered questionnaires Rotating shift work, food group intakes, diurnal preference, circadian rhythm, chronotype Cross-sectional	Among these food groups, intakes of green/yellow vegetables, white vegetables, fruits and algae were significantly (p < 0.05) lower in rotating shift workers than in day workers, and intakes of confectioneries/savory snacks and sugar-sweetened beverages were significantly (p < 0.05) higher in rotating shift workers than in day workers.	These results suggest that morningness-eveningness is associated with unbalanced dietary intakes in rotating shift workers as well as day workers, which may partially explain associations between rotating shift work and unfavorable dietary intakes.

Figure 2. Overview of the articles included in the integrative review, 2014 - 2019. Catalão (GO), 2019. Brazil.

For the classification of the level of evidence of the studies, the following reference was used: level I - meta-analysis of multiple controlled studies; level II - individual experimental study; level III - quasi-experimental single-group, nonrandomized, controlled, pre- and post-test or case-control studies; Level IV - non-experimental study as qualitative research or case study; level V - case reports or systematically obtained data of verifiable quality or data from evaluation programs and level VI - opinions of authorities or expert committees.²²

RESULTS

This IR was constituted by the analysis of six articles that answered the guiding question of this study and met the established inclusion criteria. One article was found to be indexed in the MEDLINE database, two articles in the Web of Science and

one in Science Direct. Added to the sample, through the hand search performed in an article of the Web of Science database, were two other articles.

All articles were published in foreign English-language journals, three in US journals and three in the United Kingdom. The studies were conducted in Japan (50%), followed by Brazil (33.3%) and Finland (16.7%), and the sample size (n) involved in the studies is shown in Figure 3.

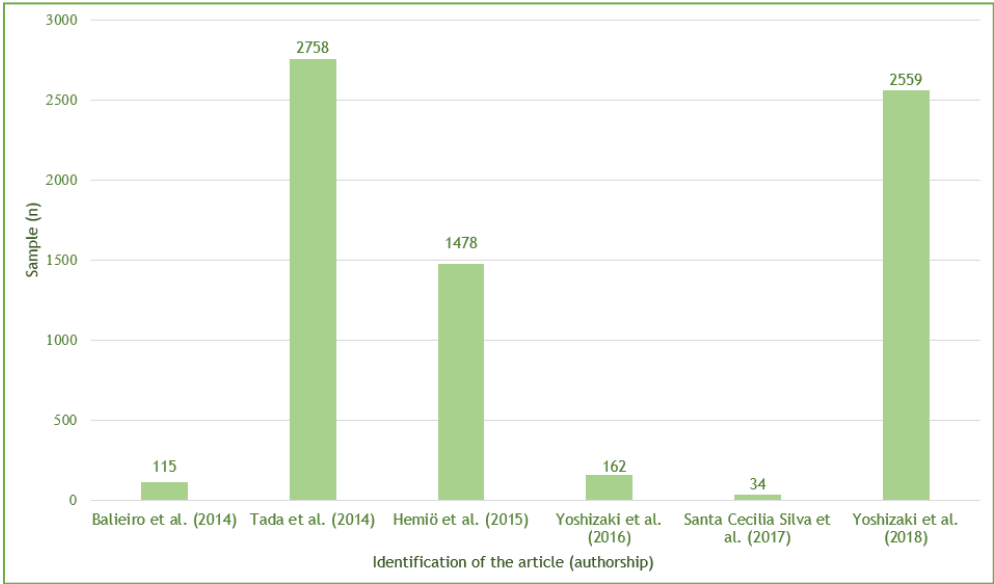


Figure 3. Sample size (n) of analyzed articles 2014-2019. Catalão (GO), Brazil, 2019.

Regarding the profile of shift workers involved in the research, it was revealed that they were nursing professionals (50%),^{15,23-4} bus drivers (16.6%),²⁵ professionals of an airline (16.6%)²⁶ and guards / security guards (16.6%).²⁷ All studies with level of evidence IV were classified and the instruments for data collection were outlined in Figure 4.

