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Moderating Role of Physical Activity for the Psychological Determinants of Eating Behaviors Affecting BMI

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Abstract

Purpose. The study is aimed to investigate relationship between psychological factors, eating habits and BMI and to examine the moderating role of physical activity affecting BMI among young adolescents.

Method. The sample of 366 young adults between the age ranges of 18-25 recruited from colleges and universities of Rawalpindi and Islamabad. Data was collected on Three Factor Eating Questionnaire (TEFQ), Depression Anxiety Stress Scale (DASS), and International Physical Activity Questionnaire (IPAQ). BMI values are estimated by given heights and weights of individuals.

Results. Results revealed a positive relationship between BMI positively relates with depression, anxiety, stress, uncontrolled eating, emotional eating cognitive restraint and sitting whereas it negatively relates with walk vigorous activity, moderate activity and total Physical activity. Results also revealed that depression, anxiety and stress total score significantly and positively relates with uncontrolled eating, emotional eating cognitive restraint, sitting whereas negatively and significantly relate with walk, moderate activity and total physical activity. Results revealed that sitting moderates relationship between emotional eating and BMI, cognitive restraint and BMI and uncontrolled eating and BMI. Results indicated that vigorous activity moderates relationship between emotional eating and BMI.

Conclusion. Present study highlights the importance of physical activity and psychological factors which directly or indirectly affects eating behaviors and BMI.

Keywords. *Physical activity, vigorous activity, moderate activity, bmi, cognitive restraint*.

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Introduction

Recently we have witnessed the common belief around us that one can diet or skip food to incorporate weight loss but we cannot deny the importance of certain other important psychosocial factors which have an impact on one's eating behavior and on overall body weight. It is a simple fact that our eating behavior is being directly or indirectly affected by psychosocial factors which as an end result affect our BMI. One important idea in this whole understanding of BMI, eating habits and psychosocial factors is physical activity which we cannot overlook as in present study it serves a role of moderating variable.

On daily basis we witness number of people who eat abundantly but they do not put on much weight because they exercise to stay fit. Whereas there are other individuals who do not consume much food but find hard to put off weight this is simply because they are not involved in any kind of physically activity which we consider very much important in maintain healthy BMI. We can pretty much conclude from abovementioned statement that BMI can be influenced by number of genetic, behavioral and psychosocial factors.

In the flourishing field of health psychology and for the betterment of general population too eating behaviors and its outcomes (one of them is BMI) have always been a very important issue. It has always been observed that BMI is commonly associated with genetic factors. Even eating healthy has been completely overruled by this logic.

The current study tries to surface psychical and psychosocial factors which directly or indirectly affect BMI. Lately eating behavior has gained so much attention of researchers but there is still so much to do in this particular area. The present study tries to find out the effects of psychosocial factors on eating behavior and ultimately on BMI, while Physical activity playing a moderating role.

Literature on relationship between physical activity and BMI suggested that moderate level of physical activity has a positive relationship in maintain BMI. Calories are burnt with the help of physical activity which also increase one's metabolic rate during exercise as well as some period after (Thompson et al., 1982). Literature also suggested that relationship between physical activity and BMI is not always this much simple and in expected direction (Rosehil, 2009).

Some of the studies reported no significant relationship between physical activity and BMI, and also no relationship was found between different levels of physical activity (mild, moderate & vigorous) and BMI. Study conducted by Sabiston on young teens in 2008 and he reported that there exist no significant relationship between physical activity and BMI. These exceptional findings can be a resultant of indirect role of certain psychosocial factors which directly affect one's eating habits and indirectly affect body mass index. The present study is an effort to inspect the effect of these psychosocial factors which are directly affecting eating behavior and indirectly affecting body mass index.

Literature indicated that there exist a negative relationship between physical activity and stress. Physical activity is also considered as a source of minimizing risk of depression (Teychenne et al., 2008) and as a treatment (e.g., Craft & Perna, 2004; Lawlor & Hopker, 2001). For so many people one of the major symptoms of being stressed is increase in eating behavior, stress appears to be positively linked with body mass index (Slochower et al., 1981).

