



Chronobiology: Proper Feeding to Sleep Cycles

Ana Luiza Vaqueiro Ramos¹, Anna Julia Coutinho¹, Anna Julia Lemos de Moura¹, Bárbara Beatriz Michelini¹, Daniel Martinez¹, Natalia Sanmiguel¹, Idiberto José Zotarelli-Filho^{2,3,4,*}, Ana Valéria Garcia Ramirez^{2,5}, Durval Ribas Filho^{1,2}

¹ FAMECA, Faculty of Medicine of Catanduva - Padre Albino University Center, Catanduva/SP, Brazil.

² Associação Brasileira de Nutrologia (ABRAN)/Brazilian Association of Nutrology, Catanduva/SP, Brazil.

³ FACERES – Faculty of medicine of São José do Rio Preto/SP, Brazil.

⁴ Zotarelli-Filho Scientific Work, São José do Rio Preto/SP, Brazil.

⁵ Ana Valeria Ramirez Clínica- Clinic of Nutrition and Health Science, São José do Rio Preto SP, Brazil.

*Corresponding author Email: dr.idibertozotarelli@faceres.com.br

DOI: <https://doi.org/10.34256/mdnt2012>

Received: 11-11-2020; Accepted: 16-11-2020; Published: 16-11-2020

Abstract: Chronobiology is the process that studies the biological rhythms of living beings, in which each organism has its own biological clock. Sleep is a state of unconsciousness, characterized by the active inhibitory process, and that has an important relationship with feeding, mainly due to the possibility of sleep deprivation increasing starvation through hormonal regulation. In addition, starvation can lead to obesity, contributing to the risk factors for chronic non-communicable diseases, such as high blood pressure, hypercholesterolemia, diabetes mellitus, cardiovascular diseases, and some forms of cancer. The cycle of bad sleep may cause direct health problems, such as the diseases mentioned above; and indirect, may result in traffic accidents, unemployment, and difficulties in interpersonal relationships, with the possibility of progressing to anxiety disorders. This study aims to analyze whether there is a relationship between healthy eating and the standard of sleep quality, providing better performance of daily activities. For this study, the 133 participants answered 3 feeding records and, later, questionnaires on sleep quality (Pittsburgh Sleep Quality Index) in three moments. Considering the three questionnaires, there were no significant differences obtained by calculating the statistical tests, however, the analysis of the gross medians with the proposed score showed a strict relationship between sleep and food. In addition to the relationship between food and sleep quality, other factors such as stress and anxiety can contribute to hormonal dysregulation, thus changing the pattern of sleep quality of individuals.

Keywords: Chronobiology, Sleep quality, Feeding, Health problems

1. Introduction

Sleep is by definition a state of unconsciousness, which is altered when a stimulus hits us; and it is classified into two types, called REM sleep (Rapid Eye Movement) and slow-wave sleep or NREM (Non-Rapid Eye Movement) [1]. NREM sleep is divided into stages (1, 2, 3, 4) and REM sleep, with a young adult, usually having four to six cycles of these, depending on the total amount of hours of sleep. The first cycle lasts approximately 90 minutes, being marked by the transition from the relaxed waking state to stage 1, and then to stage 2; sleep deepens and reaches stages 3 and 4 (NREM). After this period, there is the first REM sleep, lasting between 2 and 10 minutes, characterizing the end of the first cycle. The second cycle starts at stage 2 [2].

Sleep physiology is based on an active inhibitory process, caused by the centers located below the mid-pontine region of the brain stem, resulting in a blockage of other regions of the brain. Also, stimulation in the raphe nuclei, located in the lower half of the bridge and the bulb, in some areas in the nucleus of the solitary tract, in the rostral part of the hypothalamus (suprachiasmatic area) and the diffuse projection thalamic nuclei, can lead to sleep natural [1].

