

## Short Communication

# The relationship between sleep disorder and dairy intake in university students of the nursing department in Japan

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## OPEN ACCESS

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## Abstract

This study was conducted to clarify the relationship between sleep disorders and frequency, or timing of dairy intake with 192 university students in Japan. Pearson's chi-squared test was carried out to find the relationship between two groups of sleep disorders and the timing of dairy product intake ( $p = 0.034$ ,  $df = 4$ ,  $\chi^2 = 10.38$ ). The sleep disorder occurred significantly less if participants took a dairy product in the morning ( $p = 0.004$ ) and significantly more when participants took a dairy product in the afternoon ( $p = 0.028$ ). The findings showed that consuming dairy products in the morning is effective in treating sleep disorders.

**Keywords:** sleep disorder, the frequency of dairy products, the timing of dairy products, nursing students

## Methods

This study recruited 205 university students at the Department of Nursing from April 1<sup>st</sup> to April 25<sup>th</sup>, 2024. Ten data were excluded from the analysis because part of their data was missing, and three were excluded because they did not consume any dairy products. Among the 192 participants, most were female students (female: 185, male: 7). Dairy products were considered if consumed from milk, cheese, yogurt, or probiotic drinks. The frequency of dairy products intake was asked, and it was considered “high-frequency intake (50.5%)” if participants consumed it every day or more than four times a week, and it was considered “low-frequency intake (49.5%)” if participants consumed it less than four times a week. The timing of dairy products intake was also asked as “Morning only (53.6%),” “Daytime only (8.3%),” “Evening only (23.4%),” “Only before bed (3.1%),” and “Multiple times in a day (11.5%).”

The Japanese version, which is called PSQI-J, was developed by Doi *et al.*<sup>1)</sup> was used to measure sleep disorder (Cronbach's alpha = 0.77). The cut-off point of the sum was used at 5.5 in the original version, and we also used the cut-off point in this study.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee (# OUHS2024-0042F).

Pearson's chi-squared test was used to confirm the relationship between the groups based on whether they had sleep disorders, and the timing of dairy product intake.  $P$  values of  $<0.05$  were considered to indicate statistical significance. The analyses were performed using the EZR (Easy R) software program (version 1.61 for Windows. <https://www.jichi.ac.jp/saitama-sct/SaitamaHP.files/statmedEN.html>)<sup>2)</sup>.

## Results and Discussion

The scores of PSQI-J were listed in **Table 1**. The sum of PSQI-J scores was  $4.58 \pm 2.28$ . Each score of seven components was  $1.17 \pm 0.64$  for sleep quality,  $0.95 \pm 0.89$  for sleep latency,  $0.74 \pm 0.85$  for sleep duration,  $0.21 \pm 0.53$  for habitual sleep efficiency,  $0.54 \pm 0.51$  for sleep disturbance,  $0.06 \pm 0.38$  for the use of sleeping medication, and  $0.90 \pm 0.73$  for daytime dysfunction.

Pearson's chi-squared test was carried out to find the relationship between two groups of sleep disorders and the

**Table 1.** Subject's characteristics ( $n = 192$ )

Factors		<i>n</i> (%)
Sex	Male	7 (3.6)
	Female	185 (96.4)
School year	First-year students	73 (38.0)
	Second-year students	49 (25.5)
	Third-year students	23 (12.0)
	Fourth-year students	47 (24.5)
Frequency of dairy product intake	Everyday	48 (25.0)
	More than four times a week	49 (25.5)
	Twice or three times a week	62 (32.3)
	Once a week	19 (9.9)
	Less than once a week	14 (7.3)
Dairy products	A high-frequency intake* <sup>1</sup>	97 (50.5)
	A low-frequency intake* <sup>1</sup>	95 (49.5)
Timing of dairy product intake	Morning only	103 (53.6)
	Daytime only	16 (8.3)
	Evening only	45 (23.4)
	Only before bed	6 (3.1)
	Multiple times in a day	22 (11.5)
Sleep disorders* <sup>2</sup>	Had a sleep disorder	55 (28.6)
	None of the sleep disorders	137 (71.4)
		Mean $\pm$ SD
The scores of PSQI-J* <sup>3</sup>	C1 Sleep Quality	$1.17 \pm 0.64$
	C2 Sleep latency	$0.95 \pm 0.89$
	C3 Sleep duration	$0.74 \pm 0.85$
	C4 Habitual sleep efficiency	$0.21 \pm 0.53$
	C5 Sleep disturbance	$0.54 \pm 0.51$
	C6 The use of sleeping medication	$0.06 \pm 0.38$
	C7 Daytime dysfunction	$0.90 \pm 0.73$
Total scores of PSQI-J		$4.58 \pm 2.28$

\*1 A high-frequency intake means participants took dairy products more than four times a week, and a low-frequency intake means participants took dairy products less than four times a week.

