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DIETARY ACCULTURATION AND THE NUTRITION TRANSITION:A DETAILED STUDY ON THE STUDENTS OF MMDU, AMBALA, HARYANA

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Abstract
Dietary acculturation encompasses alterations in the eating habits of a migrant community upon relocating to a different country. International students, following their migration, often encounter distinct food environments that may result in shifts in their dietary practices and anthropometric measurements from their pre-migration status. The purpose of this study was to investigate alterations in dietary habits, food consumption patterns, anthropometric measurements, and lifestyle behaviour among international students at MMDU before and after their migration.
A total of 413 international students from Africa, Nepal and Bhutan were grouped by nationality. Significant differences were observed among the groups in terms of number of meals consumed, frequency of breakfast, appetite, consumption of fruits, vegetables, fast foods, junk food, packaged food and nutrient supplements after migration. The consumption of non-vegetarian food had significantly decreased across all groups. Also, variations in lifestyle behaviour such as sleep duration, level of physical activity and consumption of alcohol and smoking after migration were observed. Slight decline in weight and BMI was observed after migration in all the three nations.
This research sheds light on the shifts in dietary habits, food consumption, and lifestyle behaviour among international students from various countries after they move to India. Consequently, it accentuates the importance of implementing nutrition programs for international students residing in India.

Keywords: Dietary acculturation, international students, migration, dietary changes.

Introduction
The system in which migrant groups adopt the eating habits of their host country is referred to as dietary acculturation. Adaptation to the host culture as well as conservation of existing cultures are involved in this process (Noyongoyo, 2011). At the beginning, the feeling of excitement may be dominated by acculturation stress, but international students may face the difficulties of language, academic pressure, financial difficulties, and lack of social support from their families and friends as time goes by (Mahmoodi, George, & Gokhale, 2021).
Migration to a new country presents challenges in adopting new dietary habits. In addition, international

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students must face different food environments which can lead to changes in dietary behaviour and anthropometric features between the time of migration and the present (Gedrich, 2003). Due to the fact that migrants can be influenced by different environment influences and cultural shocks, migration may have a significant influence on nutrition and health status (Edwards, Hartwell, & Brown, 2010).
International students may become accustomed to its host's customs and culture as they move from one country to another. Interaction with individuals is the basis for cultural behaviour, which evolves in a range of ways over time. An example of dynamic cultural behaviour that is constantly changing is eating habits. Changes in eating patterns can be observed at different levels, which could have a significant impact on type of food intake and therefore health (Jabber, *et al*., 2003).
There are many factors affecting the nature of eating habits, for instance socioeconomic status, food access, availability and lack of time have an impact on how we choose to eat, which may result in increased or reduced consumption of certain types of foods, thereby changing what people eat (Brittin & Obeidat, 2011). However, food habits are significantly a cultural phenomenon beyond physical and economic factors (Alakaam, 2016).
Despite several advantages of studying abroad (i.e., advanced knowledge and multicultural horizons), dietary changes and health care problems are challenging and disturbing to international students. Dietary behaviour played a major role in acculturation for international students (Booth, et al., 2001). A qualitative study showed that most international students were unsatisfied with the local foods they consumed. Edwards *et al*. found that many international postgraduate students experienced food neophobia (i.e., the phenomenon of rejection to eat unfamiliar or unknown food) and the food neophobia scores were even increased after a three-month follow-up (Jung & Jeon, 2011). The process of acculturation resulted in changes in health behaviour, such as diet and drinking behaviour, among international students. As a result, body weight might increase during dietary acculturation, which could potentially impact their health if the weight gain continued (Edwards, Hartwell, & Brown, 2010). Thus, it is important to pay attention to the dietary behaviour and health of international students

In addition to acculturation, there are many factors associated with changes in dietary behaviour among immigrants. A study by Rosenmoller *et al*., found that Chinese immigrants stayed in Canada for a longer period of time, consumed significantly larger meals, ate out more often and consumed convenience foods more frequently (Rosenmollar, *et al*., 2011). Pan *et al*. investigated the eating patterns of Asian international students before and after migration to the United States. This study reported that there was a significant increase in the intake of fruits, fats, sweets and skipping breakfast among Asian students; however, they also significantly reduced their intake of meat and vegetables after migration to the United States (Pan, *et al*., 1999).

