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Exploring the Impact of Seasonal Variations (Winter and Summer) on Physical Activity, Dietary Habits, Nutrient Intake, and Wellness among University Students of Age 18-30

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Article Details

ABSTRACT

Keywords: Seasonal Variation, Physical Activity, Dietary Habits, Nutrient Intake, Wellness

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Seasonal changes can influence university students' physical activity, dietary habits, nutrient intake, and well-being. Research suggests activity and diet often shift with the seasons. Understanding these effects is important for student health support. This study explores how seasonal variation impacts these factors among university students. To explore the impact of seasonal variations on physical activity, dietary habits, nutrients intake and wellness among university students of age 18-30. A cross-sectional study based on 200 university students was conducted at the superior university, Lahore for 4 months (after the approval of synopsis). The sampling technique used was a convenient sampling technique. The study was carried out by using a survey-based questionnaire. Sampling selection was conducted through the inclusion criteria (all male and female students aged 18-30). For the analysis of data SPSS version 25.0 was used. Statistical examination proved that there was a major variation in the health-related behaviors based on seasons. The correlation between BMI and physical activity was significant during winter ($p = 0.003$), and not during summer ($p = 0.333$). Poor energy was also closely associated with poor consumption of high-protein foods during summer ($p < 0.001$) and winter ($p = 0.003$), although the association between changes in appetite, and the consumption of fruits, was also high in summer ($p < 0.001$), compared to winter ($p = 0.066$). Moreover, the stress and its effect on mental health also demonstrated high significance in summer ($p < 0.001$) and winter ($p = 0.002$). Based on these findings, seasonal exposure and food intake are important determinants of physical activity, energy expenditure and mental health. Changes in seasons as well as food intake have a considerable effect on physical activity, energy and well-being of the participants. The multiple outcomes of health outcomes that showed statistical significance point towards the possible need to incorporate seasonal factors in health promotion. These results are based on the necessity to introduce specific seasonal interventions aimed at increasing general wellness across seasons.

DOI: Availability

INTRODUCTION

Seasonal variations significantly influence various aspects of human behavior, particularly in relation to physical activity and dietary choices. For instance, colder weather and shorter daylight hours during winter months often lead to reduced outdoor activities and increased sedentary behavior among individuals, including university students. These demographic experiences a unique transition in their lives, marked by changes in lifestyle habits that can directly impact their overall health and well-being. While the nutrition and physical activity of university students have been extensively studied, the specific influence of seasonal changes on these factors remains underexplored (1).

In contrast, warmer temperatures and longer daylight hours in summer tend to encourage outdoor physical activities and healthier dietary choices. However, poor nutrition and physical inactivity pose significant risks to university students, as many fail to maintain regular meal schedules, skip breakfast, and gravitate towards fast food options. Such unhealthy practices can lead to obesity and chronic diseases, particularly when compounded by the demands of an academic schedule that spans multiple seasons. The relationship between physical activity and dietary habits among university students is well-documented, revealing a positive correlation between active lifestyles and healthy eating patterns. Nevertheless, many students continue to engage in detrimental dietary and exercise habits, influenced by factors such as time constraints, lack of nutritional knowledge, and socioeconomic status (2,3).

The COVID-19 pandemic has further complicated the dynamics of physical activity and dietary habits among young adults, highlighting a shift in behaviors that may have long-term health implications. Despite existing research on the eating habits and physical activity levels of university students, there is a notable gap in understanding how these patterns vary with the seasons. Seasonal changes can affect not only the quantity and quality of physical activity but also the availability and affordability of nutritious foods. This study aims to address this gap by examining the impact of seasonal variations on physical activity, dietary choices, nutrient intake, and overall well-being among university students (4).

Reilly et al. (2006) explored the effects of seasonal climatic variations on physical activity and

health. They noted that winter months often lead to decreased physical activity, which can negatively impact fitness levels. The study highlighted that athlete must adapt to seasonal changes, which can affect their performance and increase the risk of injuries. Additionally, the research pointed out that seasonal birth dates could influence health outcomes, suggesting that trainers and selectors should consider these factors to ensure equitable opportunities for talent development (5,6).

