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A Correlational Study between BMI and Anxiety, Depression and Coping among Adolescents from Selected Schools

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Abstract

Purpose: Adolescent is a period of rapid growth and development. Abnormally high and low BMI is a major problem of adolescents. This is mainly due to unhealthy life style of adolescents. Abnormally high and low BMI make adolescents vulnerable to teasing, bullying and resultant low self esteem. This would have detrimental effect on adolescents' mental health. Hence this study was planned to determine existence of correlation between BMI and psychological variables Anxiety, Depression and Coping.

Aim: (1) To assess BMI of adolescents of selected schools of New Delhi. (2) To assess the anxiety, depression and coping of adolescents of selected schools of New Delhi. (3) To correlate BMI with anxiety, depression and coping of adolescents of selected schools of New Delhi.

Methods: A descriptive, cross sectional study design on randomly selected 845 adolescents from two schools from central Delhi, India was undertaken. The schools were selected by convenient sampling technique and adolescents were enrolled by lottery method.

Tools: Standardized questionnaires Revised Child Anxiety and Depression Scale (RCADS) short version was used to assess anxiety and depression in adolescents and Brief COPE was used to assess coping strategies of the adolescents in English and Hindi. Validity and reliability was established after translation (r=0.82) and (r=0.88) respectively.

Results

- Mean age of adolescents was 14.38 ± 1.80 years, ranging from 12 to 18 years.
- Mean age of early adolescents (12-14) was 13.11 ± 0.902 years and that of late adolescents (15-18) was 16.26 ± 0.945 years.
- Mean BMI of adolescents was 18.79 ± 3.78 and ranged from 9.97 to 36.62.
- More than half (54.4%) of the adolescents were males while 45.6% were females.
- More than half (55.3%) of the adolescents had a family income between Rs 25000 and Rs 50000. Most (79.9%) of the adolescents belonged to nuclear family and 92.9% were from of urban area.
- The prevalence of obesity was at seven per cent whereas overweight and underweight prevalence was at 15%.
- The prevalence of underweight adolescence was 5%.
- A significant relationship was observed between categories of BMI and mean age and height. There was a significant relationship between categories of BMI and age categories and monthly family income of adolescents.
- The prevalence of anxiety and depression were 13% and 5% respectively.
- Healthy coping strategies were preferred by adolescents and this could be the reason for no relationship between BMI and anxiety and depression.
- Males were more prone to anxiety than females.

Conclusion: Anxiety, depression and coping though not found significant with BMI of adolescent in the present study there is need to pay attention to BMI status and mental health issues of adolescents.

Keywords: BMI; Adolescents; Anxiety; Depression; Coping

Introduction

Adolescence is one of the most rapid periods of human development. Whatsoever changes occur in this phase of life has consequences both in adolescence as well as in the future course of life [1]. Adolescent period being a transition from childhood to adulthood adolescents establish patterns of behaviour and make lifestyle choices to have a healthy future. However, some of them struggle to adopt behaviour that could decrease their risk of developing chronic diseases in adulthood, such as eating nutritious

food and engaging in physical activity [2]. Thus, unhealthy eating habit and sedentary life style may pave the way for overweight and obesity. In addition, unhealthy or inadequate eating habits may also result in subnormal weight.

Need of the study

Prevalence of underweight, overweight and obesity is on the rise and physical and mental health is affected. The nation's burden of mental illness among adolescents is high and also there is a high prevalence rate of abnormal BMI. Abnormal BMI is proved to be related with adverse effects on mental health by many studies done in foreign countries and very few studies done in India. The baseline information regarding any relationship between BMI and mental health in adolescent can equip parents, teachers and health professionals to take necessary precautions to prevent mental illness and also in early diagnosis of the same.

Problem statement

A Correlational Study between BMI and Psychological Variables (Anxiety, Depression and Coping) among adolescents from selected schools of New Delhi.