International students possess unique personal preferences and cultural traditions that can influence their adaptation to dietary acculturation. Moreover, the campus environment at MMDU provides its own distinct factors that may influence the food choices of international students. The objective of this study was to investigate the eating habits and shifts in food preferences among international students at MMDU, while also gaining a comprehensive understanding of the factors associated with the effects of dietary acculturation within this specific student population. Presently, there is a scarcity of research focusing on the dietary acculturation experiences of the diverse international student population at MMDU, India. Consequently, the primary objective of this study is to investigate and delve into the dietary acculturation processes among international students enrolled at MMDU.

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Method and methodology:

3.1 Locale of study

This study which consisted of 413 participants was conducted in MMDU university campus and international students' residential area.

3.2 Sampling and design of the study

A sample represents a subset of the broader population, offering advantages such as saving time, money, and energy. In this study, a convenient sampling technique was employed to choose 413 participants from the population of interest. Consequently, the findings from this research can be confidently extrapolated to the broader population.

3.3 Selection of sample

The study utilized the convenient sampling method to choose a sample comprising 413 participants. This approach is regarded as the most elementary and uncomplicated way to select a sample from a population, particularly when there is limited prior knowledge about the population.

3.4 Method used for study

The current study employed the questionnaire approach as it was deemed suitable for collecting the required information. Care was taken when formulating the questions to ensure they were clear, concise, and easily comprehensible to participants. The primary aim of the questionnaire was to establish a standardized assessment tool.

3.5 Formation of questionnaire

The objective of creating the questionnaire was to elicit precise communication and responses from the participants. The process of making the questionnaire entailed thorough deliberation and refinement, with a constant focus on the study's goals. A questionnaire consisting of both open-ended and close-ended questions was developed, featuring clear and specific inquiries. The questionnaire encompassed the following sections:

1. Socio Demographic Information:

Socio demographic characteristics such as age, gender, nationality, type of residence and the length of stay in India were collected from the sample.

2. Anthropometric measurement (Pre and post migration)

Self-reported height and weight before and after migration were gathered from the sample population. Body mass index (BMI) was calculated using formula; weight in kg divided by height in meter square (Kg/m^2).

3. Dietary Assessment

I. Dietary Behaviors (Information on Food Habits) (Pre and post migration).

Dietary behaviors like their dietary habit, number of meals, frequency of eating breakfast, changes in portion size, appetite, consumption of packaged food, nutritional supplements, junk food and frequency of eating out were collected.

II. Food Consumption Pattern (Pre and post migration).

Frequency of vegetables, fruits, meat and fast-food consumption were taken from the participants.

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4. Lifestyle Factors (Pre and post migration).
Lifestyle factors such as frequency of smoking, alcohol consumption, exercise and sleep duration were recorded.

1.6 Collection of data
The data was gathered using a questionnaire, which included Socio Demographic Information, Anthropometric measurement, Dietary behaviour (Information on Food Habits), Food Consumption Pattern and Lifestyle Factors before and after migration.

1.6.1 Pre test
To ensure accuracy, a preliminary test was administered to the constructed questionnaire using a sample of 20 participants. This was carried out with the intention of identifying any potential shortcomings or issues in the questionnaire. Following the pretest, any necessary improvements or adjustments to the questionnaire was implemented.

1.6.2 Post test
A post-test was administered to the previously mentioned group of 413 participants.

3.7 Analysis of data
Data was analysed using Microsoft excel and descriptive statistics employed from SPSS version 29.0.1.0 (171).