\*2 The cut-off value of the sum of PSQI-J scores, 5.5, was used to divide participants with sleep disorders.

\*3 PSQI-J means the Japanese version of the Pittsburgh sleep quality index.

**Table 2.** The relationship between the two groups, by whether participants had sleep disorders, and the timing of dairy product intake ( $n = 192$ )

Timing of dairy product intake	Sleep disorders* <sup>1</sup>		<i>p</i> value Degree of Freedom $\chi^2$ -statistic
	Had a sleep disorder ( $n = 55$ )	None of the sleep disorders ( $n = 137$ )	
<b>Morning only</b>	<b>20 (29.51)</b>	<b>83 (73.49)</b>	<b><i>p</i> = 0.034</b> df = 4 $\chi^2 = 10.38$
Daytime only	5 (4.58)	11 (11.42)	
<b>Evening only</b>	<b>19 (12.89)</b>	<b>26 (32.11)</b>	
Only before bed	3 (1.72)	3 (4.28)	
Multiple times in a day	8 (6.30)	14 (15.70)	

( ) Expected frequency

\*1 The cut-off value of the sum of PSQI-J scores, 5.5, was used to divide participants with sleep disorders.

timing of dairy product intake, as shown in **Table 2** ( $p = 0.034$ ,  $df = 4$ ,  $\chi^2 = 10.38$ ). The sleep disorder occurred significantly less if participants took a dairy product in the morning ( $p = 0.004$ ) and significantly more when participants took a dairy product in the afternoon ( $p = 0.028$ ).

Previous studies show that several dairy products can affect sleep outcomes positively<sup>3,4</sup>). In this study, we examined the effect of dairy product intake on sleep. If participants ingested dairy products in the morning, they had better sleep scores on PSQI-J than at other times. Tryptophan, known as one of the essential amino acids, might be the reason<sup>5</sup>). Tryptophan produces serotonin and synthesizes melatonin. Dairy products are notably rich in tryptophan, and sunlight produces serotonin better. Then melatonin, a sleep-related hormone, is also synthesized better<sup>6</sup>).

Nagashima *et al.* mentioned that tryptophan can be gained by combining dairy product intake with sunlight exposure, or sunlight exposure only. However, only dairy products intake did not affect tryptophan<sup>7</sup>). It was also mentioned that dairy products intake takes more time to increase tryptophan than sunlight. Nagashima *et al.* also mentioned that night shift workers should have a better melatonin level if they sleep under the bright light exposure in daytime<sup>8</sup>). The bright light, not sunlight exposure, can effectively increase the melatonin level. In this study, we did not ask participants if they had sunlight exposure after taking dairy products in the morning. The combination might be the key to increasing tryptophan levels and good sleep quality.

It would be a good strategy to inform university students to have dairy products in the morning and expose themselves to sunlight<sup>9</sup>). They do not need to do anything special to expose themselves to sunlight. They come to university when they have classes on foot, by public transportation, or by bicycle. It will be a moderate amount of sunlight exposure.

The present study was subject to several limitations. Because the study design was cross-sectional, cause-effect relationships were not clarified. We could not examine most of the confounding factors other than frequency, or the timing of dairy intake. In this study, all participants belong to only the nursing department at one university, which could introduce selection bias. About half of participants consumed dairy products in the morning. Future longitudinal studies are required to clarify mechanisms of sleep disorder in university students.

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### Author Contributions

All authors contributed directly to this study. SE., MT., and YK. designed the study construction and collected the data. SE., MT., and YK. analyzed the data, and YT. took responsibility for the integrity of the data analysis. All authors drafted the manuscript. This study was conducted as a graduation thesis under the supervision of YT.

### Conflict of Interest

The authors declare no economic or academic conflict of interest for this study.

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