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NAVIGATING ADOLESCENT WELLBEING: UNVEILING THE LINK BETWEEN LIFESTYLE, EATING BEHAVIOR, AND BMI DURING COVID-19 PANDEMIC

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Abstract
Previous research studies have documented a significant association between lifestyle factors, eating behaviors and Body Mass Index (BMI) among adolescents during COVID-19 pandemic. The current study was designed to investigate the relationship between lifestyle factors, eating behaviors (uncontrolled eating, emotional eating & cognitive restraint) and Body Mass Index (BMI) among middle to late adolescents during COVID-19 pandemic. In this cross sectional study, the data was collected through online Google Meet session from 357 participants (Male=136; Females=221) within the age range of 14-18 years from Islamabad and Rawalpindi. Eating behaviors were measured with Three-Factor Eating Questionnaire, lifestyle factors were measured with Simple Lifestyle Indicator Questionnaire and BMI was calculated by weight which is measured in kilogram (Kg) divided by height which is measured in meter square (m^2). Results of the current study revealed that Lifestyle factor has significant negative relationship with uncontrolled eating and has significant positive relationship with cognitive restraint. Lifestyle factors have insignificant relationship with emotional eating and BMI. Hierarchal regression analysis revealed that lifestyle factors significantly predicted uncontrolled eating and cognitive restraint eating behaviors among adolescents after controlling for demographic variable. The current study emphasized the significance of awareness among adolescents regarding the impact of healthy lifestyles on overall health outcomes during COVID-19 pandemic. The study has it's implication for mental health professionals, dietitian and nutritionist who are working in the domain of physical and psychological health during COVID-19 pandemic.

Keywords: Lifestyle Factors, Eating Behaviors, Body Mass Index, COVID-19 pandemic.

Introduction
COVID-19 which at the beginning was known as '2019 novel coronavirus', is the present day virus which is related to the viruses which cause Severe Acute Respiratory Syndrome and several kinds of flu. The virus of COVID-19 essentially spreads from one person to another via respiratory droplets and contact pathway. World Health Organization, on March 11, 2020 announced the breakout of present day coronavirus as a pandemic (Cennimo, 2021). To reduce the spread of COVID-19

pandemic several countries have imposed lockdown. The authorities of countries placed restrictions on their citizens as they were not allowed to leave their homes, to interact with others, all the educational institutes and work places were closed and all the social gatherings and events were cancelled (Abid et al., 2020).

On March 13th, 2020 government of Pakistan announced to close all the education institutions and on April 1st, confinement was implemented in the whole country to fight against the virus and to slow down its spread and this lockdown was uplifted on May 9th, 2020 (Akhtar et al., 2021). During the COVID-19 pandemic in Spain, greater number of participants experienced significant changes in lifestyle behaviors, as majority of the participants reported considerable changes in exercise and outdoor time and around one third of participants reveal considerable changes in social assistance, management of stress (Balanzá-Martínez et al., 2021).

Although imposition of lockdown has resulted in reduction of new cases but it affected the life style factors, eating behaviors of human beings because due confinement, access to fresh food was limited as a result of which dietary patterns were effected, people faced new problems and difficulties in their physical activities because due to lockdown, students were taking online classes, people were doing their office work from home and all the places where people can work to maintain their physical activity like parks, gyms etc. were closed. People encountered changes in their sleep pattern and faced problems in sufficient healthy food consumption due to COVID-19 pandemic. The COVID-19 pandemic was a distinct and rare condition. It affected people physically, but also psychologically and it has ability to give rise to behavioral problems. During COVID-19 different life style factors influenced the overall well-being of the individual. Lifestyle factors are the flexible practices and techniques of life that have the ability to have impact on health and well-being to a greater extent. Our choices of lifestyle determine our health state, so bad and worse lifestyle leads to unhealthy state of life and the unhealthy state of life has the potential to affect the individual confidence in self (Sharma et al., 2013). Diet, exercise, sleep pattern, smoking and alcohol consumption, and BMI are the some of the lifestyle factors (Li et al., 2018).