Results:
Socio demographic characteristics
This study involved 413 participants, comprising 222 male international students (representing 54%) and 191 female international students (constituting 46%). Within this sample, 304 students (or 73.1%) fell into the age bracket of under 23 years, while approximately 109 students (or 26.3%) were aged 23 years or older.
In terms of nationality, the study included a higher percentage of African students (48.7%) compared to Nepalese (26.9%) and Bhutanese (25.5%) students. Of the entire group of 413 students, 202 individuals (making up 48.9%) had resided in India for more than two years. A significant portion of the students were found to be living in hostels, accounting for a total of 81.8%.

Table 1 **Socio demographic characteristics**

Variable	Frequency	Percentage (%)
Age		
Less than 23	**304**	**73.1**
= or > 23	**109**	**26.3**
Gender		
Male	**222**	**53.8**
Female	**191**	**46.2**
Nationality		
African	**201**	**48.7**
Nepalese	**111**	**26.9**
Bhutanese	**101**	**24.5**

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Type of residence		
Hostel	**338**	**81.8**
Rented room	**75**	**18.2**
Length of stay in India		
Less than 2 years	**202**	**48.9**
More than 2 years	**211**	**51.1**

Dietary behaviour and food consumption pattern

Table 2 shows the frequency and proportion of dietary behaviour and food consumption pattern such as their type of dietary habit, portion size, consumption of packaged food, junk food and nutritional supplement etc., by nationality. Chi square test was employed to determine any statistical significance between the variables and the different nationalities.

Table 2 *Frequency and percentage of dietary behaviour and food consumption pattern and chi square test between the variable by nationality (NS- statistically not significant (p-value > 0.005), SS- statistically significant (p-value <*

Type of dietary habit among different nation like Africa, Nepal and Bhutan showed a significant statistical association. Majority of students were non vegetarian with African	**African**	**Nepalese**	**Bhutanese**	**Total**	**X^2**	**p-value**
Type of dietary habit						
1. **Vegetarian**	9(3.5)	34(30.9)	29(28.7)	73(17.7)		
2. **Non vegetarian**	183(91)	50(45.5)	55(54.5)	288(69.7)		
3. **Vegan**	2(1)	12(10.9)	7(6.9)	21(5.1)	88.409^{SS}	<0.001
4. **Lacto ovo vegetarian**	7(4.5)	14(12.7)	10(9.9)	73(7.5)		
Consumption of packaged food						
1. **Yes**	157(78.1)	94(85.5)	85(84.2)	337(81.6)	3.245^{NS}	0.197
2. **No**	44(21.9)	16(14.5)	16(15.8)	76(18.4)		
If yes, did your consumption:						
1. **Decrease**	37(18.4)	5(4.5)	5(5)	48(11.6)		
2. **Increase**	89(44.3)	70(63.6)	63(62.4)	224(54.2)	26.523^{SS}	<0.001
3. **Remained same**	31(15.4)	19(17.3)	17(16.8)	67(16.2)		
Changes in portion size						
1. **Decreased**	147(73.1)	92(83.6)	70(69.3)	309(74.8)		
2. **Increased**	17(8.5)	8(7.3)	12(11.9)	37(9)	6.586^{NS}	0.159
3. **Remained same**	37(18.4)	10(9.1)	19(18.8)	67(16.2)		