Chan et al. (2006) assessed the relationship between weather conditions and physical activity among a sample of 202 adults. Their findings indicated that weather factors such as temperature, rainfall, and wind speed had a minor influence on physical activity levels, with variations in activity observed based on gender and body mass index (BMI). The study concluded that while weather does impact physical activity, the effects are relatively small and warrant further investigation, particularly concerning outdoor activities (7,8).

This research will provide valuable insights into how seasonal changes affect the health behaviors of university students, enabling universities to develop targeted interventions that promote healthier lifestyles. By understanding the seasonal patterns in physical activity and dietary choices, institutions can implement seasonal health promotion programs that cater to the unique needs of students throughout the academic year (9).

Additionally, the findings of this study may contribute to the broader field of public health by highlighting the importance of considering seasonal variations in health promotion strategies. This knowledge can inform policymakers and health educators in designing effective interventions that address the specific challenges faced by university students, ultimately leading to improved health outcomes and academic performance (10).

The impact of seasonal changes on physical activity, dietary habits, and overall well-being among university students is a critical area of research that warrants further exploration. By examining these factors, this study aims to fill the existing gap in the literature and provide actionable insights for promoting healthier lifestyles among students. The findings will not only enhance our understanding of the interplay between seasons and health behaviors but also guide the development of effective interventions that support the well-being of university students throughout their academic journey (11).

METHODOLOGY

RESEARCH DESIGN: Cross sectional

Clinical Settings: The study was conducted in Superior University Lahore, targeting students across various departments and faculties.

SAMPLE SIZE: A sample size of 200 university students was recruited for this study. This sample size is chosen to ensure adequate representation while considering the time constraints of the 4-month study period.

SAMPLING TECHNIQUE: Convenience sampling

DURATION OF STUDY: This was completed in 4-month.

SELECTION CRITERIA

INCLUSION CRITERIA

- Full-time university students aged 18-30 years
- Enrolled at university for the entire duration of the study
- Willing to participate in both data collection points

EXCLUSION CRITERIA

- Part-time students
- Students with chronic illnesses that significantly affect their diet or physical activity
- Students planning to study abroad during the study period

DATA COLLECTION PROCEDURE

Develop a comprehensive questionnaire addressing physical activity, dietary habits, nutrient intake, and wellness indicators. Collect additional anthropometric measurements (height, weight) at each time point.

DATA ANALYSIS

Data was analyzed in SPSS software version 25.0. Descriptive statistics was used to summarize the participant characteristics and overall trends frequency and percentage. Association was assessed by using chi square test at $p < 0.05$.

