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INFLUENCE OF DIETARY INTAKE ON SLEEP QUALITY OF COLLEGE STUDENTS

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ABSTRACT

Introduction: There has been a lot of emerging knowledge about consumption of certain foods and their effect on sleep quality and duration. This study was aimed at exploring such associations between dietary intake and sleep quality. The rationale behind the study is to determine the impact of different foods on sleep quality that may further aid in developing strategies to improve sleeping patterns of the population. The study may also help to increase the awareness among people regarding healthy foods, importance of sleep, and sleep deprivation. **Method**: A survey was conducted from November 22019 to march 2020 and 100 student participants aged between 18-25 years were selected using random sampling. Data was collected using food frequency questionnaire, and Pittsburgh Sleep Quality Index (PSQI), and was analysed with the help of chi square and binary logistic regression tests. **Results**: The study showed a mean PSQI score of 5.6±2.7, suggesting poor sleep quality among students. Half of the subjects slept for less than 7 hours each night, as against recommended by National Sleep Foundation. Foods like soybeans, milk, leafy greens, fruits, green tea and coffee were found to have significant association with quality Knowledge about these foods and their influence on sleep can be of much importance in treating sleep related problems of sleep. **Conclusion**: Significant associations were found between specific foods and sleep quality thus indicating the role of dietary intake in obtaining proper sleep.

Keywords: Tryptophan, dietary intake, sleep quality, melatonin

INTRODUCTION

Sleep can be described as a resting state, both physical and mental wherein, a person becomes comparatively inactive and less aware of their surroundings **[1]**. Homeostatic physiology of circadian rhythm or sleep/ wake cycle mediates our major behavioural and physiological processes. Suprachiasmatic nucleus, located in the anterior of hypothalamus controls this biological clock **[2]**. People of different age groups need varying amounts of sleep. Adults need around 7-8 hours of sleep while teenagers and infants require more **[1]**.

Sleep deprivation is prevalent in college students. Lesser duration of sleep, increased daytime sleepiness and insomnia are also common in students around the world **[3]**. Sleep deprivation is attributable to aspects like workload, technology, social media (SM) use, stress, and inactive lifestyle **[2]**. Chronic conditions like obesity, cardiovascular diseases (CVD), and metabolic disorders can be consequences of long- term sleep deprivation **[4]**. Apart from numerous social, biological, and psychological factors that influence sleep, dietary intake plays crucial role that has remained an under rated factor **[3]**. Previous researches have suggested relationships between some nutrients, and sleep quality, and duration **[2]**. Functional components present in functional foods like barley grass powder, melatonin, potassium, tryptophan, gamma-Aminobutyric acid (GABA), and calcium have been shown to promote sleep **[5]**. Supplementing dietary tryptophan may spur serotonergic activity, and hence, enhance sleep **[6]**. There are medications used to treat and improve symptoms of insomnia that contain melatonin and GABAas their active components **[7]**. There have been links established between whole foods and sleep parameters **[3]**. Foods rich in sugar have been shown to negatively affect sleep duration **[5]**. Excessive intake of caffeine around >500 mg/day can lead to insomnia, headache and affect sleep quality and duration **[8]**. Barley grass powder has been shown to promote sleep because of presence of calcium, magnesium and GABA **[5]**. Higher fruit and vegetable consumption is associated with increased sleep duration (> 8hours/night) **[9]**. Leafy greens have been shown to promote sleep. They are rich in fibre that is associated with deep and restorative sleep **[10]**. Tart cherries have high melatonin content and are good for improving sleep quality **[5]**. Whole grains are also associated with improved sleep quality due to presence of magnesium, GABA receptors that regulate sleep wake cycle by balancing melatonin in the body **[3]**. The following study was formulated to investigate the influence of

dietary consumption on sleep quality of the subjects. Nutrients and foods hypothesized in earlier studies to have effects on sleep were chosen, their frequency of consumption registered and then assessed to find out the consequential associations.

MATERIALS AND METHODS

The study was conducted from November 2019 to March 2020 in the colleges of Delhi and Haryana, India. 100 samples were selected from students aged 18-25 years and data was collected with their consent.

The foods listed in earlier literature hypothesized to affect sleep were chosen, and their consumption frequency was assessed through a food- frequency questionnaire (FFQ).