Eating Behavior is a wide concept as it comprises of choices of food intake and reason behind its consumption, dietary habits, losing weight, and issues associated to eating like eating disorders and obesity (Fostinelli et al., 2020). Eating behaviors include uncontrolled eating or binge eating, emotional eating and cognitive restraint. Uncontrolled eating also known as binge eating is identified by frequent event of unrestricted consumption of a lot of food in a brief timeframe. These events go along with feelings of regret, disgrace and psychological distress (Mandl, 2021). Emotional eating is the act of in taking large amount of food in regards to feelings and emotions rather than hunger (Stöppler, 2021). Another form of eating behavior is cognitive restraint which is characterized by brain authority over food consumption to lose or keep up with weight, prompts unsafe outcomes in people experiencing overweight or obesity (Sweerts, 2016).

Eating Behaviors is a complicated phenomenon because every individual makes variety of food choices and these choices are made on the basis of individual differences, and the difference of other factors like; cultural and economic elements. Individual differences or personal choices have an impact on eating behavior because everyone has its own liking towards food and individuals desire to eat those foods which they like. Cultural and religious element has an impact on eating behavior in a way that there are some foods which are not allowed to eat in some cultures. For example consumption of alcohol and food made from the meat of animals like dog, donkey and pig etc. are not allowed to eat in Muslim countries. So those who belong to Muslim countries don't drink alcohol and eat meat of those animals and other animals like them whereas people who belong from other cultures like western in which consumption of alcohol is normal, drink alcohol. Economic element has an impact on eating behavior in a way that some foods are high in nutrients but their price is also high so those who cannot afford do not eat those foods (Reddy & Anitha, 2015).

Longitudinal study was conducted in which data was collected from the 10 cities of Pakistan which are highly crowded. The first survey was conducted before the outbreak of COVID-19 in which through face to face interaction data was collected from 6014 smokers and the participants were

requested to tell about their smoking patterns and after the outbreak of COVID-19 the re-examination was done through phone calls in which the participants were asked to tell what were their smoking patterns before the pandemic and after it. Findings of the study indicate that in Pakistan, remarkable two-way changes were reported in smoking patterns since the emergence of COVID-19. The findings indicate that despite the fact, that a lot of participants report decrease in smoking, some of the participant has ended smoking and some are trying to stop it but there are some participants who have reported increase in smoking whereas some participants started smoking again after they had stop smoking (Siddiqi et al., 2021).

Negative predictors of dietary practices during COVID-19 isolation are emotional eating, binge eating, vespertine chronotype, not doing physical exercise at home and male sex. Whereas the factors which are positive predictors of dietary practices during COVID-19 are cognitive restraint, better sleep quality, and better financial condition (Dos Santos Quaresma et al., 2021). A review of studies which were conducted on Indian population was carried out to summarize how COVID-19 pandemic has affected the lifestyle behavior of the Indian population. The findings of the review suggests that COVID-19 has brought change in lifestyle behavior, weight gain, decline in physical activity, has effected sleep quantity and sleep quality and it also increased psychosocial and mental stress among the participants of the study (Rawat et al., 2021).

Longitudinal study was conducted on Spanish sample to explore the impact of lockdown on exercise, dietary habits and sleep quality. Findings of the study indicates that the well-being, physical activity levels and sleep quality of physically active Spanish adults were negatively affected by confinement during COVID-19 and it has also adversely affected self-image of health and weight of body (Martínez-de-Quel et al., 2021). The aim of the research is to investigate the relationship between lifestyle factors, eating behaviors and Body Mass Index (BMI) among middle to late adolescents of Pakistan during COVID-19 pandemic.

Method

Data was gathered from middle to late adolescents of age 14 to 18 from Islamabad and Rawalpindi. The present study was quantitative in nature and the cross sectional study design was used to investigate the relationship between lifestyle factors, eating behaviors and Body Mass Index (BMI) among adolescents of Pakistan during COVID-19 pandemic. Due to COVID-19 pandemic the research was conducted online. Questionnaire was administered to participants through Google meet and instruction regarding participation and research was provided by the researcher through Google meet session. The study design was selected due to the lack of research on the said matter in Pakistan.

Ethical Considerations

All the concerns regarding morals and principles were taken into account while conducting the research study. For the conduction of research, the synopsis of the study and study protocols were provided to University in order to get official permission for data collection. Prior to collection of data, the objectives of research were explained to each and every participant individually and all of their questions were answered and for participation their consent was taken. Participants of the study were ensured regarding the preservation of confidentiality. Full right to withdraw from research at any time or at any stage was given to every participant. Authorization was taken from the authors of scales which are used in the research.