Objectives

(1) To assess BMI of adolescents of selected schools of New Delhi.
(2) To assess the anxiety, depression and coping of adolescents of selected schools of New Delhi.
(3) To correlate BMI with anxiety, depression and coping of adolescents of selected schools of New Delhi.

Operational definitions

• **Body Mass Index (BMI):** Body Mass Index (BMI) is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in metres (kg/m2) [3].

• **Anxiety:** Anxiety is an emotion characterized by feelings of tension, worried thoughts and physical changes like increased blood pressure as measured by scores on The Revised Child Anxiety and Depression Scale short version [4].

• **Depression:** Depression is characterized by a lack of interest and pleasure in daily activities, significant weight loss or gain, insomnia or excessive sleeping, lack of energy, inability to concentrate, feelings of worthlessness or excessive guilt and recurrent thoughts of death or suicide as measured by scores on The Revised Child Anxiety and Depression Scale short version [5].

• **Coping:** Coping pretty much describes all the different things people do to manage and reduce the stress they feel as a result of issues, problems or difficult situations that occur as measured by scores on The Brief COPE [6].

• **Adolescent:** An adolescent is any person between ages 12 and 18 years.

Review Of Literature

In the present study, review of literature is divided into two sections:
Section I: Weight issues among adolescents.
Section II: Clinical characteristics and its association with BMI among adolescents.

Section I: Weight issues among adolescents: A study was conducted in Indian state of Chennai on 18955 children and adolescents to determine the prevalence of overweight and obesity using IOTF criteria and Khadilkar criteria. The study reported that according to IOTF criteria overweight and obesity prevalence in private schools and government schools were at 21.4% and 3.6% respectively. Similarly, according to Khadilkar criteria prevalence of overweight and obesity were at 26.4% and 4.6% respectively [7].

A systematic review to examine the prevalence and trends of underweight status among Asian children and adolescent populations in the last two decades. Publications between the years 1990 and 2010 was reviewed. The study reported that in South Asia, the prevalence of underweight in Vietnam was consistently higher in boys than in girls, with the respective prevalence of 39.1% and 34.4% in 1992, and 38.4% and 31.2% in 2002. In West Asia, a higher prevalence of underweight in boys than in girls was also observed in Bahrain with the respective prevalence of 8.6% and 2.3% in 2005–2006, in Iran with the prevalence of 8.1% and 5.7% in 2003–2004 and in India 3.9% [8].

Section II: Clinical characteristics and its association with BMI among adolescents: A cross-sectional study was conducted on 5254 adolescents in Grades 7-12 in Taiwan to examine the association between body weight and mental health indicators including depression, social phobia, insomnia, and self-esteem. Body weight status was determined by the age- and gender-specific International Obesity Task Force reference tables. The study reported that both overweight ($p < 0.05$) and obese adolescents ($p < 0.001$) had a lower level of self-esteem than did those of average weight. However, depression, social phobia, or insomnia were found to have no significant difference between overweight/obese and those of average weight. Similarly, no significant differences in the four mental health indicators were found between those who were underweight and those of average weight. Also, Sociodemographic

characteristics sex (female or male), age, residential background (urban or rural), and paternal and maternal levels of education had no moderating effect on the association between body weight and mental health indicators [9].

A study conducted in France included a clinical group of 17 obese adolescents and a control group of 67 normal weight adolescents. There anxiety, Satisfaction of the needs for autonomy, competence and relatedness were measured with the Fear of Negative Evaluation Scale (FNE), the Perceived Autonomy in Life Domains Scale (PALDS), the Perception of Competence in Life Domains Scale (PCLDS) and the Interpersonal Relationship Quality Scale (EQRI). The study reported that obese adolescents have significantly lower satisfaction of the needs for autonomy, competence and relatedness as compared to normal weight adolescents. Also, social anxiety was negatively correlated to Satisfaction of the needs for autonomy, competence and relatedness [10].

A study conducted in Iceland including 11388 adolescents in the age group 16-20 years were included to examine the association between body mass index (BMI), body image and depressive symptoms. The study reported a significant association between higher BMI levels and depressive symptoms mediated by perception of body image and moderated by gender (stronger in girls than boys) [11].