The participants were interviewed by personal interview method. Subjects who were willing to participate were chosen and included in the study.

SQ was assessed in students through Pittsburgh Sleep Quality Index (PSQI) that calculates a Global Sleep Score (GSS) where a score of 5/more suggestive of poor SQ **[11]**.

Inclusion criteria

- Both male and female students were included.
- Students between age group 18-25 were included.

Exclusion criteria

- Participants having any food allergies.
- Students suffering from any chronic condition/ neurological/ psychological deficit.

Data was entered into IBM SPSS. Frequencies of consumption of different foods were estimated with the help of $\chi 2$test and consequential associations were determined($p<0.05$ taken as significant). Strength of the associations was found by Cramer's test. Binomial logistic regression analysis was further used for making predictions between different foods and sleep.

RESULTS

100 students participated in the study, out of which 56% were females and 44% were males. Students selected aged between 18-25 years with a mean age of 22.81± 2.27.

Half of the subjects received >7 hours of sleep each night. Problems in falling asleep were faced by subjects. 11% students could not fall asleep within 60 minutes of going to bed. Only 26% subjects were found to have very good sleep quality, 60% were found to have good sleep quality, 10% experienced fairly bad, while 4% experienced very bad sleep quality. Medication for inducing sleep was the factor that contributed the least to poor sleep quality and sleep disturbances the most. With a GSS of <5 taken as indicative

of good sleep quality, the mean PSQI score for the study was 5.6 ±2.7 suggesting mean poor sleep score. **Table 1** depicts the component scores of PSQI of the subjects.

Results show associations ($p<0.05$) between certain foods and sleep quality. Consequential associations were revealed between wheat, milk, soybeans, dark chocolate, citrus fruits and berries, leafy greens, green tea, and coffee. **Table 2** depicts the association between specific foods and sleep quality (SQ).

A Cramer's V test was conducted to reveal strength of these associations. Wheat (V=0.375), milk (V=0.422), soybeans (V=0.499), dark chocolate (V=0.490), citrus fruits (V=0.457), berries (V=0.453), green tea (V=0.450) and coffee (V=0.328) had particularly strong associations.

With logistic regression test, the impact of foods on probability of subjects having good quality of sleep was determined. The likelihood of good SQ was 2.6 times moreprobable with wheat consumption (CI 0.51- 13.48), 2.4 times more likely with berries (CI 0.9- 6.58), and 1.6 times more probable with soybeans consumption, (CI 0.24- 4.48) **(Table 3)**.

Table 1: Component score of PSQI

S No.	PSQI component item	Mean	S.D.
1	Subjective sleep quality	0.96	0.73
2	Sleep latency	1	1
3	Sleep duration	1	1
4	Sleep efficiency	1	1
5	Sleep disturbances	1.03	0.51
6	Sleep medication	0.1	0.5
7	Daytime dysfunction	1	1
8	Total PSQI score	5.6	2.7

The data represents the mean ± S.D.

Table 2: Association of specific foods with sleep quality

Food		Sleep quality (n)		p- value	Cramer's V
		Good	Poor		
Whole Wheat	Less	14	8	0.029	0.375
	More	56	22		
Milk	Less	11	29	0.001	0.422
	More	52	8		
Soybeans	Less	2	33	0.000	0.499
	More	34	31		
Dark chocolate	Less	5	40	0.001	0.490
	More	31	24		
Citrus fruits	Less	4	19	0.001	0.457
	More	32	45		
Berries	Less	7	39	0.002	0.453
	More	29	25		
Leafy greens	Less	1	6	0.042	0.277
	More	35	58		
Green Tea	Less	29	23	0.001	0.450
	More	7	41		
Coffee	Less	7	5	0.057	0.328
	More	29	59		