Chronobiology is the process that studies the biological rhythms of living beings so that each organism has its biological clock [3]. The circadian cycle, known as an internal clock of approximately 24 hours, is located in the suprachiasmatic nucleus of the hypothalamus, and its function is to regulate sleep and consolidate the sleep-wake cycle [2].



Sleep has an important relationship with food, mainly due to the possibility of sleep deprivation increases hunger by increasing ghrelin secretion and decreasing leptin secretion [4]. Skipping breakfast and eating irregularly throughout the day, low intake of high-quality carbohydrates, low protein intake, frequent consumption of energy, and sugary drinks, is related to sleepless nights [5]. Also, there was a significant association between short sleep duration and a higher prevalence of weight gain or obesity, with increased waist circumference and the percentage of body fat.

Studies on the trend of changes in the dietary pattern of the Brazilian population in recent decades highlight the increase in the consumption of meat and processed foods (soft drinks, cookies, and ready meals) and the reduction in the consumption of legumes, roots, and tubers, fruits and vegetables [6]. Brazil is a country with a high rate of obesity, a chronic disease characterized by excess body fat, and among the factors that contribute to people gaining weight are poor eating habits, such as not having a fixed time to eat, exaggerating consumption of fatty foods, taking "trendy diets" (without professional supervision), staying for long periods of fasting and having few meals during the day and in large volumes [7].

Currently, television is the most sought-after vehicle for information in search of food, and this is a major disseminator of advertising with attractive and striking messages about foods that, in the vast majority, are products of high nutritional density. These foods are considered to be practical, and of immediate consumption, facilitating the preparation of meals at home. Also, another factor that appears as a preponderant in purchasing decisions is prices, leading low-income individuals to make purchases of low consumption of fruits and vegetables and products with a high energy density, mainly processed foods, sugar, and oil [8].

In the last decades, Brazil has undergone a rapid nutritional transition, characterized by changes in the structure of individuals' diets. These changes in dietary patterns include a high intake of ultra-processed and industrialized foods that, in turn, have high levels of fat and sugars, contribute to the increase in the prevalence of overweight and obesity, and reduce the individual's quality of life. The increase in the prevalence of obesity, which can be defined as the excessive accumulation of body fat; as well as overweight, has important consequences for the health standard of society. This is because excess weight is

one of the main risk factors for chronic non-communicable diseases, such as arterial hypertension, hypercholesterolemia, diabetes mellitus, cardiovascular diseases, and some forms of cancer. Other diseases such as orthopedic, renal, and hepatic diseases, in addition to osteoarthritis, are also observed in addition to being overweight [9, 10].

According to the World Health Organization (WHO), obesity and high blood pressure are the two main responsible for most deaths and diseases worldwide. Data released by the Brazilian Society of Cardiology indicate that 52% of Brazilian adults are overweight, 11% of whom are obese, which explains the increase in morbidity and mortality for these groups. Obesity, particularly that located in the abdominal region, can increase the risk of the occurrence of type II diabetes tenfold, a fact that can be evidenced by the exponential increase of this disorder in several countries, including Brazil. This form of distribution of body fat has also been associated with the genesis of insulin resistance, which could explain the finding in epidemiological studies of increased risk of arterial hypertension in obese individuals [11-13].

The consequences of sleep disturbance are greater than spending a day in a bad mood or without stimulation to perform day-to-day functions. Many studies indicate that a cycle of sleepless nights will result in poor health, for example, the article "How Does Sleep Affect Your Heart Health?" which illustrates the negative effects of poor sleep on a person's heart, including hypertension, type 2 diabetes, and obesity. It is possible to analyze that the three causes are associated with food, because, according to the researchers, not getting enough sleep leads to an increase in appetite (due to hormonal disorders), anxiety and insulin resistance [14].