Set point theory maintains that an internal homeostatic mechanism regulates body weight so it remains near a certain predetermined level (Bernett & Gurin, 1982; Keesey, 1980; Nisbet, 1972). Some people's set point is higher or lower than what is considered normal by an individual or society (Kolata, 1985). Theoretically in order to maintain the set point, the brain monitors the fat stores, appetite, and activity level, increasing or decreasing them accordingly (Kessey, 1975; Powley, 1986).

The set point model did not highlight the socio-economic or the environmental factors that may take part in causing obesity. This model considers emphasized the role of physiological factors, which is improbable (Symonds et al., 2011). James Hill, for the first time, proposed the Settling Point Theory. He belonged to the University of Colorado. He proposed this theory in order to explain the reasons of obesity not being only a metabolic problem (Hill et al., 1994). He gave an idea that it is not the metabolic processes that causes obesity; rather it is the type of diet an individual follows and the type of physical activity that a person gets involved in. The type of diet and the physical activity then set the habits of the individuals. The habits are also determined by the genetic outlook the person may have, his leanings and the type of environment that he lives in.

Any phenomenon which the set point model has failed to explain, the settling point model can provide a logical and convincing explanation to that. The settling point model explains the causes for obesity to be greater exposure to the food and the greater availability of the food. The settling point model also holds the phenomenon of lower physical activity to be responsible for obesity. Anyone of the following environmental factors may result in the greater intake of food: an increase in portion sizes (Rolls et al., 2007), increased exposure to high energy density foods (Hetherington & Rolls, 2008; Rolls, 2010), an increase in the variety of foods offered (Rolls & Hetherington, 1989), a greater tendency to eat outside the home (Thornton et al., 2010) where portion sizes are larger (Piernas & Popkin, 2011; Duffey & Popkin, 2011) and where eating behavior is increased by eating with others (Hetherington et al., 2006), or other concurrent activities such as eating while watching television (Epstein et al., 1992; Epstein et al., 1997; Wansink, 2004; Temple et al., 2007). These factors interact with psychological (and probably genetic) factors in given individuals (Westerterp-Plantenga et al., 1996; Vogels & Westerterp-Plantenga, 2005; Vogels et al., 2005).

The settling point model tried to overcome the shortcomings of the set point model or set point theory though great research work is yet to be done on current issue. Hypothesized conceptual model of psychosocial factors affecting eating behavior, where physical activity level serves as moderator between eating behavior and BMI.

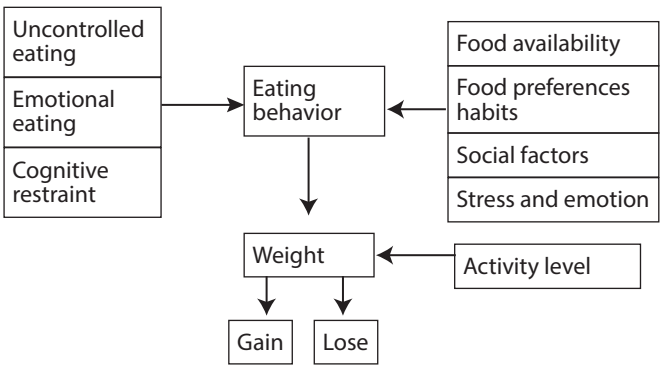


Figure 1. Model explaining effects of psychosocial factors, eating habits and activity level on BMI (Bernard & Krupat, 1994).

This model explains the significant importance of factors that influence eating behavior. These factors are physiological as well as psychological. These unavoidable features include food availability, food preferences habits, social factors, stress and emotion.

Eating behavior determines whether a person loses or gain weight, whereas weight is also being affected by physical activity level is carried out with respect to need of the situation. Literature also suggests that stress appears to have positive relationship with unhealthy eating habits and which in turn have a positive relationship with body mass index. In the lights of all the above mentioned empirical evidences the current study tries to investigate the direct or indirect relationship between physical activity and BMI and also to investigate the role of psychosocial factors and eating behaviors on BMI.