***Chi- square test ($\chi 2$) was used to calculate p values**

Table 3: Binomial logistic regression results of sleep quality and foods

Predictors	B	S.E.	Wald	D.F.	Sig.	Exp(B)	95% CI for EB	
							Lower	Upper
Wheat	0.969	0.833	1.355	1	0.024	2.636	0.515	13.480
Milk	0.351	0.971	0.130	1	0.718	1.420	0.212	9.518
Soybeans	-0.508	0.460	1.216	1	0.027	1.602	0.244	4.484
Dark chocolate	-0.281	0.466	0.363	1	0.547	0.755	0.303	1.882
Citrus fruits	-0.014	0.544	001	1	0.979	0.986	0.339	2.844
Berries	0.890	0.507	0.073	1	0.040	2.434	0.900	6.581
Leafy greens	-0.775	0.936	0.686	1	0.407	0.460	0.074	2.884
Green tea	-.0130	0.428	0.092	1	0.762	0.878	0.380	2.032
Coffee	0.461	0.693	0.442	1	0.506	1.586	0.408	6.168

p<0.05, B= beta, S.E.= Standard Error, Sig.= significance level, D.F.= degrees of freedom, C.I.= confidence interval, and Exp(B)= exponentiation of B coefficient

DISCUSSION

This study showed the influence of certain foods on the quality of sleep of college students. Serotonin precursor, tryptophan is known to trigger serotonergic activity and enhance sleep **[6]**.

Soybeans had particularly strong association with SQ (V= 0.499). isoflavones found in soybeans resemble human estrogen chemically. Estrogen is known to have effects on SQ and duration and hence isoflavones are also hypothesized to affect and promote SQ **[12]**. L- ornithine has also been found to reduce anxiety and stress and thus promote sleep **[13]**.

Whole wheat (V= 0.375) contains magnesium that binds to GABA receptors and regulate melatonin levels **[5]**. Whole grains contain tryptophan as well and carbohydrates aid it's transport to the brain according to NSF **[14]**. Antioxidant selenium present in grains also improves irritability and bedtime stress and hence promotes sleep **[5]**.

Milk (V= 0.422) is a traditional sleep-promoting food. Decreased chances of difficulty in maintaining sleep are shown to be due to butanoic acid, which is present in cow's milk **[10]**. Milk obtained by milking cows at night time is rich in melatonin. High content of melatonin and tryptophanare primarily attributable for the sleep promoting impact of night- time milk **[15]**.

Dark chocolate (V=0.490) may have varying effects on sleep. It contains caffeine and theobromine which stimulate central nervous system and may suppress sleep onset if taken before bedtime [16]. In contrast, it also contains magnesium which may be responsible for its positive effects on sleep quality **[5, 17]**.

Citrus fruits (V= 0.457) and berries (V= 0.453) have been found to be associated with sleep quality and duration. Carotenoids, plasma vitamin C, lycopene have been shown to be associated with sleep [18]. Other studies have also revealed similar associations **[1, 15]**.

Leafy greens (V= 0.277) contain a number of micronutrients including magnesium, fibre, iron, tryptophan, potassium, beta carotene, complex carbohydrates that influence sleep **[19]**. Fiber promotes sleep that is more restorative **[3]**. Carotenoids (lycopene and beta carotene) have impact on growth of cells, and are related with lesser difficulty in falling sleep **[19]**.

Green tea (V=0.450) negatively influences sleep quality. It contains caffeine which is known to suppress sleep. Caffeine increases state of alertness and thus has negative effects on sleep quality **[20, 21]**.

Coffee (V=0.328) has caffeine as its primary component which is shown to reduce sleep efficiency, lessen sleep duration, and rapid eye movement sleep. These findings have been confirmed in many studies till date **[22, 23, 24]**.

CONCLUSION

A trend showing poor sleep quality was observed in the college students with more participants not sleeping sufficiently enough as recommended by NSF. Approaches to cure sleep related problems are more focussed on intake of sleeping pills as suggested by medical literature rather than on dietary and lifestyle modifications. These associations suggest consumption of foods may be useful in dealing with these issues. Foods like soybeans, cherries, and milk can be particularly beneficial. More clinical trials are required to establish chemical grounds of these associations which can contribute to the knowledge base of treating sleep related problems with dietary intake.

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REFERENCES

[1] Peuhkuri K, Sihvola N, Korpela R (2012). Diet promotes sleep duration and quality. Nutrition Research, 32: 309-319.

[2] Sutanto CN, Wang MX, Tan D, Kim JE (2020). Association of Sleep Quality and Macronutrient Distribution: A Systematic Review and Meta-Regression. Nutrients, 12(1): 126.

