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Relationship between Mental Health and Food Access among Healthcare College Students in a Snowy Area in Japan

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***Abstract*—**Dropout rates in higher educational institutions pose significant challenges for both students and institutions, with poor mental health (MH) emerging as a key risk factor. Healthcare college students, including medical students, are particularly vulnerable to MH issues due to the demanding academic schedules they face. Poor mental health (MH) would be considered as a key risk factor for dropout from higher educational institutions that pose significant challenges for both students and institutions. And, inadequate food access (FA) has been related to poor MH. Given that targeted students may experience multiple risk factors for poor MH and vulnerable FA, the study aims to clarify the relationship between MH and FA to enhance student well-being. A cross-sectional design was used to explore the association between MH status and FA among 421 students (147 male, 274 female). Participants completed two questionnaires assessing MH and FA during winter 2022. The mean MH score was 6.7 ± 4.6, with higher scores indicating worse MH (max. score 27). While year-round FA showed no significant association with MH, FA during winter was significantly associated with MH ($p = 0.01$). Although car ownership did not directly impact MH, it was significantly associated with FA ($p < 0.01$), thus indirectly influencing MH. Our findings underscore the importance of FA in promoting MH, particularly during winter. Adopting a lifestyle that facilitates easier FA may be beneficial for MH, given its indirect association with MH outcomes. These insights emphasize the significance of addressing FA-related challenges to enhance student's mental well-being.

***Keywords*—**Mental health, food access, co-medical students, lifestyle.

I. Background

DROPPING out of higher education has profound consequences for both institutions and students. While educational institutions incur financial losses, students who do not complete their studies may face constraints on their future employment opportunities. According to a report by Japan's Ministry of Education, Culture, Sports, Science, and Technology (MEXT), the dropout rate from higher education institutions in 2021 was 1.95% [1]. Among the principal factors contributing to student attrition include school transfer (16.3%) and school maladjustment (15.7%). According to Sato, the students' "unwillingness to join the university community" and "anxiety about academic learning" constitutes stress on their MH and contributes to difficulties in adjusting to the student life environment. Thus, the promotion of student MH is essential for universities and students alike [2].

Particularly among students seeking a degree in medicine or a healthcare profession, poor MH is a common concern due to the demanding academic workload and mental stress associated with national exams. Research suggests that the mental health (MH) of medical students tends to be poorer than that of the general young population, with a significant number of them facing MH issues [3], [4]. To further complicate matters, the onset of the COVID-19 pandemic not only caused financial insecurity among students but also had detrimental effects on their mental well-being. A study conducted in Japan during the COVID-19 restrictions revealed that 70% of healthcare college students struggled with poor MH [5]. Although pandemic restrictions have eased in recent years, young medical students still encounter substantial challenges related to their MH.

While some studies suggest a close association between nutrition and MH [6]-[8], it is crucial to consider the broader environmental context when advocating for improved nutrition to support mental well-being. The Food and Agriculture Organization (FAO) emphasized "Food Security (FS)" in 1996, asserting that all individuals have the right to access safe and nutritious food [9]. Among the dimensions of FS, FA is particularly significant as several studies have linked poor FA with adverse effects on both physical and MH [8]. This is also a concern in Japan, notably among the elderly population living in rural areas. A previous study reveals that the mortality rate among elderly individuals with lower FA is 1.61 times higher than that of other elderlies [10]. Additionally, findings from Ishikawa et al. suggest that lower FA is associated with subjective feelings of poor health among the elderlies [11]. Despite these insights, the researches which investigated the relationship between FA and MH among young population is not enough. Therefore, in recognizing the link between nutrition and MH, the study aims to investigate the relationship between FA and mental well-being within the younger population.

The project site is a healthcare training facility situated in a remote area of Japan characterized by heavy snowfall. With an average dropout rate of 5.7% between 2018 and 2021 [12], the targeted college experiences a higher attrition rate compared to healthcare institutions in neighboring prefectures [13]. Previous research has revealed a statistically significant correlation between psychiatric morbidity and seasonal affective disorder, indicating the potential impact of weather conditions on students' MH [14]. Students may also be susceptible to poor

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MH due to factors such as academic pressure, isolated living arrangements, and limited FA, especially during the winter season.

This study adopts a cross-sectional and observational approach to investigate the relationship between MH and FA among healthcare college students. The data collection in winter aims to assess how seasonal variations affect MH and FA. Winter, marked by upcoming national or end-term examinations, is recognized as a particularly stressful period for students. Moreover, FA may be more vulnerable during this time, amplifying the potential impact on students' mental well-being.