There are so many problems related to sleep deficiency that was created in 1979 and published in the magazine *Sleep*, the International Classification of Sleep Disorders (CIDS). In this classification, four groups of disorders are separated, each with its due causes and consequences. Based on this, some scientists claim other deleterious responses caused by poor rest, such as low immunity, stroke, and cancer. Due to these diverse pathologies, research from the University of Stockholm reported that people with restless than 5 hours a night, have a death rate of 65% higher than people who sleep longer [15].

The bad sleep cycle gives rise to direct health problems, as mentioned above; and indirect, since it



can result in traffic accidents, loss of jobs, and even difficulties in interpersonal relationships, with the possibility of progressing to anxiety disorders, as well as feelings of shame and guilt, which are harmful to the quality of life of individuals (, and who will need adaptive responses) [15].

It is known that healthy eating is a determining factor in promoting the health and well-being of the individual and society as a whole, which is why, therefore, the preservation of good eating habits by the Brazilian Federal Constitution, considered as individual and collective rights. To this end, the importance of adequate food from the first years of life was categorized and, as an educational measure, the Ministry of Health created projects and released guidelines in line with the economic and cultural reality of the Brazilian population to promote greater health promotion [16].

Pre-conceived ideas, disseminated by the population in general, that healthy eating consists only of eating vegetables, led the Ministry of Health to publish a basic food guide containing general recommendations accessible to the general population, to help this group to achieve a healthy diet. The guide presents as an example of good nutrition, one that contains fresh or minimally processed foods, consumption of animal and vegetable oils and fats in moderate but not excluding quantities, at least 3 meals a day, daily consumption of 2 liters of water and performing at least 30 minutes of physical exercise per day. Also, to follow the criteria of evaluative scales on food quality, the food pyramid has been reformulated to include new ways of achieving a good diet [17].

In the Food Guide for the Brazilian Population, the Ministry of Health emphasizes that healthy eating consists of consuming all the nutrients according to their adequate portions, without restrictions or exaggerations, in addition to proper hygiene of the foods consumed to avoid poisoning. Therefore, we conclude that healthy eating takes into account the cultural and socioeconomic context of the person, forming new concepts based on the food pyramid, encouraging the consumption of vegetables, legumes, fruits, vegetables, and regional grains [17].

Therefore, the present research aimed to show the existence, or not, of the influence of dietary patterns for the functioning of circadian rhythm and, consequently, for the quality of sleep of individuals.

2. Materials and Methods

The study carried out is of an observational-epidemiological study. In this study, 133 (one hundred and thirty-three) individuals participated, aged 18 to 30 years old, 78 (seventy-eight) women and 55 (fifty-five) men. These were subdivided into four groups: "healthy men" (N = 25); "Unhealthy men" (N = 30); "Healthy women" (N = 38); "Unhealthy women" (N = 40), through the application of a 24 (twenty-four) hour food record for 3 (three) consecutive days; the criteria used in this subdivision were based on the Food Pyramid by Sonia Tucundu Philippi.

After this classification, the participants answered the same questionnaire about the quality of sleep (Pittsburgh Sleep Quality Index) in three moments, with an interval of 15 (fifteen) days each, totaling a period of 30 (thirty) days.

The questionnaire on sleep quality (Pittsburgh Sleep Quality Index) consists of 19 (nineteen) questions, answered by the participants themselves, which are classified into 7 (seven) components, which have weights distributed on a scale of 0 to 3; "These components (...) are the subjective quality of sleep, sleep latency, sleep duration, habitual sleep efficiency, sleep disorders, the use of sleeping pills and daytime dysfunction" [2]. The sum of the scores for each component produces a score ranging from 0 to 21, the higher the score being, the worse the quality of sleep². In addition to those, there are 5 (five) questions for the roommates, of the participants who have them, to answer regarding the participant's sleep patterns (Table 1).