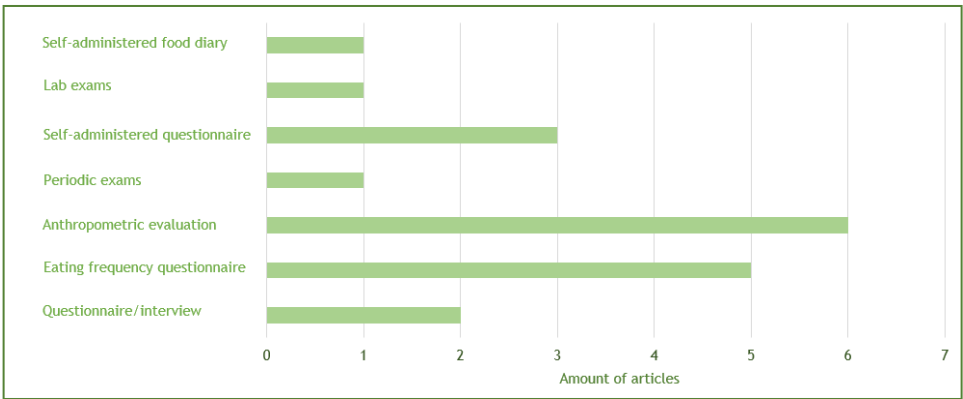


Figure 4. Instruments used for data collection in sample articles 2014-2019. Catalão (GO), Brazil. 2019.

All studies evaluated the participants anthropometrically: in three of them there are self-reported values; in two, measured values and one study did not mention how weight and height

values were obtained. The instruments used to assess food consumption are shown in the articles in Figure 5.

Article (author)	Instrument used for food intake assessment
Balieiro, Rossato, Waterhouse, Paim, Mota, Crispim. (2014) ²⁵	Semi-quantitative Food Frequency Questionnaire (FFQ) - 52 items - validated
Tada, Kawano, Maeda, Yoshizaki, Sunami, Yokoyama, et al. (2014) ²³	QFA - does not cite how many items and whether or not it is validated
Hemiö, Puttonen, Viitasalo, Härnä, Peltonen, Lindström. (2015) ²⁶	QFA - 16 items - validated
Yoshizaki, Kawano, Noguchi, Onishi, Teramoto, Sunami, et al. (2016) ¹⁵	QFA - 55 items - does not mention whether or not it is validated
Santa Cecília Silva, Lopes, Teixeira, Mendes, Borba, Mota, et al. (2017) ²⁷	Self-administered food diary
Yoshizaki, Komatsu, Tada, Hida, Kawano, Togo. (2018) ²⁴	QFA - does not cite how many items and whether or not it is validated

Figure 5. Instruments used for the assessment of food consumption used in the articles analyzed 2014-2019. Catalão (GO), Brazil, 2019.

It is noteworthy that the objectives found in the research reveal the intention of researchers to evaluate the influence of shift work on behavior and food intake (66.7%), body mass index (16.7%) and anxiety level. and food perception (16.7%).

Regarding the dietary pattern, it was found that shift workers have an inadequate dietary pattern, lower vegetable consumption^{15,23-6} and higher oil consumption, confectionery, alcoholic beverages, sugar-sweetened beverages²³⁻⁴ compared to day workers. From the results emerged a higher prevalence of overweight / obesity in night shift workers than in day workers, namely: 90.2% versus 78.2%²⁵ and 14.1% versus 9.6%,²³ respectively, and shift work was positively associated (p <0.05) with body mass index (BMI).¹⁵

DISCUSSION

This IR was constituted as an innovative investigation by systematizing scientific evidence in one product, which pointed to factors associated with the shift worker and his eating behavior. The compilation of the research results reinforced the vulnerability of workers to chronic health problems associated with their rhythm and period of professional practice, especially eating habits, overweight and obesity, factors that, in turn, enhance the health- disease process, with increased chances of comorbidity. The limitation of the study is admitted, with the absence of analysis of a larger number of researches with evidence of work causality and chronic diseases.