Measures

Simple Lifestyle Indicator Questionnaire (SLIQ)

This questionnaire was used to evaluate the lifestyle. There are 12 items in this scale and these 12 items evaluate 5 components of lifestyle in which 3 questions are about diet, 3 questions are about physical activity, 3 questions are about alcohol consumption, 2 questions are about smoking, and 1 question is about stress. Raw score and category scores are generated for each component and the score of every component is 0, 1, or 2. The total SLIQ score is obtained by adding the raw score of

all these 5 components, so the total score of SLIQ ranges from 0 to 10. When the total SLIQ raw score is ranges 0 to 4, than the total category SLIQ score is 0 which indicates unhealthy lifestyle. When the total SLIQ raw score is ranges 5 to 7, than the total category SLIQ score is 1 which indicates moderate lifestyle. Whereas when the total SLIQ raw score is ranges 8 to 10, than the total category SLIQ score is 2 which indicates healthy lifestyle. Alpha reliability of it was α= 0.58 for items of diet, whereas it was α= 0.6 for items of physical activity (Godwin et al., 2013). In the current study, alpha reliability of Simple Lifestyle Indicator Questionnaire SLIQ shows reliability of α= 0.6 whereas the internal consistency of subscale of diet category is calculated to be α= 0.6 and the internal consistency of subscale of exercise is calculated to be α= 0.6.

Three-factor Eating Questionnaire (TFEQ) - R21

This scale is a self-evaluation form made to access cognitive and behavioral elements of eating. It measures emotional eating (EE), cognitive restraint (CR) and uncontrolled eating (UE). This questionnaire contains 21 items and it uses a four-point Likert scale for items 1–20 and for item 21 it uses an eight-point numerical rating scale. Item number 1 to 16 are reversely scored whereas, item 21 is scored in a way that 1 score is given for 1 to 2, 2 score is given for 3 to 4, 3 score is given for 5 to 6, and 4 score is given to 7 to 8.

To measure tendency of negative feelings six items are incorporated in EE. To measure elements regarding consumption of food, issues regarding changes in weight six items are incorporated in CR. Nine items are incorporated in UE to access individual ability to high food consumption caused by external stimulus. Domain scores of UE, CR, and EE are calculated from the means of all the items which are incorporated in the domains. High score on the questionnaire shows outstanding EE, CR and UE. Alpha reliability of Three-factor eating questionnaire is α= 0.78–0.94 (Stunkard & Messick, 1985). Alpha reliability of TFEQ-R21 is α= 0.83 in current study. TFEQ-R21 has the 9 items of Binge eating which have reliability of α= 0.83, 6 items of emotional eating with reliability of α= 0.9 and 3 items of cognitive restraint with reliability of α= 0.8.

Statistical Analysis

To check distribution of data, errors, missing values and outliers in the data, data screening was done through SPSS program version 23. For categorical data, through frequencies and percentages descriptive were assessed whereas for continuous data, it was assessed through mean and standard deviation. Normality analysis was done numerically as well as graphically for the distribution of the continuous data. Z score values of skewness and kurtosis were assessed for numerical analysis. Graphical representation was done through histograms. Considering the central limit theorem, the data was considered normal because it ranged within ±2.58 (Field, 2009).

Results

Table 1 *Descriptive for baseline Sociodemographic characteristics of participants N=357*

Characteristics	Mean (M)	Standard Deviation (SD)	Categories	Frequencies	Percentages
Age	17.1232	1.16669			
Sex			Male	136	38.1%
			Female	221	61.9%
Marital Status			Single	347	97.2%
			Married	10	2.8%
Family monthly income			0-50000	89	24.9%
			50100-100000	175	49.0%
			100100-150000	28	7.8%
			150100-200000	41	11.5%
			Above 200000	24	6.7%
Education			Middle School	5	1.4%
			Matriculation	68	19.0%
			Intermediate	149	41.7%
			Undergraduate	135	37.8%
Institution			Private Institutions	201	56.3%
			Public Institutions	156	43.7%