Method

Sample and procedure. The current study was conducted in two phases. Phase I was pilot testing phase. In phase II hypotheses testing was done. Sample of the pilot testing was 75 educated individuals between the age ranges of (18-25). Test retest reliability for International Physical Activity Questionnaire was also established in pilot study. Same participants were approached and requested to fill physical activity questionnaire again 65 participants were included out of 75 individuals. Test retest reliability was established on 65 participants by correlating scores from first administration with second administration. Only 65 participants were considered for establishing test retest reliability because unfilled questionnaires were discarded. It has been observed that there was no need to modify protocol after pilot testing. For main study 366 educated university and colleges participants were approached. Sample size was calculated through G Power.

Demographic information was taken from subjects on demographic form and it was followed by administration of Three Factor Eating Questionnaire, Depression Anxiety Stress Scale and International Physical Activity Questionnaire.

Instruments. Following instruments used to fulfill the purpose of study.

Three Factor Eating Questionnaire. Eating behavior was measured by using three factor eating questionnaire (TEFQ). The questionnaire measures 3 different aspects of eating behavior: restrained eating (conscious restriction of food intake in order to control body weight or to promote weight loss), uncontrolled eating (tendency to eat more than usual due to a loss of control over intake accompanied by subjective feelings of hunger), and emotional eating (inability to resist emotional cues).

The instrument is a shortened and revised version of the original 51-item TFEQ. The TFEQ-R18 consists of 18 items on a 4-point response scale (definitely true/mostly true/mostly false/definitely false). Responses to each of the 18 items are given a score between 1 and 4 and item scores are summated into scale scores for cognitive restraint, uncontrolled eating, and emotional eating. The 1–2 scores were coded 1; 3–4 scores were coded 2; 5–6 scores were coded 3; 7–8 scores were coded 4. The cognitive restraint scale was composed of items 2, 11, 12, 15, 16, and 18. The uncontrolled eating scale was composed of items 1, 4, 5, 7, 8, 9, 13, 14, and 17. The emotional eating scale was composed of items 3, 6, and 10. Higher scores in the respective scales are indicative of greater cognitive restraint, uncontrolled, or emotional eating. Cronbach's alphas of these three scales were high: 0.75 for cognitive restraint, 0.85 for uncontrolled eating, and 0.87 for emotional eating.

Physical Activity Questionnaire. International Physical Activity Questionnaire – Long Form (IPAQ-Long) was used for measuring physical activity it is a 27-item self-completion or telephone-administered recall questionnaire. Craig et.,al (2003) established its psychometrics properties. Target group is 15–69 year olds. It measures Walking, moderate intensity and vigorous intensity activities taken in each of the four domains: leisure-time physical activity; domestic and gardening activities; work-related physical activity and transport-related physical activity.

It also includes questions on sitting activities such as reading, television viewing and sitting at a desk, although this is not included as part of the summary score of physical activity. It has acceptable reliability and criterion validity.

Depression, Anxiety and Stress Scale. (DASS) Depression, stress and anxiety scale is a 21 items self report measure of anxiety, depression, and stress developed by Lovibond and Lovibond (1995) which is increasingly used in diverse settings. Each DASS contains 7 items. Item no 3, 5, 10, 13, 16, 17, 21 measures depression. Cronbach's alpha for depression scale is 0.94. Item no 2,4,7,9,15,19,20 measures anxiety. Cronbach's alpha is 0.88. Item no 1, 6,8,11,12,14,18 measures stress. Chronbach's alpha for stress scale is 0.93. Urdu short and long version of DASS is also available but in the present study English version was used.

Results

Preliminary analysis revealed that all study variables are normally distributed i.e., skweness ≤ 2 except physical activity, the data of physical activity which is not normally distributed i.e., skweness > 2. The data of physical activity is positively skewed which means that physical activity is not normally distributed among population less people involve in physical activity. Mean differences on study variables across gender revealed that women and men significantly differs on study variables, i.e. cognitive restraint, emotional eating, uncontrolled eating, BMI and vigorous activity.

Table 1

Correlation Matrix of Study Variables (*N*= 366).