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Consumption of junk food 1. **Yes** 2. **No**	166(82.6) 35(17.4)	88(80) 22(20)	82(81.2) 19(18.8)	337(81.6) 76(18.4)	0.291^{NS}	0.856
Do you ensure your food is nutritionally balanced? 1. **Yes** 2. **No**	119 (59.2) 82 (40.8)	44(40) 66(60)	32(31.7) 69(68.3)	195(47.2) 218(52.8)	23.924^{SS}	<0.001
Do you take any nutritional supplement? 1. **Yes** 2. **No**	52(25.9) 149(74.1)	24(21.8) 86(78.2)	23(22.8) 78(77.2)	99(24) 314(76)	0.814^{NS}	0.666
If yes, change in consumption after coming to India? 1. **Decreased** 2. **Increased** 3. **Remained same**	23(11.4) 16(8) 13(6.5)	11(10) 6(5.5) 7(6.4)	12(11.9) 4(4) 7(6.9)	46(11.1) 26(6.3) 27(6.5)	2.346 ^{NS}	0.885
How often do you cook native diet in India: 1. **Never** 2. **Seldom or almost never** 3. **Occasionally** 4. **Every alternate day** 5. **Everyday**	33(16.4) 52(25.9) 80(39.8) 20(10) 16(8)	10(9.1) 24(21.8) 52(47.3) 16(14.5) 8(7.3)	12(11.9) 18(17.8) 60(59.4) 6(5.9) 5(5)	55(13.3) 95(23) 192(46.5) 42(10.2) 29(7)	15.252^{SS}	0.054
Influence of Indian diet on shopping and cooking: 1. **Not at all** 2. **Somewhat** 3. **Very much**	86(42.8) 80(39.8) 35(17.4)	57(51.8) 49(44.5) 4(3.6)	38(37.6) 51(50.5) 12(11.9)	181(43.8) 181(43.8) 51(12.3)	15.243^{SS}	0.004
Do you eat? 1. **Yes** 2. **No**	161(80.1) 40(19.9)	82(74.5) 28(25.5)	86(85.1) 15(14.9)	330(79.9) 83(20.1)	3.553^{NS}	0.169

students topping the list with 91% followed by Bhutanese student with 54.5% and Nepalese with 45.5%. Consumption of packaged food showed no significant statistical association by nationality. Majority of the population were found to consume packaged food with percentage of 81.6% from the total population.

Changes in portion size showed no significant statistical association with nationality after migration. The largest proportion of students (74.8%) reported decrease in portion size after migration followed

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by portion size remaining same with 16.2% and 9% reporting increase in portion size. Consumption of junk food showed no significant statistical association with nationality. Maximum number of students (81.6%) were found to consume junk food.

About 52.8% of students reported that they do not ensure that their food is nutritionally balanced and only 47.2% make sure that their food is nutritionally balanced. And it shows significant statistical association with nationality. Only 24% of students were found to consume nutritional supplement whereas majority of them didn't take any nutritional supplement (76%) and it showed no significant statistical association with nationality. And among those students taking nutritional supplement, the consumption declined considerably after migration.

Table 2 *Frequency and percentage of dietary behaviour and food consumption pattern before and after migration with chi square analysis of the variables with nationality NS (p-value- >0.005)-Statistically not significant, SS(p-value-<0.005).*

Variables	**Africa(n=201)**			**Nepal(n=110)**			**Bhutanese(n=101)**			**Total**
	In Africa	**In India**	**X²**	**In Nepal**	**In India**	**X²**	**In Bhutan**	**In India**	**X²**	**X²**
No. of meals per day										
1. **1 meal per day**	2 (1)	10 (5)		1(0.9)	5(4.5)		0	4(4)		
2. **2 meals per day**	9 (4.5)	77(38.3)	42.66 SS	6(5.5)	51(46.4)	48.49 SS	4(4)	34(33.7)	3.861 NS	69.95 SS
3. **3 meals per day**	146(72.6)	87(43.3)		77(70)	41(37.3)		92(91.1)	62(61.4)		
4. **4 meals per day**	39 (19.4)	25(12.4)		23(20.9)	13(11.8)		5(50)	1(10)		
5. **More than 4 meals/day**	5 (2.5)	2(1)		3(2.7)	0		0	0		
Frequency of eating breakfast										
1. **Always**	155(77.1)	73(36.3)	23.89 SS	82(74.5)	39(35.5)	15.15 SS	70(69.3)	36(35.6)	9.688 SS	20.09 SS
2. **Never**	3(1.5)	14(7)		2(1.8)	9(8.2)		3(3)	13(12.9)		
3. **Sometimes**	43(21.4)	114(56.7)		26(23.6)	62(56.4)		28(27.7)	52(51.5)		
Appetite										
1. **Excellent**	144(71.6)	5(2.5)		92(83.6)	3(2.7)		60(59.4)	5(5)		
2. **Fair**	6(3)	83(41.3)	1.145 NS	3(2.7)	51(46.4)	18.718 SS	6(5.9)	41(40.6)	2.668 NS	16.66 SS
3. **Good**	51(25.4)	79(39.3)		13(11.8)	42(38.2)		35(34.7)	33(32.7)		
4. **Poor**	0			2(1.8)			0			