Table 1 Score - Sleep quality questionnaire

Score - Sleep quality questionnaire (Pittsburgh Sleep Quality Index)	
0 to 4 points	Good sleep
5 to 10 points	Bad sleep
> 10 points	Sleep disturbance

3. Statistical Analysis

This is a qualitative analysis of the data. The level of significance (α) adopted was 0.05 (5%). Median and quartiles were considered to ascertain the results obtained by the 3 (three) applications of the sleep quality questionnaire, being applied in the Wilcoxon (paired data) and Mann-Whitney tests (unpaired data). The analysis of the Wilcoxon and Mann-Whitney tests and graphs contained 2



moments: SF1 for healthy women and SF1 for unhealthy women; SF2 of healthy women and SF2 for unhealthy women; SF3 for healthy women and SF3 for unhealthy women; SF1 of healthy men and SF1 of unhealthy men; SF2 of healthy men and SF2 of unhealthy men and SF3 of healthy men and SF3 of unhealthy men (Table 2).

Table 2 Sleep quality questionnaires	
SF1	First sleep quality questionnaire
SF2	Second sleep quality questionnaire
SF3	Third sleep quality questionnaire

4. Results

In the comparison of SF1 of healthy women and SF1 of unhealthy women, the median obtained was 6 and 7 respectively ($p = 0.2697$), concluding that there are no significant differences in the medians for healthy women compared with unhealthy women in the SF1 subgroup (Figure 1).

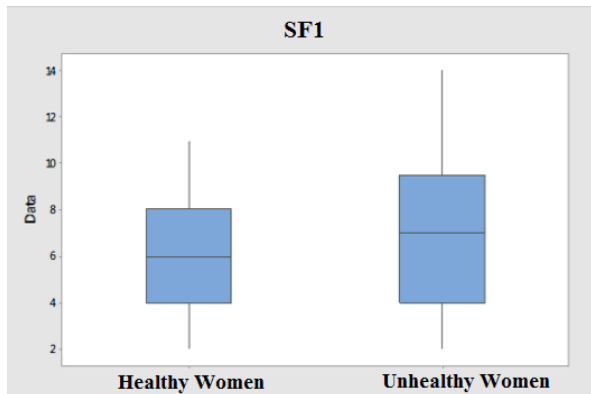


Figure 1 Comparison of SF1 for healthy women and SF1 for unhealthy women.

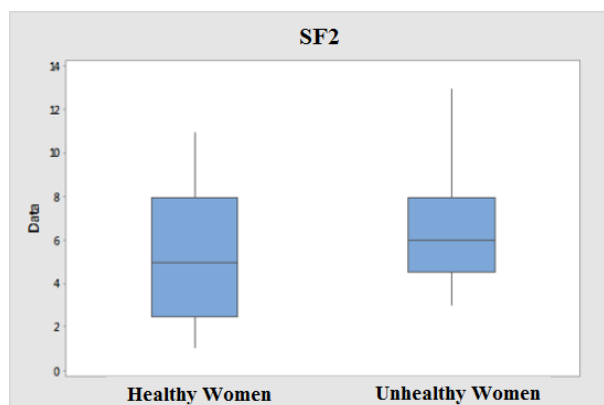


Figure 2 Comparison of SF2 of healthy women and SF2 of unhealthy women.

In the comparison of SF2 of healthy women and SF2 of unhealthy women, the median was obtained was 5 and 7 respectively ($p = 0, 1903$), concluding that there are no significant differences in the medians for healthy women compared with unhealthy women in the SF2 subgroup (Figure 2).

In the comparison of SF3 of healthy women with SF3 of unhealthy women, the median obtained was 4.5 and 6 respectively ($p = 0.7032$). In conclusion, there are no significant differences in medians for healthy women compared to unhealthy women in the SF3 subgroup (Figure 3).