II. Methods

The participants in the study were healthcare college students enrolled in four different vocational courses: clinical laboratory, dietetics, nursing, and clinical engineering. All students were invited to participate and provided with written and oral guidance by an investigator before data collection. They were asked to complete two web-based questionnaires anonymously, assessing their MH and FA. The first questionnaire sought their consent to participate, and if a participant did not agree, their data were excluded from the analysis.

Data collection was implemented during the snowy winter from the 5th to 26th of December 2022. Interested participants completed two questionnaires: one on mood status and one on lifestyle, including FA. The questionnaire on mood status was assessed using the Quick Inventory of Depressive Symptomatology (QIDS-J), which contains 16 questions with a total score of 27, where a higher score indicates poorer MH [15]. The Japanese version of the QIDS-J was developed by Fujisawa and adopted for use in the "A Manual of Prevention and Support for Depression" by the Ministry of Health and Welfare, Japan [16].

Participants also completed a questionnaire on FA, which included questions about year-round FA and during winter, rated on a 4-point Likert scale. The questionnaire also addressed factors related to FA, such as living arrangement and car ownership. All questionnaires were administered online.

As per the Internal Review Board of the project site, ethical approval was deemed unnecessary for this study (No. 2021-003).

III. Results

Table I presents the characteristics of the study participants. The total targeted population was 421 with a completion rate of 74.0%. Female students outnumbered male students (65.1%). The majority of participants fell within the age range of 19-21. Gender disparities were observed among faculties (p = 0.00) and age groups (p = 0.04), but not among school grades.

Table II displays the MH scores of participants. The mean MH score was 6.7. The QIDS-J has a maximum score of 27, with higher scores indicating poorer MH. Scores between 0-5 are considered normal, while the scores between 6-10 indicate mild depression. The mean MH score of the students fell within the mild depression range. There were no significant differences observed based on gender, school grade, or car ownership. However, a significant association was found between MH and living arrangement, with students living alone exhibiting worse MH compared to those living with family (p = 0.02).

Table III shows the relationship between FA and MH. Year-round FA did not show a significant relationship with MH (p = 0.07), whereas FA in winter was significantly associated with MH (p = 0.01).

Table IV displays the results of the relationship between FA and FA related factors. A significant regression equation was found for FA, considering gender, school grade, living arrangement, and car ownership as variables ($F(4,416)$ = 31.727, $p < 0.000$), with an R^2 of 0.234 for year-round FA, and $F(4,416)$ = 20.752, $p < 0.000$), with an R^2 of 0.166 for FA in winter, respectively. Although there was no significant relationship between car ownership and MH in Table II, car ownership was significantly associated with both year-round FA and in winter. It suggests an indirect relationship between car ownership and MH, as car ownership significantly improves FA, which in turn is associated with MH.

Exclusive car ownership and living arrangement were the most significantly associated factors with both year-round FA and FA in winter ($p < 0.01$). Gender and school grade did not show significant associations with FA. FA was ranked and coded from 1 to 4, with higher code numbers indicating more difficult FA. Car owners and non-car users were coded as 1 and 2, respectively. FA increased by 0.43 scale (year-round FA) or 0.30 scale (in winter) among non-car users compared to car owners. Furthermore, the FA of students living alone decreased by 0.750 scale (year-round FA) or 0.722 scale (in winter) compared to students living with family, with each 1 scale increase in FA.

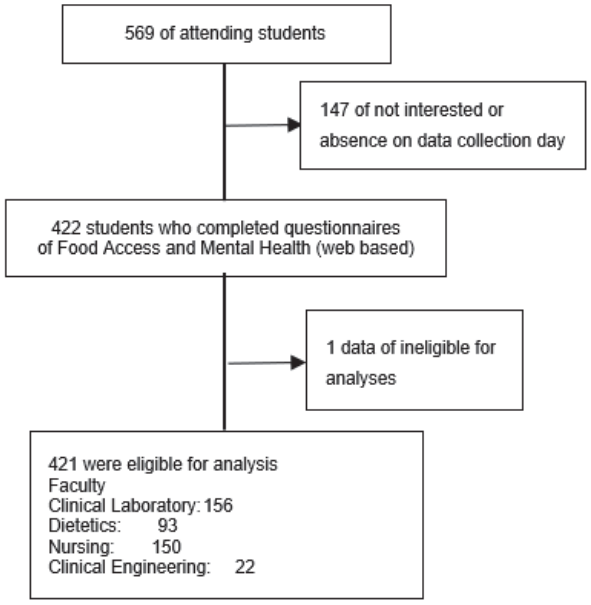

Fig. 1 Flowchart of data collection

IV. Discussion

The study represents the investigation into the relationship between MH and FA among healthcare college students. Previous studies have reported that MH tends to be poorer among female medical students compared to their male counterparts [3], [17], [18]. However, in contrast to these findings, our study did not observe a gender difference in MH among male and female students. Nonetheless, it is important to note that our results represent a snapshot at a single point in time. Further investigation is necessary to explore gender differences in MH trends among healthcare college students and determine whether these differences resemble those observed among medical students.