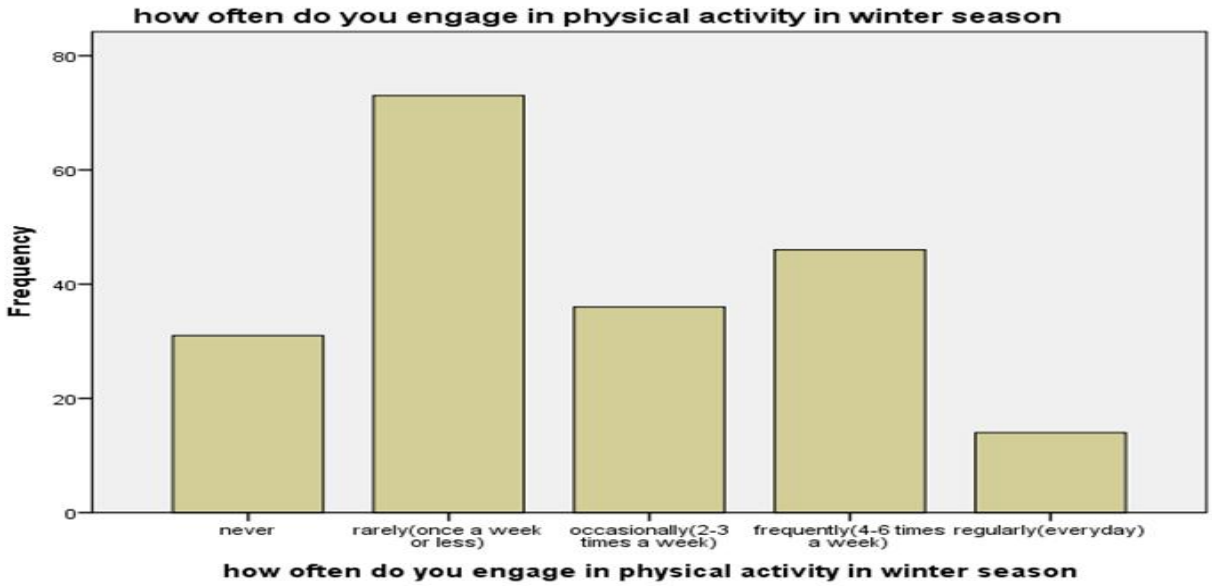
RESULTS

TABLE 1: FREQUENCY OF BMI

BMI	FREQUENCY	PERCENTAGE
Underweight	27	13.5
Normal	130	65.0
Overweight	39	19.5
Obese	4	2.0
Total	200	100

This table provides a clear distribution of BMI categories among the 200 participants, with the majority (65%) falling within the normal BMI range, (13.5%) falling within the underweight. (19.5%) are overweight and (2%) are obese.

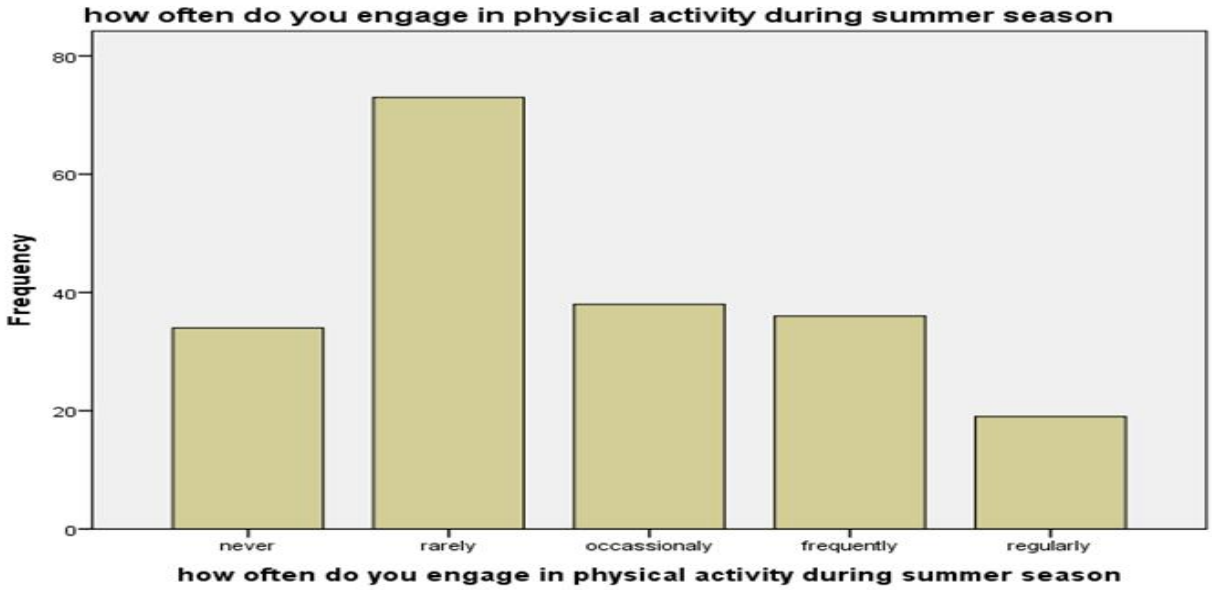
FIG 01: HOW DO YOU ENGAGE IN PHYSICAL ACTIVITY IN WINTER SEASON



The table provides a clear image of how often people engage in physical activity during the winter season. The majority of the respondents (36.5%) reported being physical active rarely i.e., once a week. A significant proportion (23.0%) reported being physically active frequently i.e., 4-6 times a week. The data also shows that (15.5%) of the respondents never engage in physical activity during winter, while (7.0%) do so regularly i.e., every day.