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		34(16.9)			14(12.7)			22(21.6)		
Consumption of vegetables: 1. **Less than or equal to one** 2. **Twice a day** 3. **Thrice a day** 4. **More than or equal to four times a day**	47(23.4) 68(33.8) 71(35.8) 15(7.5)	81(40.3) 71(35.3) 38(18.9) 11(5.5)	42.354 SS	7(6.4) 18(16.4) 67(60.9) 18(16.4)	32(29.3) 53(48.2) 22(20) 3(2.7)	36.91 SS	7(6.9) 18(17.8) 64(63.4) 12(11.9)	43(42.6) 40(39.6) 16(15.8) 2(2)	10.845 SS	70.31 SS
Consumption of fruits: 1. **Almost never** 2. **Once a day** 3. **Twice a day** 4. **Thrice a day** **More than or equal to four times a day**	10(5) 114(56.7) 46(22.9) 13(6.5) 18(9)	122(60.7) 59(29.4) 13(6.5) 3(1.5) 4(2)	55.245 SS	6(5.5) 57(51.8) 37(33.6) 7(6.4) 3(2.7)	65(59.1) 39(35.5) 4(3.6) 2(1.8) 0	64.224 SS	24(23.8) 48(47.5) 15(14.9) 7(6.9) 7(6.9)	73(72.3) 20(19.8) 7(6.9) 1(1) 0	20.615 SS	99.27 SS
Fast food consumption per week: 1. **Almost never** 2. **1-3 times** 3. **4-6 times** 4. **More than or equal to 7 times**	45(22.4) 133(66.2) 18(9) 5(2.5)	36(17.9) 76(37.8) 55(27.4) 34(16.9)	62.73 SS	24(21.8) 80(72.7) 6(5.5) 0	6(5.5) 39(35.5) 49(44.5) 16(14.5)	40.75SS	34(33.7) 62(61.4) 4(4) 1(1)	12(11.9) 40(39.6) 33(32.7) 16(15.8)	56.03 SS	126.93 SS

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If non-vegetarian, frequency of meat consumption: 1. **Rarely** 2. **Occasionally** 3. **Alternate days** 4. **Every day**	3(1.5) 12(6) 92(45.8) 76(37.8)	73(36.3) 60(29.9) 41(20.4) 9(4.5)	189.32 SS	3(2.7) 11(10) 22(20) 14(12.7)	17(15.5) 25(22.7) 6(5.5) 2(1.8)	141.63 SS	3(3) 23(22.8) 26(25.7) 3(3)	32(31.7) 17(16.8) 4(4) 2(2)	116.77 SS	133.44 SS
If you eat out, how often do you eat out? 1. **Rarely** 2. **Occasionally** 3. **Alternate day** 4. **Every day**	39(19.4) 90(44.8) 25(12.4) 7(3.5)	13(6.5) 62(30.8) 73(36.3) 13(6.5)	257.14 SS	20(18.2) 50(45.5) 9(8.2) 3(2.7)	5(4.5) 34(30.9) 37(33.6) 6(5.5)	189.94 SS	35(34.7) 39(38.6) 11(10.9) 1(1)	11(10.9) 34(33.7) 31(30.7) 10(9.9)	134.77 SS	592.75 SS