Variables	*M*	*SD*	α	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Body Mass Index	23.54	1.68	-	-	.23*	.24**	.32**	.42**	.32**	.24**	.42**	-.32**	-.23**	-.61**	.25**	-.57**
2. Depression	8.10	4.61	.75		-	.77**	.82**	.61**	.21	.32**	.24**	-.35*	-.26**	-.35**	.07	-.43**
3. Anxiety	8.82	4.38	.67			-	.74**	.48**	.29**	.37**	.11**	-.25*	-.24**	-.30*	.13*	-.32**
4. Stress	8.88	4.69	.68				-	.53**	.11	.43**	.12*	-.23	-.32**	-.26*	.10	-.33**
5. DASS	16.63	6.54	.87					-	.29*	.16	.32**	-.12*	-.43**	-.13*	.09	-.19*
6. Uncontrolled eating	21.57	4.62	.73						-	.32**	.21**	-.06	-.12	-.013	.08	-.05
7. Emotional eating	5.55	2.18	.73							-	.25**	-.03	-.11	-.06	.10	-.08
8. Cognitive restraint	15.24	3.62	.67								-	-.00	-.02	-.04	.14	.12
9. Walking	744.36	145.50	-									-	.17**	.32*	-.22**	.54**
10. Vigorous	492.09	110.21	-										-	.43**	-.15*	.39**
11. Moderate	733.69	285.22	-											-	-.03	.74**
12. Sitting	1200.95	220.55	-												-	-.21**
13. PACT	1418.81	250.13	-													-

Note:$p < .05$; **$p < .01$

Table 1 shows Mean, Standard Deviation, Alpha Reliability and Correlation for body mass index, depression, anxiety, stress, uncontrolled eating, emotional eating, cognitive restraint, walk, vigorous activity, moderate activity sitting. Result indicates that alpha reliability ranges from .67 to .87 which shows that all variables have satisfactory internal consistency. The significant relationship between all the subscales of DASS, TFEQ and Physical activity questionnaire shows high construct validity. Pearson correlation indicates that BMI positively relates with depression, (r=.27, p <.01) anxiety, (r=.23, p <.01) stress, (r=.27, p <.01) DASS total, (r=.34, p <.01) uncontrolled eating, (r=.19, p <.01) emotional eating, (r=.43, p <.01) cognitive restraint (r=.32, p <.01) and sitting (r=.24, p <.01) whereas it negatively relates with walk, (r= -.34, p <.01) vigorous activity, (r= -.25, p <.01) moderate activity(r= -.32, p <.01) and total Physical activity. (r= -.42, p <.01) Depression, anxiety and stress total score significantly and positively relates with uncontrolled eating, (r=.32, p <.01) emotional eating, (r=.26, p <.01) cognitive restraint, (r=.21, p <.01) sitting (r=.32, p <.01) whereas negatively and significantly relate with walk, (r= -.14, p <.01) moderate activity(r= -.15, p <.01) and total physical activity. (r= -.20, p <.01). All the subscales of physical activity positively and significantly relates with PA total except sitting it negatively relates with PA total.

Table 2

Moderating Effect of Sitting in Relationship with Uncontrolled Eating and BMI (N=366).

Variable	*BMI*			
			CI 95 %	
	B	*p*	LL	UL
Constant	.00	.00	.10	.12
Sitting	.18	.00	.08	.23
Uncontrolled eating	.21	.00	.11	.31
Interaction	.16	.00	.04	.27
R^2	.08			
F	11.85			
ΔR^2	.02			

Table 2 shows Moderating effect of sitting in relationship with uncontrolled eating and BMI. Moderation analysis revealed that effect of uncontrolled eating is significantly moderated by sitting behavior on BMI (β=.15, p<.00). Effect of emotional eating is significantly moderated by sitting behavior on BMI (β=.12, p<.00). Effect of cognitive restraint is significantly moderated by sitting behavior on BMI (β=.15, p<.00). Following mod graph further explains the interaction effect on BMI. Effect of uncontrolled eating is significantly moderated by sitting behavior on BMI (β= -.08, p<.05).