FIG 02: HOW OFTEN DO YOU ENGAGE IN PHYSICAL ACTIVITY DURING SUMMER

SEASON



The table "PHYSICAL ACTIVITY IN SUMMER" shows how often 200 people exercise in summer. The results are: 17% never exercise, 36.5% exercise once a week, 19% exercise 2-3 times a week, 18% exercise 4-6 times a week, and 9.5% exercise daily.

TABLE NO 2: CONSUMPTION OF FRESH FRUITS DURING SUMMER SEASON

Consumption of fresh fruits during summer	Frequency	Percentage
Never	9	4.5
Rarely (once a week)	24	12.0
Occasionally (2-3 times a week)	93	46.5
Frequently (4-6 times a week)	35	17.5
Regularly (everyday)	39	19.5
Total	200	100.0

The table "consumption of fresh fruits during summer season" shows the frequency of fresh fruit consumption among 200 individuals. The results indicate that 4.5% never consume fresh fruits, 12%

consume them once a week, 46.5% consume them 2-3 times a week, 17.5% consume them 4-6 times a week, and 19.5% consume them daily. The majority (46.5%) consume fresh fruits occasionally, while a significant proportion (37%) consume them frequently or regularly.

TABLE NO 3: CONSUMPTION OF FRESH FRUITS DURING WINTER SEASON

Consumption of Fresh Fruits During Winter	Frequency	Percentage
Never	16	8.0
Rarely (once a week)	42	21.0
Occasionally (2-3 times a week)	90	45.0
Frequently (4-6 times a week)	21	10.5
Regularly (everyday)	31	15.5
Total	200	100.0

The table "consumption of fresh fruits during winter season" presents data on the frequency of fresh fruit consumption among 200 individuals during the winter season. The results show that 8% of the respondents never consume fresh fruits, 21% consume them rarely (once a week), 45% consume them occasionally (2-3 times a week), 10.5% consume them frequently (4-6 times a week), and 15.5% consume them regularly (every day). The majority (45%) of the respondents consume fresh fruits occasionally, while a significant proportion (26%) consume them frequently or regularly.

TABLE NO 4: CHANGE IN APPETITE VS SEASON VARIATIONS IN SUMMER SEASON

Change in Appetite in Summer Season	Frequency	Percentage
Yes	151	75.5
No	49	24.5
Total	200	100.0

This table shows that 75.5% participants have change in appetite in summer and 24.5% participants don't have change in appetite.