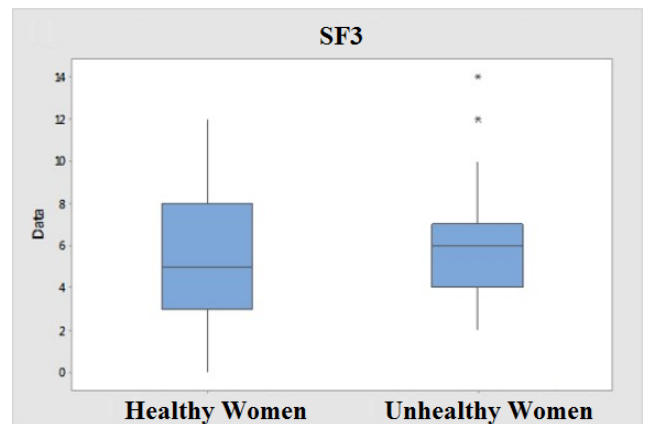


Figure 3 Comparison of SF3 for healthy women and SF3 for unhealthy women

In the comparison of SF1 of healthy men with SF1 of unhealthy men, the median obtained was 4 and 6.5 respectively ($p = 0.0753$). In conclusion, there are no significant differences in medians for healthy men compared to unhealthy men in the SF1 subgroup (Figure 4).

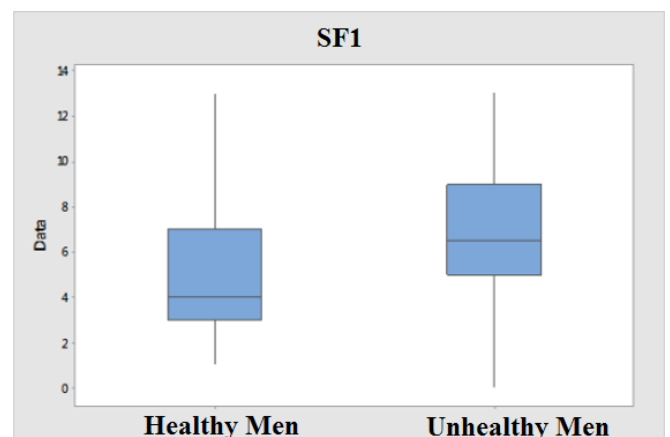


Figure 4 Comparison of SF1 for healthy men and SF1 for unhealthy men.

In the comparison of SF2 of healthy men with SF2 of unhealthy men, the median obtained was 4 and 6 respectively ($p = 0.0512$). In conclusion, there are no significant differences in medians for healthy men



compared to unhealthy men in the SF2 subgroup (Figure 5).

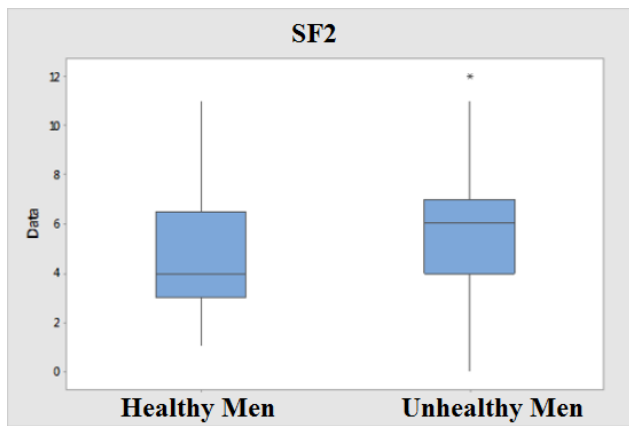


Figure 5 Comparison of SF2 of healthy men and SF2 of unhealthy men.

In the comparison of SF3 of healthy men with SF2 of unhealthy men, the median obtained was 4 and 5 respectively ($p=0.1364$).

Table 3 Score and results of sleep quality between men and women.