Following Mode graph further explains the interaction effect on BMI.

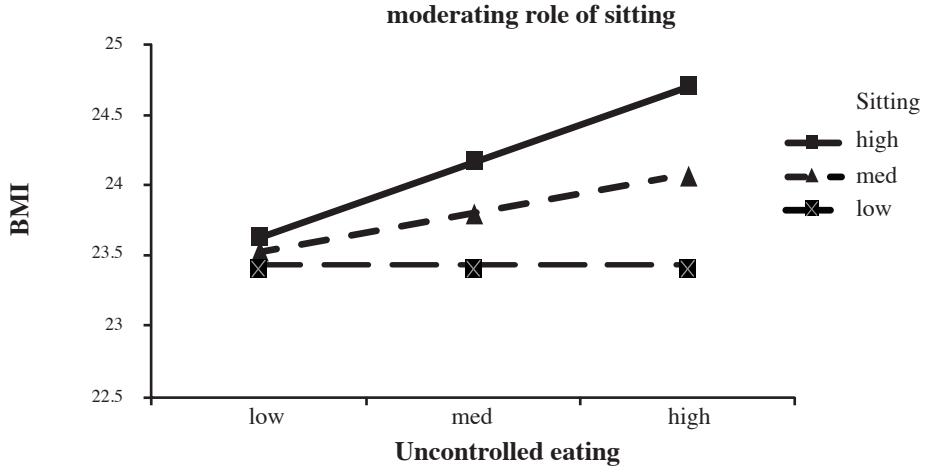


Figure 2. Moderating effect of sitting in relationship with uncontrolled eating and BMI.

Table 3

Moderating Effect of Sitting in Relationship with Emotional Eating and BMI (*N*=366).

Variable	*BMI*			
			CI 95 %	
	β	*p*	LL	UL
Constant	.00	.00	.10	.10
Sitting	.16	.00	.06	.24
Emotional eating	.14	.00	.04	.24
Interaction	.13	.00	.03	.22
R2	.07			
F	9.48			
ΔR^2	.02			

Table 3 shows Moderating effect of sitting in relationship with emotional eating and BMI. It shows that effect of emotional eating is significantly moderated by sitting behavior on BMI (β=.12, p<.00).

Following Mode graph further explains the interaction effect on BMI.

Figure 3. Moderating effect of sitting in relationship with emotional eating and BMI.

Table 4

Moderating Effect of Sitting in Relationship with Cognitive Restraint and BMI (*N*=366).

Variable	*BMI*			
			CI 95 %	
	β	*p*	LL	UL
Constant	.01	.00	.11	.09
Sitting	.16	.00	.06	.26
Cognitive restraint	.08	.10	-.02	.18
Interaction	.16	.00	.06	.26
R2	.06			
F	8.85			
ΔR^2	.02			

Table 4 shows Moderating effect of sitting in relationship with cognitive restraint and BMI. It shows that effect of cognitive restraint is significantly moderated by sitting behavior on BMI (β=.15, p<.00).

Following Mode graph further explains the interaction effect on BMI

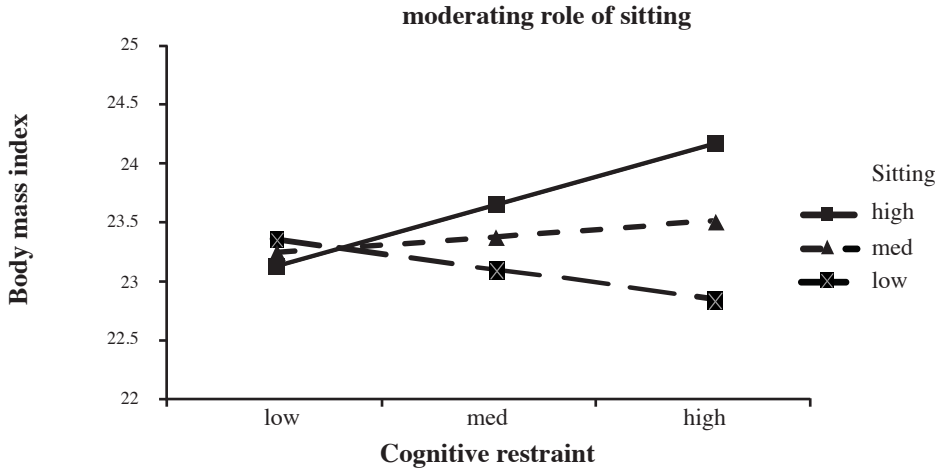


Figure 4. Moderating effect of sitting in relationship with cognitive restraint and BMI.