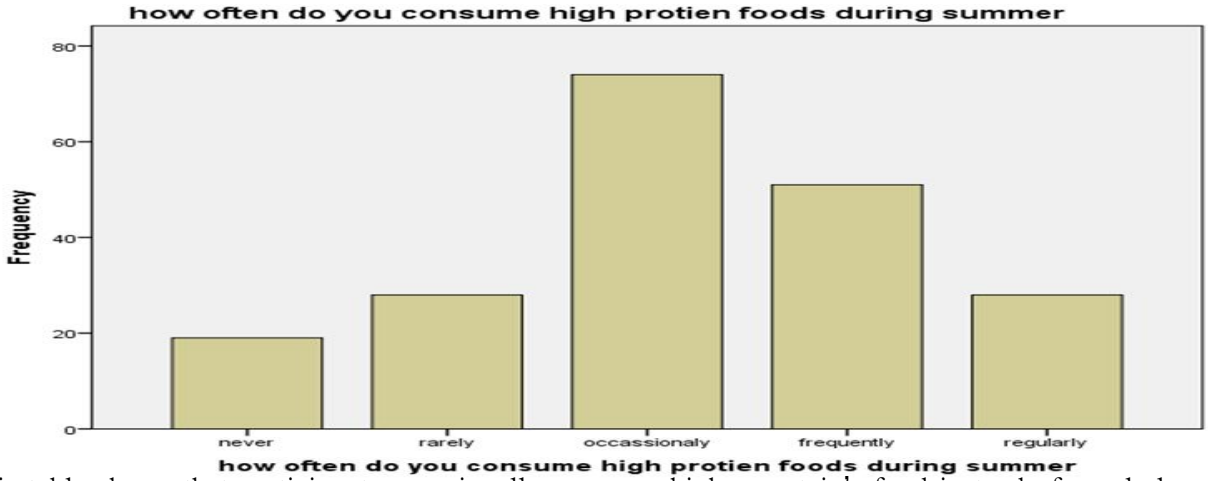
TABLE NO 5: CHANGE IN APPETITE VS SEASON VARIATIONS IN WINTER SEASON

Change In Appetite In Winter Season	Frequency	Percentage

Yes	138	69.0
No	62	31.0
Total	200	100.0

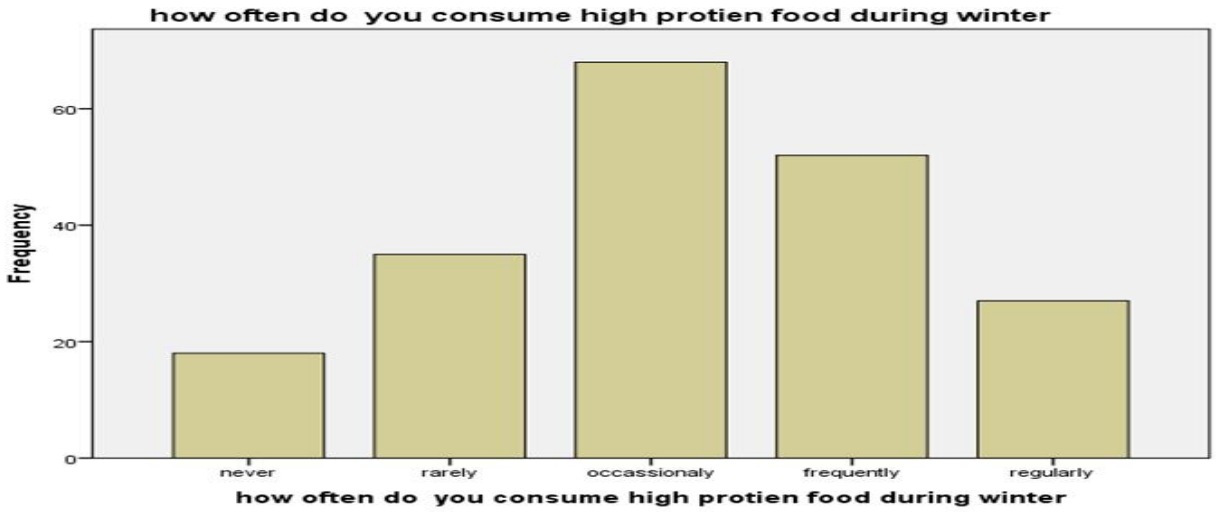
This table shows that 69% participants have change in appetite during winter and 31.0 % participants don't have change in appetite during winter.

FIG 03: HOW OFTEN DO YOU CONSUME HIGH PROTEIN FOODS DURING SUMMER



This table shows that participants occasionally consume higher protein's food instead of regularly and frequently. Occasionally they consume 37.0%, frequently25.5%, regularly and rarely just for 14% and regularly consume the lowest 9.5%.

FIG 04: HOW OFTEN DO YOU CONSUME HIGH PROTEIN FOOD DURING WINTER



The table presents a survey on the frequency of consuming high-protein food during winter, with 200 respondents. The results show that 9% never consume high-protein food, 17.5% rarely do, 34% do so occasionally, 26% frequently, and 13.5% regularly. This data provides insight into the eating habits of individuals during the winter season.

TABLE NO 6: DIETARY SUPPLEMENTATION IN SUMMER

Dietary Supplementation During Summer	Frequency	Percentage
Yes	41	20.5
No	159	79.5
Total	200	100.0

In the summer, 41 individuals, accounting for 20.5% of the total, took dietary supplements. Conversely, 159 individuals, representing 79.5%, did not take any supplements. The total number of individuals surveyed during this season was 200.