Table 3 provides information about the frequency and proportion of dietary behaviour and food consumption pattern variables before and after migration in different nationalities such as African, Bhutanese and Nepalese. The data also underwent chi square test to find any statistical significance between the variables and different nationalities.
All the dietary behaviour and food consumption pattern variables before and after migration showed a significant statistical association with nationality.
After migration majority of the students were found to lead an unhealthy lifestyle with increased consumption of fast food and frequency of eating out. And decrease in consumption of fruits, vegetables and meat were observed. Following migration, the participants were also found to have decreased incidences of breakfast consumption and a suppressed appetite.

Table 3 *Total mean and standard deviation of weight, height and BMI before and after migration*

	Before	**After**
Variable	**Mean±SD**	
Height (Cm)	167.02±9.24	167.69±9.403
Weight (Kg)	60.65±9.52	59.184±9.18
BMI (Kg/m^2)	21.74±3.22	21.04±2.988

Anthropometric measurements
Table 4 illustrates the total mean changes in anthropometric measurements such as weight, height and BMI before and after migration. The mean height before migration was 167.02 cm and it showed slight increase after migration with 167.69 cm. The mean body weight before migration was 60.65kg and

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there was a slight drop in mean body weight after migration with 59.184kg. No significant changes in BMI were recorded, before migration the mean BMI was 21.74 Kg/m^2 and after migration it was 21.04 Kg/m^2.

Table 5 *Mean changes in anthropometric indices like weight, height and BMI before and after migration by different nationality. Pearsons R correlation coefficient test was done to find any significant correlation*

Variable	Africa		Nepal		Bhutan		Pearson's R
	In Africa	In India	In Nepal	In India	In Bhutan	In India	
	Mean ±SD		Mean ±SD		Mean ±SD		
Height	169.19±9.72	170.1±9.601	166.47±8.57	166.91±9.01	163.27±7.64	163.71±7.93	0.985
Weight	63.47±9.36	62.391±8.83	58.52±8.95	56.47±8.37	57.33±8.87	55.7±8.56	0.912
BMI	22.25±3.707	21.62±3.27	21.07±2.632	20.23±2.45	21.45±2.68	20.75±2.70	0.888
Variable	**Africa**		**Nepal**		**Bhutan**		**Pearson's R**
	In Africa	**In India**	**In Nepal**	**In India**	**In Bhutan**	**In India**	
	Mean ±SD		**Mean ±SD**		**Mean ±SD**		
Height	169.19±9.72	170.1±9.601	166.47±8.57	166.91±9.01	163.27±7.64	163.71±7.93	0.985
Weight	63.47±9.36	62.391±8.83	58.52±8.95	56.47±8.37	57.33±8.87	55.7±8.56	0.912
BMI	22.25±3.707	21.62±3.27	21.07±2.632	20.23±2.45	21.45±2.68	20.75±2.70	0.888

Table 5 shows the mean changes in anthropometric indices like weight, height and BMI before and after migration among different countries. Pearsons R correlation coefficient test was conducted on individual indices against the countries before and after migration to identify any significant correlation. Height before and after migration shows very high positive correlation with nationality. In African population slight increase in mean after migration was observed (In Africa- 169.19 cm, in India- 170.1 cm). Whereas in Nepalese and Bhutanese students, very minute difference was observed.

Bodyweight before and after migration shows very high positive correlation with nationality. Decline in bodyweight was observed in all three nationalities before and after migration (In African- drop from 63.47kg to 62.391kg, In Nepalese- decline from 58.52 to 56.47kg and in Bhutanese- fall from 57.33kg to 55.7kg).

BMI before and after migration showed a high positive correlation with nationality. BMI slightly declined after migration in all the three nationalities (In African- from 22.25kg/m^2, in Nepalese- from 21.07 kg/m^2 to 20.23 kg/m^2 and in Bhutanese BMI declined from 21.45 kg/m^2 to 20.75 kg/m^2).