[3] Nisar M, Mohammad RM, Arshad A, Hashmi I, Yousuf SM, Baig S (2019). Influence of Dietary Intake on Sleeping Patterns of Medical Students. Cureus, 11(2).

[4] Chattu V K, Chattu S K, Burman D, Spence D W, Pandi-Perumal SR (2019). The Interlinked Rising Epidemic of Insufficient Sleep and Diabetes Mellitus. Healthcare (Basel), 7: 37.

[5] Zeng Y, Yang J, Du J, Pu X, Yang X, Yang S et al (2014). Strategies of

Functional Foods Promote Sleep in Human Being. Current Signal Transduction Therapy; 9: 148-155.

[6] Melancon MO, Lorrain D, Dionne IJ. Exercise and sleep in aging: emphasis on serotonin (2014). PatholBiol; 62(5): 276–83.

[7] Neubauer DN (2013). Chronic insomnia. Continuum; 19(1): 50–66.

[8] Wierzejska R (2012). Caffeine-common ingredient in a diet and its influence on human health. Rocz Panstw ZaklHig; 63(2): 141–7.

[9] Kruger AK, Reither EN, Peppard PE, *et al* (2014). Do sleep-deprived adolescents make less-healthy food choices? Br J Nutr; 111(10): 1898–904.

[10] Kennedy DO (2016). B vitamins and the brain: mechanisms, dose and efficacy—a Review. Nutrients; 8: 68.

[11] University of Pittsburgh (pitt.edu) Available at: https://www.psychiatry.pitt.edu/sites/default/files/inline-files/PSQI%20Article.pdf

[12] Cui Y, Niu K, Huang C, *et al* (2015). Relationship between daily isoflavone intake and sleep in japanese adults: a cross-sectional study. Nutr J; 14: 127.

[13] Miyake M, Kirisako T, Kokubo T, *et al* (2014). Randomised controlled trial of the effects of l-ornithine on stress markers and sleep quality in healthy workers. Nutr J; 13:53.

[14] Food and sleep. [Mar; 2018];https://www.sleepfoundation.org/sleep-topics/food-and-sleep 2007

[15] St. Onge MP, Mikic A, Pietrolungo CE (2016). Effects of Diet on Sleep Quality. AdvNutr; 7: 938-49.

[16] Baggott MJ, Childs E, Hart AB, *et al* (2013). Psychopharmacology of Theobromine in Healthy volunteers. Psychopharmacology [Berl]; 228: 109–118.

[17] Cinquanta L, Di Cesare C, Manoni R, Piano A, Roberti P, Salvatori G (2016).Mineral essential elements for nutrition in different chocolate products. Int J Food SciNutr; 67: 773–778.

[18] Noorwali EA, Cade JE, Burley VJ, Hardie LJ (2018). The relationship between sleep duration and fruit/vegetable intakes in UK adults: a cross-sectional study from the National Diet and Nutrition Survey. BMJ Open; 8(4).

[19] Grandner MA, Jackson N, Gerstner JR, Knutson KL (2014). Sleep symptoms associated with

intake of specific dietary nutrients. J Sleep Res; 23: 22–34.

[20] Tahara Y., Shibata S (2014). Chrono-biology, Chrono-pharm-acology and Chrono-nutrition. Journal of Pharmaco-logical Sciences; 124(3): 320–335.

[21] Carrier J, Paquet J, Fernandez-Bolanos M, Girourard L, Roy J, Selmaoui B *etal* (2009). Effects of Caffeine on Daytime Recover Sleep: A Double Challenge to the Sleep- Wake Cycle in Aging. Sleep Medicine; 10(9): 1016-1024.

[22] Robillard R, Bouchard M, Cartier A, Nicolau L, Carrier J (2015). Sleep is More Sensitive to High Doses of Caffeine in the Middle Years of Life. Journal of Psychopharmacology; 29(6): 688-697.

[23] Drake C, Roehrs T, Shambroom J, Roth T (2013). Caffeine Effects on Sleep Taken 0, 3, or 6 Hours before going to Bed. Journal of Clinical Sleep Medicine; 9(11): 1195-1200.

[24] Clark I and Landolt HP (2016). Coffee, Caffeine and Sleep. Sleep Medicine Reviews; 31: 70-78.