The mean MH score observed during winter was indicative of mild depression. Previous research has highlighted the impact of seasonal and weather variations on MH. For instance, studies have found a positive and significant correlation between major depressive disorder admissions and factors such as the number of rainy, dusty, or snowy days, as well as cloudiness [19]. Additionally, risk factors for seasonal affective mood disorder (SAD) include a family history of the disorder, female sex, residence at higher latitudes, and young adulthood (18 to 30 years of age) [20]. Given these findings, it is advisable to monitor MH among healthcare college students due to considering their multiple risk factors.

TABLE I
Characteristics of the Target Population

Variables	Male n	Male %	Female n	Female %	Subtotal n	Subtotal %	*p*-value
Faculty							
Clinical Laboratory	81	19.2%	75	17.8%	156	37.1%	0.00*
Dietetics	14	3.3%	79	18.8%	93	22.1%	
Nursing	40	9.5%	110	26.1%	150	35.6%	
Clinical Engineering	12	2.9%	10	2.4%	22	5.2%	
Subtotal	147	34.9%	274	65.1%	421	100%	
Age-Class							
18	11	2.6%	12	2.9%	23	5.5%	0.04*
19	35	8.3%	79	18.8%	114	27.1%	
20	39	9.3%	71	16.9%	110	26.1%	
21	21	5.0%	60	14.3%	81	19.2%	
22	22	5.2%	34	8.1%	56	13.3%	
≥23	19	4.5%	18	4.3%	37	8.8%	
Subtotal	147	34.9%	274	65.1%	421	100%	
School Grade							
1st	67	15.9%	93	22.1%	160	38.0%	0.08*
2nd	39	9.3%	75	17.8%	114	27.1%	
3rd	32	7.6%	78	18.5%	110	26.1%	
4th	9	2.1%	28	6.7%	37	8.8%	
Subtotal	147	34.9%	274	65.1%	421	100%	

*chi-square test

TABLE II
Mental Health Score by Characteristics of the Targeted Students

Variables	n	Mean ± SD	median	(IQR)*		adjusted *p*-value	*p*-value
Total Mental Score	421	6.7 ± 4.6	6.0	(3.0-10.0)			
Mental Score by Gender							
Male	147	6.2 ± 4.5	5.0	(3.0-9.0)			0.06(1)
Female	274	7.0 ± 4.7	7.0	(3.0-10.0)			
Subtotal	421						
Mental Score by Faculty							
Clinical Laboratory (1)	156	7.0 ± 4.1	7.0	(4.0-10.0)	(1)VS(2)	n.s	0.03(2)
Dietetics (2)	93	7.4 ± 5.3	6.0	(3.0-10.0)	(1)VS(3)	n.s	
Nursing (3)	150	6.4 ± 4.7	6.0	(3.0-9.0)	(1)VS(4)	0.04	
Clinical Engineering (4)	22	4.5 ± 3.6	3.0	(1.0-8.0)	(2)VS(3)	n.s	
Subtotal	421				(2)VS(4)	n.s	
					(3)VS(4)	n.s	
School Grade							
1st	160	6.1 ± 4.1	5.5	(3.0-8.0)			0.11(2)
2nd	114	7.6 ± 4.8	7.0	(3.0-11.0)			
3rd	110	6.8 ± 5.0	6.0	(2.0-10.0)			
4th	37	6.6 ± 4.5	6.0	(3.0-10.0)			
Subtotal	421						
Living arrangement							
Living Alone (1)	275	7.1 ± 4.5	7.0	(3.0-10.0)	(1)VS(2)	0.01	0.02(2)
With Family (2)	139	5.9 ± 4.4	5.0	(2.0-8.0)	(1)VS(3)	n.s	
Others (3)	7	8.4 ± 8.3	8.0	(1.0-10.0)	(2)VS(3)	n.s	
Subtotal	421						
Mental Health Score by Car Ownership							
Car Owner	188	6.9 ± 4.9	7.0	(3.0-10.0)			0.78(1)
No Car User	233	6.9 ± 4.9	7.0	(3.0-10.0)			
Subtotal	421						