QUESTIONNAIRE	SCORE	RESULTS
SF1 healthy women	6	Bad sleep
SF2 healthy women	5	Bad sleep
SF3 healthy women	4,5	Bad sleep
SF1 unhealthy women	7	Bad sleep
SF2 unhealthy women	7	Bad sleep
SF3 unhealthy women	6	Bad sleep
SF1 healthy men	4	Good sleep
SF2 healthy men	4	Good sleep
SF3 healthy men	4	Good sleep
SF1 unhealthy men	6,5	Bad sleep
SF2 unhealthy men	6	Bad sleep
SF3 unhealthy men	5	Bad sleep

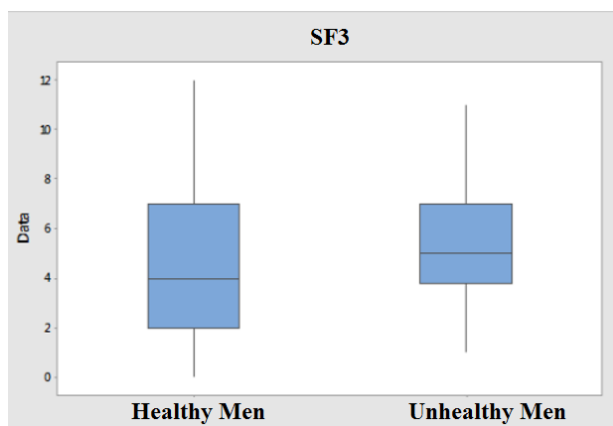


Figure 6 Comparison of SF3 for healthy men and SF3 for unhealthy men.

In conclusion, there are no significant differences in the medians of healthy men compared to unhealthy men in the SF3 subgroup (Figure 6). Table 3 shows the score and the results of sleep quality between men and women.

5. Discussion

The statistical analysis, using the Wilcoxon and Mann-Whitney tests, with a $p > 0.05$ in all criteria, shows that it was not possible to establish a relationship between the quality of food and the quality of sleep in the studied sample, despite so much in SF1, SF2 and SF3, in both groups (female and male), median values of the Pittsburgh Sleep Quality Index (PSQI-BR) for individuals with a healthy eating pattern were slightly lower compared to those of a standard not healthy. However, even with the insignificant p-value, in all comparisons, looking at the score obtained by the gross medians, one can perceive a restricted link between food and sleep.

This discrepancy in results may be associated with some limitations pertaining to the research, such as the global situation resulting from the SARS-CoV-2 pandemic. Recent studies prove that the application of quarantine and social isolation presented themselves as important factors for threatening the psychological well-being of the population as a whole since they have resulted in the appearance of stress, fear, anxiety, panic, guilt, and sadness [18]. The mixture of these negative feelings, with emphasis on worry and stress, promotes increased levels of cortisol in the body, from the activation of the hypothalamic-pituitary-adrenal axis, resulting in changes and sleep disorders [19].

With normal functioning of the hypothalamus-pituitary-adrenal axis, higher levels of cortisol are noted in the morning, just after the individual awakens and, with a decrease throughout the day, reaches his biphasic, the lowest value obtained in the oscillation of the circadian rhythm, around midnight [20]. When there is prolonged internal temporal desynchronization, and, consequently, higher levels of cortisol in the body at atypical times, such as night periods, the individual may develop chronic disorders such as depression or sleep disorders [20].

In addition, as a percentage, it can be observed that within the female group, 31.58% of women with a healthy eating pattern had good sleep quality by PSQI-BR (average score between 0 and 4), against 12, 20% of those with an unhealthy pattern, while this value for the male group was higher



(41.67% versus 16.67%). These results are interesting since they can be associated with higher levels of anxiety among the groups observed, but this issue needs to be better discussed, since there are studies that indicated a difference by the Depression, Anxiety and Stress Scale (DASS-21) between male and female, and studies that did not find a significant difference between these values. As an example of these disagreements, we have the study "Depression, Anxiety and Stress Scale: psychometric properties and prevalence of affectivity" [21] and the study "Anxiety in sexual and gender minorities: an integrative review" [22, 23].