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Table 6 *Frequency and percentage of lifestyle variables and their chi square test among different nationality NS (p value->0.05)- Statistically not significant, SS (p-value-<0.05)- Statistically* significant.

Variables	Africa	Nepal	Bhutan	Total	X^2	p-value
Do you drink alcohol?						
1. **Yes**	69(34.3)	38(34.5)	45(44.6)	152(36.8)	3.453^{NS}	0.178
2. **No**	132(65.7)	72(65.5)	56(55.4)	261(63.2)		
Do you smoke?						
1. **Yes**	47(23.4)	35(31.8)	26(25.7)	108(26.2)	2.470^{NS}	0.291
2. **No**	154(76.6)	75(68.2)	75(74.3)	305(73.8)		
In comparison to your home nation, how active are you in India?						
1. **Less active**	59(29.4)	20(18.2)	35(34.7)	114(27.6)	8.665^{NS}	0.070
2. **Constant**	88(43.8)	60(54.5)	41(40.6)	109(26.4)		
3. **More active**	54(26.9)	30(27.3)	25(24.8)	190(46)		
Do you exercise?						
1. **Yes**	147(73.1)	67(60.9)	59(58.4)	273(66.1)	8.732^{SS}	0.013
2. **No**	54(26.9)	43(39.1)	42(41.6)	140(33.9)		

Lifestyle factors

Table 6 provides information about the frequency and percentage of different lifestyle variables such as drinking, smoking and physical activity against students of different nationality. And also, the variables underwent statistical test i.e., chi square test of independence to find if there is any significant relationship between the lifestyle factors among different nation. There were more sample from the study who didn't drink alcohol amounting to 63.2% of the total population and around 36.8 % were found to consume alcohol. And also, the frequency of smoking was relatively less in the sample population accounting to about only 108 with 26.2% from population of 413 samples. Almost half of the students recorded being more active after migrating to India for studies with the total of 46% and followed by being less active with 27.6% and then being steady with 26.4%.

A greater proportion of sample recorded exercising with 66.1% compared to those who didn't exercise with 33.9%. The frequency of exercising showed a statistically significant association with nationality. Whereas frequency of drinking, smoking and level of physical activity after migration showed no statistically significant association.

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Table 4 *Association of lifestyle variable before and after migration with nationality and chi square analysis. NS (p value >0.05) – Statistically not significant, SS (p value-<0.05)– Statistically significant.*

Variables	**Africa**		**X²**	**Nepal**		**X²**	**Bhutanese**		**X²**	**Total X²**
	In Africa	**In India**		**In Nepal**	**In India**		**In Bhutan**	**In India**		
Frequency of alcohol consumption:	53(26.4)	48(23.9)	223.97 SS	33(30)	29(26.4)	161.37 SS	35(34.7)	35(34.7)	110.99 SS	446.49 SS
1. Occasionally	10(5)	17(8.5)		3(2.7)	8(7.3)		9(8.9)	10(9.9)		
2. 2-3 times a month	5(2.5)	2(1)		1(0.9)	1(0.9)		1(1)	0		
3. 2-3 times a week	1(0.5)	2(1)		1(0.9)	0		0	0		
4. Everyday										
Frequency of smoking:	26(12.9)	15(7.5)	283.67 SS	23(20.9)	5(4.5)	138.05 SS	8(7.9)	5(5)	151.86 SS	543.11 SS
1. Once a day	18(9)	7(3.5)		7(6.4)	7(6.4)		12(11.9)	8(7.9)		
2. Occasionally	3(1.5)	25(12.4)		5(4.5)	23(20.9)		6(5.9)	13(12.9)		
3. Numerous times a day										
Level of physical activity:	35(17.4)	52(25.9)	22.815 SS	29(26.4)	38(34.5)	18.287 SS	20(19.8)	30(29.7)	7.18 NS	48.44 SS
1. Sedentary	141(70.1)	125(62.2)		74(67.3)	68(61.8)		75(74.3)	66(65.3)		
2. Moderate	25(12.4)	24(11.9)		7(6.4)	4(3.6)		6(5.9)	5(5)		
3. Heavy										
Sleep duration:	21(10.4)	63(31.3)	37.462 SS	4(3.6)	25(22.7)	32.528 SS	7(6.9)	30(29.7)	16.966 SS	63.005 SS
1. Less than 6 hours				28(25.5)			16(15.8)			
2. 6 hours	57(28.4)	69(34.3)		70(63	41(37.3)		57(56	33(32.7)		