* Inter-Quartile Range
(1) Mann-Whitney-U-Test
(2) Kruskal-Wallis test

TABLE III
RELATIONSHIP BETWEEN MENTAL HEALTH SCORE AND FOOD ACCESS

Variables	n	Mean ± SD	median	(IQR)			*p*-value
Year-Round Food Access							
No Problem (1)	214	6.2 ± 4.3	6.0	(2.8-9.0)			0.07(1)
Slightly Inconvenient (2)	118	6.8 ± 4.2	6.0	(3.0-9.3)			
Quite Inconvenient (3)	45	8.1 ± 5.0	8.0	(4.0-11.0)			
Extremely Inconvenient (4)	44	7.8 ± 5.8	6.0	(3.0-11.0)			
Subtotal	421						
Food Access in Winter						adjusted *p*-value	
No problem (1)	151	6.0 ± 4.6	5.0	(2.0-9.0)	(1)VS(2)	n.s.	0.01(1)
Slightly Inconvenient (2)	142	6.7 ± 4.3	7.0	(3.0-9.0)	(1)VS(3)	n.s.	
Quite Inconvenient (3)	60	7.1 ± 4.1	7.0	(4.0-10.0)	(1)VS(4)	0.01	
Extremely Inconvenient (4)	68	8.21 ± 5.3	7.0	(4.0-11.0)	(2)VS(3)	n.s.	
Subtotal	421				(2)VS(4)	n.s.	
					(3)VS(4)	n.s.	

(1) Kruskal-Wallis test

TABLE IV
MULTIPLE REGRESSION ANALYSIS WITH FOOD ACCESS AS A DEPENDENT VARIABLE, N = 421

	Unstandardized Coefficients		Standardized Partial Regression Coefficient	p-value	95% CI of B		Statistics for Collinearity	
Variables	B	SE	β		min	max	Tolerance	VIF(1)
Year-Round Food Access								
Gender	0.181	0.092	0.086	0.05	0.001	0.361	0.964	1.038
School Grade	-0.039	0.044	-0.039	0.37	-0.125	0.046	0.980	1.021
Living Situation	-0.750	0.084	-0.387	0.00	-0.916	-0.584	0.975	1.026
Car Ownership	0.428	0.088	0.213	0.00	0.255	0.601	0.954	1.048
Squared Multiple Correlation Coefficient (R): 0.483								
Coefficient of Determination (R^2): 0.234								
Adjusted Coefficient of Determination (R^2): 0.226								
Food Access in Winter								
Gender	0.184	0.102	0.082	0.07	-0.016	0.385	0.964	1.038
School Grade	-0.026	0.048	-0.024	0.60	-0.121	0.070	0.980	1.021
Living arrangement	-0.722	0.094	-0.349	0.00	-0.907	-0.538	0.975	1.026
Car Ownership	0.301	0.098	0.141	0.00	0.108	0.494	0.954	1.048
Squared Multiple Correlation Coefficient (R): 0.408								
Coefficient of Determination (R^2): 0.166								
Adjusted Coefficient of Determination (R^2): 0.158								

(1) VIF: variance inflation factor

While year-round FA showed no significant association with MH (p = 0.07), FA in winter was found to be associated with MH (p = 0.01). A previous study targeting low-income adults in the US found that healthier food consumption, such as fresh fruit or whole grains, decreased in winter compared to autumn. This study also noted that severe weather events, such as rain and snow, reduced both shopping trips and basket sizes due to winter-related barriers [21]. Other previous studies investigating FA among the elderly in Japan have demonstrated a relationship between FA and MH, however, the data collection periods in these studies were either not during winter or were unspecified [10], [11]. Our findings provide evidence that FA affects MH among young students, particularly during winter, similar to observations among the elderly.

Given the vulnerability of FA during winter and its dependence on lifestyle factors, a multiple regression analysis was implemented to identify the factors associated with FA. The most significant risk factors for FA were car ownership and living arrangement (p = 0.00) both year-round FA and during winter. Our results suggest that living alone directly contributes to poorer MH and difficulties of FA. Additionally, while car ownership may not be directly associated with MH, it indirectly contributes to mental well-being by facilitating easier FA during winter. These findings underscore the importance of prioritizing easier FA for students, especially those living alone. Moreover, stakeholders should consider initiatives to assist students in obtaining a car or improving transportation options.

V. LIMITATION

The limitation of the study arises from its focus on a single co-medical institution located in a rural snowy area in Japan. Consequently, the findings may not fully capture the diversity of experiences across different types of medical and co-medical institutions throughout the country. However, given the abundance of medical and co-medical institutions throughout Japan, the findings may still be valuable in predicting trends in student MH, despite not capturing all aspects of the project site.

Additional limitation is that the study is reliant on data

collected during the winter season. Since seasonal variations can influence MH outcomes, the results may not provide a comprehensive understanding of MH trends throughout the year. Further investigation during non-winter seasons is necessary to establish a comparative baseline and better understand the fluctuations in MH among healthcare college students.

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