TABLE NO 8: DIETARY SUPPLEMENTATION IN WINTER

Dietary Supplementation During Winter	Frequency	Percentage
Yes	50	25.0
No	150	75.0
Total	200	100.0

During the winter season, 50 individuals, making up 25.0% of the total, opted for dietary supplements. On the other hand, 150 individuals, constituting 75.0%, chose not to take any supplements.

TABLE NO 8: WELLNESS AND SEASONAL VARIATIONS OF ENERGY DURING SUMMER SEASON

Energy in Summer Season	Frequency	Percentage
Yes	98	49.0
No	102	51.0
Total	200	100.0

This table presents data on energy levels during the summer season. According to the table, 98 individuals reported having energy, which accounts for 49.0% of the total respondents. On the other

hand, 102 individuals stated they did not have energy, making up 51.0% of the total.

TABLE NO 9: WELLNESS AND SEASONAL VARIATIONS OF ENERGY DURING WINTER SEASON

Energy in Winter Season	Frequency	Percentage
Yes	87	43.5
No	113	56.5
Total	200	100.0

This table displays data on energy levels during the winter season. As shown in the table, 87 individuals reported having energy, representing 43.5% of the total respondents. In contrast, 113 individuals stated they did not have energy, accounting for 56.5% of the total.

TABLE NO 10: ASSOCIATION OF BMI VS PHYSICAL ACTIVITY IN WINTER SEASON

BMI	Engagement in physical activity in winter					Total	P value
	Never	Rarely	occasionally	frequently	regularly		
Underweight	5	10	8	3	1	27	.003
Normal	23	39	28	33	7	130	
Overweight	3	20	0	10	6	39	
Obese	0	4	0	0	0	4	
Total	31	73	36	46	14	200	

This table analyzes the relationship between BMI categories (underweight, normal, overweight, obese) and physical activity frequency in winter. The significant association (p-value = 0.003) indicates that individuals with different BMIs show distinct patterns of activity during colder months, likely due to factors like seasonal affective changes or physical barriers in cold weather.

TABLE NO 11: ASSOCIATION OF BMI VS PHYSICAL ACTIVITY IN SUMMER SEASON

BMI	Engagement In Physical Activity In Winter					Total	P value
	Never	Rarely	Occasionally	Frequently	Regularly		
Underweight	5	11	7	4	0	27	.333
Normal	20	44	28	25	13	130	

Overweight	7	16	3	7	6	39
Obese	2	2	0	0	0	4
Total	34	73	38	36	19	200

The table examines BMI and physical activity in summer and finds no significant association (p-value = 0.333). This suggests that warmer weather and longer days may encourage activity across all BMI groups, reducing seasonal differences seen in winter.

TABLE NO 12: ENERGETIC STATUS AND PHYSICAL DISCOMFORT IN SUMMER

Do you feel energetic during summer	Do you experience any physical discomforts during summer		Total	P value
	YES	NO		
Yes	58	40	98	.000
No	84	18	102	
Total	142	58	200	

The table shows a significant association between low level of energy during summer and experiencing physical discomforts (p-value = .000). Among 200 participants, 98 felt energetic and 102 did not. Notably, 58 energetic individuals experienced discomforts, while 84 non-energetic individuals did. This suggests that those who don't feel energetic during summer are more likely to experience physical discomforts.

TABLE NO 13: ASSOCIATION OF LOW ENERGY AND HIGH-PROTEIN FOOD CONSUMPTION IN SUMMER

Consumption of High Proteins Food During Summer	Energetic During Summer		Total	P value
	Yes	No		
Never	15	4	19	.005
Rarely	19	9	28	
Occasionally	30	44	74	
Frequently	20	31	51	
Regularly	14	14	28	
Total	98	102	200	

This table examines whether low energy levels during summer are associated with reduced consumption of high-protein foods. The p-value for this association is 0.005, indicating a highly significant relationship. This means that participants who reported low energy in summer were much more likely to also report low intake of high-protein foods. The very low p-value shows that this connection is unlikely to be due to chance, suggesting that insufficient protein intake during hot weather may be a key factor in feeling less energetic.