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3. 6-8 hours 4. More than 8 hours	98(48.8) 25(12.4)	58(28.9) 11(5.5)		.6) 8(7.3)	37(33.6) 7(6.4)		.4) 21(20.8)	34(33.7) 4(4)		

Table 7 illustrates the changes in lifestyle factors like drinking, smoking, sleeping, and level of physical activity before and after migration within different nationality i.e., African, Nepalese and Bhutanese. Chi square test was performed on the data to find statistical significance before and after migration by nationality.

Among the various lifestyle factor variables, there was a significant statistical correlation with nationality for all except for Bhutanese students, where the level of physical activity before and after migration did not exhibit a statistically significant association. Notably, the frequency of alcohol consumption and smoking increased following migration. Additionally, a small number of students were observed to transition from moderate and high levels of physical activity to a sedentary lifestyle.

Before migration majority of students from all nationality were found to sleep between 6-8 hours (African- 48.8%, Nepalese- 63.6% and Bhutanese-56.4%) but after migration the trend shifted to 6 hours and less than 6 hours of sleep.

Discussion

This research aimed to investigate alterations in dietary habits, food consumption trends, anthropometric measurements, and lifestyle choices among international students at MMDU both prior to and following their migration. The study encompassed a total of 413 participants, comprising 201 individuals from Africa, 110 from Nepal, and 101 from Bhutan among the international student.

In summary, the study's findings indicate that international students at MMDU developed unhealthy dietary habits following their migration. There was a notable increase in the consumption of fast food, junk food, and packaged snacks, accompanied by a decrease in the intake of fruits, vegetables, and meat products across all three nationalities. Additionally, the number of daily meals decreased from three to four meals to one to two meals per day, with a significant reduction in breakfast consumption and portion sizes. A significant proportion of the participants also reported a supressed appetite after migration.

This study also revealed that most of the participants did not include nutritional supplements in their diet, and among those who did, the frequency of consumption decreased. Furthermore, Nepalese and Bhutanese participants were not following a nutritionally balanced diet. The above-mentioned negative impact on dietary behaviour may be attributed to the transition from living with their parents to a new environment. And also, in cases where healthy eating habits were not firmly established during their time with their parents, the migration experience may exacerbate this issue due to a potential lack of knowledge, culinary skills, and self-confidence in meal preparation. Additionally, limited financial resources among international students could also contribute to these dietary changes.

No significant changes in anthropometric measurements were observed both before and after migration. There was slight drop in weight and BMI which may be attributed to reduced portion size, number of meals and supressed appetite.

The study also identified adverse effects of acculturation on lifestyle behaviour, including alcohol consumption, smoking frequency, physical activity levels, and sleep duration following migration.

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Post-migration, there was an increase in the frequency of alcohol consumption and smoking, possibly due to the greater availability and affordability of these products in the host country. Meanwhile, physical activity shifted from moderate and high levels to more sedentary behaviour, and students reported shorter sleep durations after their move. Considering the self-reliant lifestyle of international students, it becomes imperative to implement nutrition interventions aimed at assisting students in independently making wise dietary choices for their long-term nutritional well-being.

Limitation of the study

The current research has certain constraints, including a limited sample size and reliance on self-reported data especially for anthropometric measurements, which increases the potential for recall bias.

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