Table 5

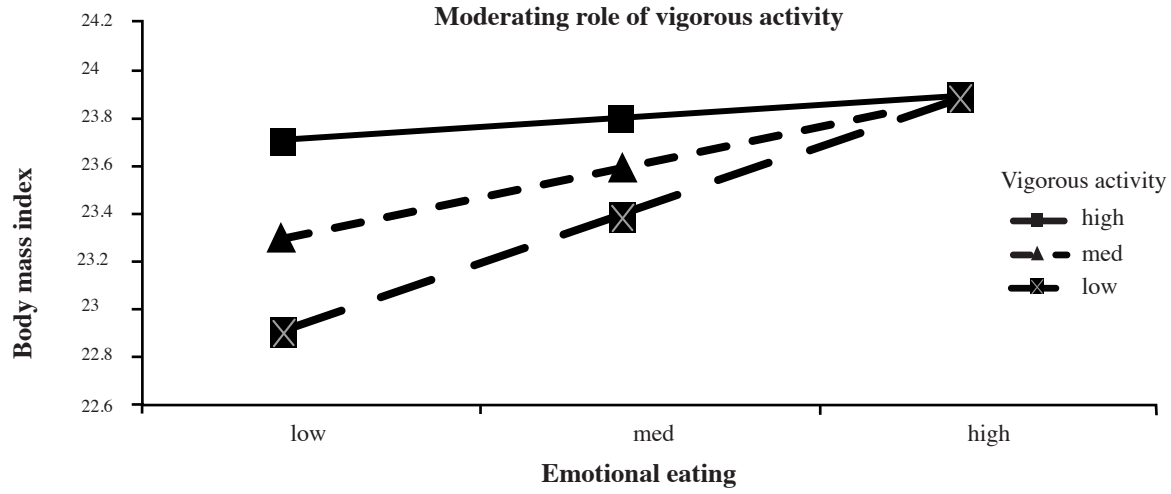
Moderating Effect of Vigorous Activity in Relationship with Emotional Eating and BMI (*N*=366).

Variable	*BMI*			
			CI 95 %	
	β	*p*	LL	UL
Constant	.01	.00	.09	.11
Vigorous	.00	.17	-.04	.22
Emotional eating	.13	.01	.03	.24
Interaction	-.08	.05	-.17	.00
R2	.02			
F	3.5			
ΔR^2	.01			

Table 5 shows Moderating effect of vigorous activity in relationship with emotional eating and BMI. It shows that effect of uncontrolled eating is significantly moderated by sitting behavior on BMI (β= -.08, p<.05).

Following Mode graph further explains the interaction effect on BMI

Figure 5. Moderating effect of vigorous activity in relationship with emotional eating and BMI.



Discussion

The current study was an effort to investigate the relationship between physical activity, eating habits, psychosocial factors and BMI among population. Preliminary analysis was carried out and results revealed no issues in data. Results indicated negative relationship between depression, anxiety, stress and physical activity. These findings can be explained by this belief that when one feels low and depressed in turn the physical activity also decreases and it can also be used as a treatment to reduce stress and depression. Physicians always suggest physical activity and staying active to improve one's physical conditions as well as fighting diseases.

Results showed positive relationship between depression, anxiety, stress and BMI, these findings can be backed up with the logic that while depressed we search for sugary food to lighten up our mood, which in turn cause increase in one's BMI. Work of researchers (Garg et al., 2007) back up our current findings their study revealed that people who are happy consider sugary treats like buttered popcorn and chocolate as mood spoiler and try to avoid them whereas people who are sad try to make themselves feel good and use sweets and sugary products to uplift their mood.