6. Conclusion

In a conclusion, there is a slight relationship between food and sleep quality; however, the current global situation, marked by the SARS-CoV-2 pandemic, helps to understand the results obtained. The physical and psychological effects brought about by the pandemic indicate the influence of stress and anxiety on the two factors in question, causing a disharmony of the circadian rhythm through an irregular release of cortisol. Thus, it is emphasized the importance of carrying out more studies that seek to relate chronobiology to the dietary patterns of individuals in periods when there are no generalized stressful conjunctural interferences so that more concrete information can be provided.

References

- [1] A.C. Guyton, J.E. Hall, Tratado de Fisiologia Médica. 13. ed. Rio de Janeiro: Elsevier, 2017.
- [2] A.N. Bertolazi, Tradução, Adaptação Cultural e validação de dois instrumentos de avaliação do sono: escala de sonolência de Epworth e índice de qualidade de sono de Pittsburgh (2008). <https://lume.ufrgs.br/handle/10183/14041>
- [3] Alessandra Naimaier Bertolazi, Dissertação (Mestrado em Medicina). Faculdade de Medicina, Universidade Federal do Rio Grande do Sul, Porto Alegre (2008). <https://www.lume.ufrgs.br/bitstream/handle/10183/14041/000653543.pdf>
- [4] Liziane Seibt, Vanessa Morais Lima, Kleber Fernando Pereira, Fabio José Bianchi, Larissa R Renata de Oliveira Bianchi, Conhecimento cronobiológico e hábitos de sono de acadêmicos da Universidade Paranaense, Revista Neurociências, 17(3) (2009) 239-245. [DOI](#)
- [5] Hassan S Dashti , Frank Ajl Scheer, Paul F Jacques, Stefania Lamon-Fava, José M Ordovás, Short Sleep Duration and Dietary Intake: Epidemiologic Evidence, Mechanisms, and Health Implications, *Advances in nutrition*, 6(6) (2015) 648-659. [DOI](#) | [PubMed](#)
- [6] M.P. Stonge, A. Mikic, C.E. Pietrolungo, Effects of Diet on Sleep Quality, *Advances in nutrition*, 7(5) (2016) 938-949. [DOI](#) | [PubMed](#)
- [7] R.M. Claro et al., Consumo de alimentos não saudáveis relacionados a doenças crônicas não transmissíveis no Brasil: Pesquisa Nacional de Saúde, 2013. *Epidemiologia e Serviços de Saúde*, 24(2) (2015) 257-265. [DOI](#)
- [8] Recine, E. Radaelli, Patrícia, Ministério da Saúde. Secretaria de Políticas de Saúde - SPS. Departamento de Atenção Básica. Área Técnica Alimentação e Nutrição. Universidade de Brasília - UnB. Faculdade de Ciências da Saúde. Departamento de Nutrição. <https://pesquisa.bvsalud.org/portal/resource/pt/lis-LISBR1.1-16905>
- [9] I.C. Bento, J.M.M. Esteves, T.E. França, Alimentação saudável e dificuldades para torná-la uma realidade: percepções de pais/responsáveis por pré- escolares de uma creche em Belo Horizonte/MG, Brasil, *Ciência & Saúde Coletiva*, 20(8) (2015) 2389-2400. [DOI](#)
- [10] T. Weinreich, H.P. Filz, U. Gresser and B.M. Richartz, Effectiveness of A Four-Week Diet Regimen, Exercise and Psychological Intervention for Weight Loss, *Journal of Clinical & Diagnostic Research*, 11(3) (2017) 20-24. [DOI](#) | [PubMed](#)
- [11] Aline Brandão Mariath, Luciane Peter GrilloI, Raquel Oliveira da Silva, Patrícia Schmitz, Isabel Cristina de Campos, Janete Rosa Pretto MedinaII, Rejane Magda Kruger, Obesidade e fatores de risco para o desenvolvimento de doenças crônicas não transmissíveis entre usuários de unidade de alimentação e nutrição, *Cadernos de Saúde Pública*, 23(4) (2007) 897-905. [DOI](#)
- [12] Inácio Swarowsky, Éboni Marília Reuter, Caroline Ferreira, Paloma Priebe, Dulciane Nunes Paiva, Hildegard Hedwig Pohl, Obesidade e fatores associados em adultos, *Cinergis*, 13(1) (2012) 64-71. [DOI](#)
- [13] E.B. Souza, Transição nutricional no Brasil: análise dos principais fatores, *Cadernos UniFOA*.