The sociodemographic data (Table 1) of 357 participants shows that the mean age of participants of the study was 17.1232 (SD=1.16669).136 participants (n=136/357; 38.1%) males and 221 (n=221/357; 61.9%) females. 347 participants (n=347/357; 97.2%) were single while 10 (n=10/357; 2.8%) were married. When asked about family monthly income 89 participants (89/357; 24.9%) fall in the category of 0 to 50000, 175 participants (175/357; 49.0%) fall in the category of 50100 to 100000, 28 participants (28/357; 7.8%) fall in the category of 100100 to 150000, 41 participants (41/357; 11.5%) fall in the category of 150100 to 200000, whereas 24 participants (24/357; 6.7%) fall in the range of Above 200000. The education level of participants shows that 4 participants (4/357; 1.5%) were students of middle school, 68 participants (68/357; 19.0%) were students of matriculation, 149 participants (149/357; 41.7%) were students of intermediate, whereas 135 participants (135/357; 37.8%) were undergraduate students. 201 participants (201/357; 56.3%) were studying in private institutions whereas 156 participants (156/357; 43.7%) were studying in public institutions (Table 1).

Table 2 *Bivariate correlation among study variables (N= 357)*

Variables	**1**	**2**	**3**	**4**	**5**
1. Lifestyle factors	-	.00*	-.17**	.23***	.01*
2. BMI	-	-	.04*	-.03*	.02*
3. Uncontrolled Eating	-	-	-	-.05*	.50***
4. Cognitive Restraint	-	-	-	-	.17**
5. Emotional Eating	-	-	-	-	-

Note. ***p< .001; **p< .05; *p>.05

Bivariate correlation analysis (Table 2) revealed that there is insignificant relationship between lifestyle factors and BMI (r (357) = .00*, p>.05). Lifestyle factor has significant negative relationship with uncontrolled eating (r (357) = -.17**, p<.05) which indicates that individual having healthy lifestyle will have low score on uncontrolled eating, whereas, lifestyle factors has significant positive relationship with cognitive restraint (r (357) = .23***, p<.001) which indicate that individual having healthy lifestyle will have high score on cognitive restraint. While lifestyle factors has insignificant relationship with emotional eating (r (357) = .01*, p>.05).

Table 3 *Mean Differences in the Study Variables on the Basis of Gender among Adolescents (N=357)*

	Men (n=136)		**Women (n=221)**				**95% CI**		
Variables	***M***	***SD***	***M***	***SD***	***t(df)***	***P***	***LL***	***UL***	***Cohen's d***
Lifestyle Factors	5.68	1.31	6.18	1.19	-3.66(365)	.00	-.76	-.23	
Uncontrolled Eating	2.86	.63	2.43	.67	5.94(299.69)	.00	.28	.56	
Cognitive Restraint	1.77	.65	2.14	.86	-4.58(340.39)	.00	-.52	-.21	
Emotional Eating	2.30	.71	2.30	.82	-.02(316.31)	.98	-.16	.16	

Mean differences among study variables on the basis of gender revealed that female show significantly healthy lifestyle (M= 6.18, SD= 1.19, t= -3.66, p< .00) and cognitive restraint (M= 2.14, SD= .86, t= -4.58, p< .00) than male. Male show higher uncontrolled eating (M= 2.86, SD= .63, t= 5.94, p< .00) than female (Table 3).

Table 4*Hierarchical Regression Analysis for sub scales of Eating Behaviors Predicted by Lifestyle Factors among Adolescents (N=357)*

Variables	**B**	**SE B**	**R^2**	**ΔR^2**	**F**
1. Uncontrolled Eating					
Model 1			.09	.09	12.78***
Constant					

Sex	-.36	.07	-.25***			
Age	-.03	.03	-.05*			
Family Monthly Income	.05	.03	.09*			
Model2				.11	.01	11.05***
Constant						
Sex	-.33	.07	-.23***			
Age	-.03	.03	-.05*			
Family Monthly Income	.05	.03	.09*			
Lifestyle Factors	-.06	.02	-.11**			
2.	Cognitive restraint					
Model 1				.07	.07	10.03***
Constant						
Sex	.28	.09	.17**			
Age	.11	.04	.15**			
Family Monthly Income	-.05	.04	-.07*			
Model2				.12	.04	11.74***
Constant						
Sex	.22	.09	.13**			
Age	.11	.04	.15**			
Family Monthly Income	-.05	.04	-.07*			
Lifestyle Factors	.13	.03	.20***			
3.	Emotional Eating					
Model 1				.01	.01	.94*
Constant						
Sex	.05	.09	.03*			
Age	.00	.03	.00*			
Family Monthly Income	.06	.03	.09*			
Model2				.01	.00	.73*
Constant						
Sex	.04	.09	.03*			
Age	.00	.03	.00*			
Family Monthly Income	.06	.03	.09*			
Lifestyle Factors	.01	.03	.01*			