The articles analyzed in MEDLINE were indexed, relating them to the medical and biomedical areas; Web of Science, with themes from various areas of knowledge²⁸ and Science Direct, focusing on Biological Sciences, Health, Social and Human Sciences, Engineering and Physics.²⁹

Half of the studies were conducted in Japan, a country commonly recognized for its extensive working hours.³⁰ Arose in the 1970s the term Karoshi or death from overwork³¹ associated with working hours, shifts and times of irregular periods, among other factors.³² In this country, nurses from the public network of a municipality were evaluated in this country, with a sample of 2,758, the largest analyzed by this IR. It is

reported that contributed to the size of the sample accessibility and availability of elements of the population to participate in the study³³ and, from a statistical point of view, it is emphasized that a representative and random sample is fundamental for the information collected to be generalizable to the population.³⁴

Most of the research involved nursing professionals who, by the very nature of the profession, deal with the effects of shift work.³⁵ It is known that a study that addresses this theme is common in the health area, as it is one of the sectors that most use shift work due to the need for 24-hour patient care.³⁶

Regarding the methodology, it is detailed that most articles were composed of cross-sectional studies (83.3%), in which cause and effect are evaluated simultaneously,³⁷ with level of evidence IV,²² pointing, therefore, to the importance of developing more robust design studies, with emphasis on those that analyze the effects of interventions in the elaboration of recommendations that increasingly support clinical performance.³⁸ An inherent limitation of this design is the impossibility of establishing causal relationships between shift work and the effects on workers' nutritional status and eating behavior.³⁹

A semi-quantitative food frequency questionnaire was used to evaluate behavior and food intake in 83.3% of the analyzed studies, an evaluation method that estimates the usual intake,⁴⁰ ease of application and being adaptable to various populations.⁴¹ However, it is essential that the instrument be validated in order to ensure the reliability and credibility of the information obtained.⁴² It is noticed that not all articles analyzed ^{15,23-4} specified on the validation of the questionnaires, which may lead to non-reproducible and comparable data,⁴³ as well as the amount of food items present in the instrument. One can, by questionnaires composed of 52 and 55 items,^{15,25} make the interview tiring or increase the lack of answers due to its length.⁴⁴

It is believed that despite the importance of this food consumption assessment instrument,⁴⁵ The choice of method should be based on the

objective of the study.⁴⁶ It was used, to evaluate the perception of hunger as a function of shift work, the food diary,²⁷ which has the advantage of reducing the participant's memory bias as the consumed foods are noted at the time of consumption. However, it is possible to change the consumption, because the participant knows that he is under observation, besides the difficulty in estimating the size of the portions ingested.⁴⁰

In this sense, it was verified by a systematic review carried out in Brazil, that shift workers have higher consumption of foods rich in saturated fat and sugar.⁴⁷ Among Polish nurses and midwives working on rotating night shifts, higher energy intake (2005 Kcal vs 1850 Kcal), higher total fatty acid consumption (77.9 g vs 70.4 g), cholesterol (277 mg vs 258 mg), carbohydrates (266 g vs 244 g) and sucrose (55.8 g vs 48.6 g) compared to daytime professionals.⁴⁸ In another study, shift workers (n = 683) showed higher energy intake than day workers (n = 7173), 2222Kcal and 1990Kcal / day, respectively, with a predisposition to overweight, obesity and other adverse health effects of these individuals.⁴⁹ These findings corroborate the results found,^{15,23-6} found that shift workers have a poorer dietary pattern than daytime workers.

It was suggested by a meta-analysis that analyzed 27 independent studies with shift workers (n = 311,344) that shift work was positively associated with overweight (RR: 1.25; 95% CI: 1.08-1.44) and obesity (RR: 1.17; 95% CI: 1.12-1.22).⁵⁰ In China, a prospective cohort of 3,871 shift workers found that night shift workers were at increased risk of overweight and obesity, with odds ratios (OR) of 1.17 (95% CI, 0.97-1.41) and 1.27 (95% CI, 0.74-2.18), respectively⁵¹ and 82.8% of chemical shift workers were found to be overweight (average BMI: 27.6 kg / m²),⁵² These data are in agreement with the 90.2% of bus drivers of one company (n = 150) who were overweight and obese (BMI > 25 Kg / m²).²⁵

Given the above, the quality of the diet was related to overweight /obesity⁵³ and constitutes a risk factor for chronic health problems.⁵⁴

CONCLUSION

This IR pointed to the association between shift work hours, weight gain and inadequate food intake, which constitutes a risk factor for metabolic and nutritional diseases.

It is believed that studies with more robust design, preferably experimental and longitudinal, could elucidate the identified associations and point to actions that promote nutritional education and sleep hygiene during the work scale in order to improve the quality of life of these professionals.

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