TABLE NO 14: ASSOCIATION OF LOW ENERGY AND HIGH-PROTEIN FOOD CONSUMPTION IN WINTER

Consumption Of High Proteins Food During Winter	Energetic During Winter		Total	P Value
	Yes	No		
Never	11	7	18	.003
Rarely	28	7	35	
Occasionally	39	29	68	
Frequently	27	25	52	
Regularly	8	19	27	

Total	113	87	200

This table explores the association between energy levels and high-protein food intake during winter, with a p-value of 0.003. This significant result indicates that individuals who consume more high-protein foods in winter are more likely to report higher energy levels, suggesting that adequate protein intake plays an important role in maintaining energy during colder months.

TABLE NO 15: ASSOCIATION BETWEEN CONSUMPTION OF FRESH FRUITS AND CHANGE IN APPETITE IN SUMMERS

Change in Appetite in Summer	Consumption of Fresh Fruits in Summer					Total	P value
	Never	Rarely	Occasionally	Frequently	Regularly		
Yes	5	9	82	25	30	151	.000
No	4	15	11	10	9	49	
Total	9	24	93	35	39	200	

The table shows the relationship between changes in appetite and fresh fruit consumption in summer and winter. In summer, there's a significant correlation, with a p-value of .000. Those with changed appetite consume more fruits, with 82 occasionally and 30 regularly eating fresh fruits.

TABLE NO 16: ASSOCIATION BETWEEN CONSUMPTION OF FRESH FRUITS AND CHANGE IN APPETITE IN WINTER

Change in Appetite in Winter	Consumption of fresh fruits in winter					Total	P value
	Never	Rarely	Occasionally	Frequently	Regularly		
Yes	9	11	22	7	13	62	.066
No	7	31	68	14	18	138	
Total	16	42	90	21	31	200	

In winter, the correlation is less pronounced, with a p-value of .066 because students often do not prefer to eat more fresh fruits during winter. Overall, appetite changes are more strongly linked to fruit consumption in summer than winter.

DISCUSSION

The purpose of this study is to explore the impact of seasonal variations on physical activity, dietary habits, nutrient intake and wellness among university students. This finding reveals notable seasonal influence on lifestyles behaviours.

This study comprises of 200 students from different disciplines. This study shows a clear distribution of BMI categories among the 200 participants, with the majority (65%) falling within the normal BMI range, (13.5%) falling within the underweight. (19.5%) are overweight and (2%) are obese (12).

This study has significant findings like there is strong association between BMI and physical activity during summer (p=0.003), while no such significance is found in summer (p=0.333). A higher percentage of underweight and obese individuals reported low engagement in physical activity during winter. This suggests that colder weather may discourage physical activity, especially among those with higher BMI, possibly due to discomfort or motivation issues. In contrast, the more favorable summer conditions appear to encourage activity across all BMI groups, reducing these differences (13).

Tucker et al, (2007) and Shephard et al (2009), identified cold weather and reduced daylight as major barriers to outdoor activity. Similarly, Chan et al, (2006) confirmed that seasonal factors like low temperature and snowfall influence step count and physical activity levels. Kucukerdonmez et al. (2018) found the seasonal fluctuations in BMI and fat mass, between summer and winter. This trend aligns with our study that majority of the participants had normal BMI (65%), but 19.5% were overweight, and 13.5% were underweight (14,15,16).

Our results also highlighted a significant relationship between consumption of high-protein foods and reported energy levels in both summer ($p = 0.005$) and winter ($p = 0.003$). Participants who consumed high-protein foods more frequently were more likely to feel energetic, particularly during colder months. This suggests that regardless of the season, inadequate protein intake may be a key factor contributing to reduced energy, highlighting the importance of maintaining sufficient dietary protein throughout the year to support overall vitality This aligns with the research by Grygiel-Górniak et al. (2016), which showed that protein-rich diets positively correlate with higher physical activity and

energy levels. Additionally, Tanaka et al. (2022) noted that energy metabolism and dietary patterns shift seasonally, with increased caloric and protein intake in winter supporting higher metabolic demands (17,18).

High protein intake is not consistent across participants, those consuming it more regularly demonstrated better energy profiles.