Note. ***p< .001; **p< .05; *p>.05; B= Unstandardized Coefficient; β= Standardized Coefficient; S.E= Standard Error

Hierarchical regression analysis (Table 4) was conducted where sex, age and family monthly incomes of adolescents were control variable. Results indicated that for uncontrolled eating in Model II, lifestyle factors (β=-.11, p<.05) significantly predicted uncontrolled eating among adolescents and accounted for 11% variance in uncontrolled eating F (3, 353) = 12.78, p<.001. Similarly for Cognitive Restraint in Model II, lifestyle factors (β=.20, p<.001) significantly predicted cognitive restraint among adolescents and accounted for 12% variance in cognitive restraint F (3, 353) = 11.74, p<.001. Furthermore results of hierarchical regression showed that for Emotional Eating Model II, lifestyle factors (β=.01, p>.05) insignificantly predicted emotional eating among adolescents and accounted for 0.1% variance in emotional eating F (3, 353) = 0.73, p>.05.

Discussion

The current research was conducted with the aim to investigate the relationship between lifestyle factors, eating behaviors and Body Mass Index (BMI) among middle to late adolescents of Pakistan during COVID-19 pandemic.

Findings of the current study revealed that Female show significantly healthy lifestyle and cognitive restraint than male. Whereas male show higher uncontrolled eating (M= 2.86, SD= .63, t= 5.94, p< .00) than female. Previous study conducted to explore gender differences in life style have reported that the intake of fruit, vegetables, preference and interest to eat food low in calories and healthy diet is higher in females as compared to males which support gender differences found in lifestyle in current study (Janse van Rensburg & Surujlal, 2013).

In the correlation analysis, it was found that lifestyle factor has significant negative relationship with uncontrolled eating which indicates that individual having healthy lifestyle will have low score on uncontrolled eating, whereas, lifestyle factors has significant positive relationship with cognitive restraint which indicate that individual having healthy lifestyle will have high score on cognitive restraint. Whereas it was found that lifestyle factors has insignificant relationship with emotional eating and BMI. A cross sectional study was conducted in which data from 617 middle school students was collected and the results of the study indicate that significant relationship exists between emotional eaters and frequent intake of both salty ($t = -2.06$, $p = 0.0395$) and sweet ($t = -3.48$, $p = 0.0005$) high energy rich foods as compared to those who are non-emotional eaters (Nguyen-Michel et al., 2007).

Furthermore, hierarchal regression analysis revealed that lifestyle factors significantly predicted uncontrolled eating and cognitive restraint eating behaviors among adolescents after controlling for demographic variable. The existing literature shows that the negative predictors of diet patterns during pandemic are emotional eating and binge eating, vespertine chronotype, inactivity and male sex. Whereas the factors which are positive predictors of diet patterns during pandemic are cognitive restraint, better sleep quality, and better financial condition. (Dos Santos Quaresma et al., 2021). Thorpe et al. (2019) conducted a study to examine the changes in dietary patterns and to examine the predictors of dietary change over a 4 year period. The findings show that reduced consumption of key food groups within the principal component analysis-determined dietary patterns was observed. Higher education levels and favorable lifestyle characteristics, including not smoking and physical activity, at baseline predicted an increase in healthier dietary patterns over 4 years.

In conclusion, lifestyle factor has significant negative relationship with uncontrolled eating and has significant positive relationship with cognitive. Lifestyle factors significantly predicted uncontrolled eating and cognitive restraint eating behaviors among adolescents after controlling for demographic variable. The study has it's implication for mental health professionals, dietitian and nutritionist who are working in the domain of physical and psychological health

Conclusion

The current cross sectional study identified that Lifestyle factor has significant negative relationship with uncontrolled eating and has significant positive relationship with cognitive. Lifestyle factors have insignificant relationship with emotional eating and BMI. Hierarchal regression analysis revealed that lifestyle factors significantly predicted uncontrolled eating and cognitive restraint eating behaviors among adolescents after controlling for demographic variable. So health professionals and authorities should they should think about the awareness campaigns regarding how to modify and sustain healthy eating and living practices, physical activity, sleep habits during COVID-19 pandemic. So this study concludes that COVID-19 pandemic has affected the lifestyle factors and eating behaviors.

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