Study by Tice et al. (2001) revealed that people try to overcome stress by consuming fatty and sugary food. Another study conducted by (Wansink et al., 2008) suggested that people who are feeling happy try to extend this feeling of happiness and involve in healthy eating and consume nutritious food, whereas people feeling sad try to get out of that phase and in trying to overcome their gloom they indulge in nice tasting snacks, and sugary foods.

These researches support the idea that eating behavior is immensely effected by mood. Another study by (Davis et al., 1988) revealed in bulimics low mood results in binge eating. People having no eating disorder showed the same pattern. Studies have revealed that body weights mostly over weight and underweight people have depressive tendencies (Hou et al., 2013; Linde et al., 2004).

Results revealed a positive relation between depression, anxiety, stress and unhealthy eating habits (uncontrolled eating, emotional eating, and cognitive restraint). If a person is experiencing depression or low mood it is more likely that his eating behavior because of low mood is going to affect.

People having depression, anxiety and stress experience unhealthy eating behavior. Depression is considered as appetite enhancer but not in a healthy manner.

Results also revealed that BMI is positively related with unhealthy eating behaviors (uncontrolled eating, emotional eating and cognitive restraint). Past researches and work has shown that unhealthy eating habits always results in either weight loss or weight gain. Higher BMI is always a resultant of uncontrolled and emotional eating whereas fewer researches suggest that cognitive restraint helps in lowering the BMI, cognitive restraint theory and many past researches tell us that when a person practice restrained eating that person tries to overdo it and always end having weight gain.

Research conducted by Ogden (2003) revealed that people always end up overdoing something from which they try to restrain themselves. Results indicated that sitting behavior behave as a moderating factor in relationship between BMI and uncontrolled eating. When more sitting behavior is observed this relationship tends to be higher. The relationship seems to decrease when medium sitting behavior is observed whereas there appears no relationship between BMI and uncontrolled eating when low sitting behavior was observed.

Sitting also act as a moderator in the relationship between BMI and cognitive restraint. When sitting is higher this relationship tends to be higher whereas no relationship was detected between BMI and cognitive restraint when medium level of sitting behavior was reported, when sitting behavior is low there exist a negative relationship between cognitive restraint and BMI. Results also indicated that vigorous activity served as a moderator in relationship between emotional eating and BMI. When vigorous activity is high this relationship tends to decrease, when vigorous activity is medium this relationship increases and when vigorous activity is low the relationship between BMI and emotional eating tends to increase, so for the weight gain through emotional eating vigorous activity is considered as an effective treatment plan.

Conclusion

Present study was an attempt to know about the relationship between physical activity eating behaviors distress (depression, anxiety, and stress) and BMI. Study tried to study the indirect effects and indirect relations among variables used in the study. With the help of current study's findings some sort of interventions can be designed to be implemented at college and university levels since physical activity is considered very much important in maintaining healthy BMI and at the same time there are certain eating patterns which are considered risky and dangerous in the longer run. The present study also tried to shed some light on the negative role of sitting behavior. College and university level students should be provided with healthy opportunities to take part in co-curricular activities on regular basis.

Limitations and Suggestions

Even though the current study aimed at understanding physical activity, psychological factors, eating habits among common population researcher came across a number of difficulties and obstacles during carrying out that research. The most tough part was data collection since individuals were requested to provide their weight and height measures to calculate their BMI, they did feel hesitant in revealing such details to a stranger. The current study provides an understanding of relationship between physical activity, eating behaviors and distress still a lot can be done in this area since there are many other issues like extraneous variables affecting BMI. The sample used in current study was 366, if the sample size could be enhanced or be more representative of the population the generalizability of the findings can be increased.

Declaration

Ethical Approval. The study was approved by ethics committee and follow the National Institute of Psychology ethical review board criteria.

Conflict of Interest. The authors declared no conflict of interest associated with this manuscript.

Availability of Data and Materials. Contact corresponding author.

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