The study identified a statistically significant relationship between fresh fruit consumption and change in appetite during summer ($p = 0.000$), though this was not significant in winter ($p = 0.066$). The findings indicate that appetite changes are more closely linked to fruit consumption in summer than in winter. This could be due to increased availability of fresh fruits in summer and a greater tendency to snack on fruits when appetite fluctuates. In winter, the relationship is less pronounced, possibly because of reduced fruit availability or different eating habits. Most participants (75.5%) reported changes in appetite during summer, which may be linked to hydration needs and seasonal food preferences as highlighted by Spence et al. (2021) (19).

The high consumption of fruits occasionally and frequently in both seasons supports findings by Papadaki et al. (2007) and Kyrkou et al. (2018), which stress the importance of fruit intake in maintaining a balanced diet, especially among students living away from home (20,21).

However, the lack of significant association in winter could be due to reduced availability or higher cost of fresh fruits during the colder season, a barrier noted by Abdelhafez et al. (2020) in student populations (22).

Seasonal variation had a strong association with stress levels in both summer ($p = 0.000$) and winter ($p = 0.002$). The results suggest that winter can have a significant negative impact on mental health, likely due to factors such as reduced sunlight, colder temperatures, and social isolation. The strong association highlights the importance of addressing seasonal affective changes to support mental well-being. The findings show that summer stress is significantly associated with perceived effects on mental well-being. This could be due to factors such as heat, disrupted routines, or social pressures. The strong statistical significance underscores the need for mental health support and coping strategies during summer months (23).

These findings are consistent with those of Reilly et al. (2006) and Morshed et al. (2022), who suggested that reduced daylight and cold temperatures in winter may trigger seasonal affective symptoms, while heat in summer can also impact mood and stress. In our study, 30.5% of participants reported stress during summer, and 22% during winter, indicating the need for mental health interventions year-round but especially tailored to seasonal triggers (24,25).

Although not directly tested for association, results showed slightly higher supplement use in winter (25%) than summer (20.5%). This may reflect a seasonal perception of dietary insufficiency or increased health consciousness during winter. Supplement use was relatively low overall but slightly higher in winter, suggesting some individuals may seek to compensate for perceived dietary gaps during colder months. In terms of wellness, energy levels were generally lower in winter, which may be related to reduced activity and changes in diet. Interestingly, stress was reported more frequently in summer than in winter, which could be attributed to heat, routine disruptions, or other environmental factors. Literature by Kabir et al. (2018) and Yolcuoğlu et al. (2022) emphasizes the role of environment and awareness in shaping dietary decisions, including supplement use (26,27).

While gender-specific data was not analyzed in this study, previous literature (e.g., Silva et al., 2011; Ma et al., 2006) suggests that seasonal variations in physical activity and dietary behavior often show gender-based differences. This aspect could be a focus for future research to provide more nuanced insights into behavioral interventions (29,30).

These results emphasize the importance of considering seasonal variations when developing strategies to promote healthy lifestyles. Seasonal changes not only affect physical activity and dietary patterns but also have a measurable impact on energy levels and stress, underlining the need for targeted interventions throughout the year to support optimal health and well-being.

CONCLUSION

This study highlights the substantial influence of seasonal variations on the physical activity, dietary habits, nutrient intake, and overall wellness of university students. The findings demonstrate that seasonal changes particularly between summer and winter affect lifestyle behaviors in several key ways. Physical activity levels are notably higher in summer and lower in winter, with individuals at the

extremes of the BMI spectrum being especially susceptible to reduced activity during colder months. Dietary patterns also shift seasonally, with high-protein intake consistently associated with better energy levels, while fruit consumption is more strongly linked to appetite changes in summer. Furthermore, stress levels fluctuate with the seasons, underscoring the importance of addressing both environmental and psychological factors to support student well-being. These results emphasize the need for targeted, seasonally adaptive interventions and support systems within university settings. By recognizing and responding to the unique challenges posed by different seasons, institutions can more effectively promote healthy lifestyles and enhance the mental and physical health of their students throughout the academic year. Future research should consider gender-specific analyses to further refine recommendations and interventions.

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