- 5(13) (2010) 49-53.
- [14] S.R.G. Ferreira, M.T. Zanella, Epidemiologia da hipertensão arterial associada à obesidade. *Revista Brasileira de Hipertensão*, 7(2) (2000) 128-135.
- [15] How Does Sleep Affect Your Heart Health?. Centers for Disease Control and Prevention, 2018. Available from: <https://www.cdc.gov/features/sleep-heart-health/index.html> Accessed on 13 May 2020.
- [16] M.R. Müller, S.S. Guimarães, Impacto dos transtornos do sono sobre o funcionamento diário e a qualidade de vida, *Estudos de Psicologia*, 24(4) (2007) 519-528. [DOI](#)
- [17] Patrícia Constante Jaime, Sheila Rizzato Stopa, Taís Porto Oliveira, Maria Lúcia Vieira, Célia Landmann Szwarcwald, Deborah Carvalho Malta, Prevalence and sociodemographic distribution of healthy eating markers, National Health Survey, Brazil 2013, *Epidemiologia e Serviços de Saúde*, 24(2) (2015) 267-276. [DOI](#)
- [18] Ministério Da Saúde, Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Guia alimentar para a população brasileira. Biblioteca Virtual em Saúde MS, (2014). https://bvsms.saude.gov.br/bvs/publicacoes/guia_alimentar_populacao_brasileira_2ed.pdf Accessed 13 May 2020.
- [19] W.B. Dias et al., Impacts on mental health caused by the sars-cov-2 pandemic and social isolation: an experience report, *Research, Society and Development*, 9(8) (2020) e979986876. [DOI](#)
- [20] M.C.P. Rocha, M.M.F. Martino, Estresse e qualidade do sono entre enfermeiros que utilizam medicamentos para dormir, *Acta Paulista de Enfermagem*, 22(5) (2009) 658-665. [DOI](#)
- [21] T. Adamowicz, Estudo dos efeitos da acupuntura sobre os padrões de sono e a secreção de cortisol em mulheres com dor crônica, *Dissertação (Mestrado em Biologia Celular e Molecular) – Universidade Federal do Paraná*, (2010). <https://core.ac.uk/reader/147517680> Accessed 1st September 2020.
- [22] MARTINS, Bianca Gonzalez, SILVA, Wanderson Roberto da, MAROCO, João and CAMPOS, Juliana Alvares Duarte Bonini, Escala de Depressão, Ansiedade e Estresse: propriedades psicométricas e prevalência das afetividades, *Jornal Brasileiro de Psiquiatria*, Rio de Janeiro, 68(1) (2019) 32-41. [DOI](#)
- [23] Leilane Camila Ferreira de Lima Francisco, Alice Correia Barros, Mariana da Silva Pacheco, Antonio Egídio Nardi, Verônica de Medeiros Alves, Ansiedade em minorias sexuais e de gênero: uma revisão integrativa, *Jornal Brasileiro de Psiquiatria*, Rio de Janeiro, 69(1) (2020) 48-56. [DOI](#)

Acknowledgement

Nil

Funding

Nil

Authors Contribution

Data sharing statement

No additional data are available

Ethics Approval

Approval was sought and granted by the Departmental Ethics Committee.

Informed consent

All participants gave written informed consent to participate in this study.

Conflict of interest

The authors declare no conflict of interest.

About The License

© The author(s) 2020. The text of this article is open access and licensed under a Creative Commons Attribution 4.0 International License