A study was conducted in Iran in 2009-2010 among 5570 students, aged 10-18 years, living in 27 provinces in Iran. Data was collected using the World Health Organization Global School-based Health Survey. The study reported that overweight and obese prevalence were at 7.9% and 8.8% respectively. Further, 58.7% of students were found to have anxiety, 62.6% with depression and 49.4% with insomnia without significant association to overweight and obese. Thus, the study concludes excess weight did not increase the risk of psychological distress [12].

A study was conducted on a community sample of 235 low-income, predominantly African-American adolescents in the US to assess how psychosocial factors vary by body weight and gender among them. All the adolescents were assessed for BMI, depression (the Beck Depression Inventory), self-esteem (The Rosenberg Self-esteem scale), body image (the Appearance subscale of the Bodyesteem Scale for Adolescents and Adults) and eating attitudes (The children's version of the Eating Attitudes Test). The study reported that 11% of the adolescents were overweight and 26% were obese. 11% of the adolescents were found to be above the clinical cutoff (16-20) for depression. In females there is a positive correlation between body weight and depression and in males no correlation [13].

A study was conducted in Iran on 9172 students aged 10-18 to assess the correlation between body mass index, gender and age with psychiatric symptoms. The global school based health survey questionnaire of the World Health Organization (GSHS-WHO) was used to collect data. The study reported that prevalence of emotional problems, depression and anxiety were at 27.8%, 29.7% and 11.5% respectively. Girls had significantly higher prevalence of predictors of psychiatric symptoms. Overall obesity was a protective factor against emotional problems OR (CI95%):0.79(0.65-0.98), but it was attributable to obese boys OR (CI95%):0.72(0.55-0.95) [14].

A study was conducted to examine relationships among self-esteem, stress, social support, and coping; and to test a model of their effects on eating behavior and depressive mood on 102 high school students. The study reported that stress and low self-esteem were related to avoidant coping and depressive mood, and that low self-esteem and avoidant coping were related to unhealthy eating behavior. Thus the study concluded that teaching adolescents skills to reduce stress, build self-esteem, and use more positive approaches to coping may prevent unhealthy eating and subsequent obesity, and lower risk of depressive symptoms [15].

Methodology

Research approach

Quantitative approach was chosen for the problem under study.

Research design

Cross sectional study

Setting

Selected two central schools in South Delhi.

Population

Adolescents in the age group of 12 – 18 years

Sample

School going adolescents in the age group of 12 – 18 years.

Sampling technique

- School selection: Convenience sampling
- Subject selection: Simple random sampling (Lottery Method)

Inclusion criteria

- Adolescents in the age group of 12-18 years
- Adolescents studying in selected study setting from July to November 2015

Exclusion Criteria

- Parents and children who refuse to give consent/assent to participate in the study.

Sample size

- 845 Adolescents

Sampling design

- Selected two schools from South Delhi by convenience sampling.
- Used lottery method to select two divisions from classes 7 to 12 of each schools

Methods and tools for data collection

Subject data sheet: Structured questionnaire for socio-demographic profile and selected variables of the subjects.

Tool 1 (BMI calculator): BMI was assessed with the formula Weight in Kilograms (Kg) / Height in Meter square (M_2)

It has two components:

(1) Weight : It was measured with a standardized weighing machine in Kilograms(Kg)
(2) Height : It was measured with a standardized inch tape in Meters (M)

Tool 2 (RCADS 25): Standardized self report questionnaire to assess anxiety and depression in adolescents.

Tool 3 (Brief COPE): Standardized self report questionnaire to assess different coping strategies used by adolescents.

Ethical consideration

- Ethical clearance was obtained from ethical committee of AIIMS, New Delhi (Ref no. IESC/T-144/01.04.2015).
- Permission obtained for using the tools as well as for their translation to Hindi.
- CTRI registration done on 2 July 2015 (CTRI/2015/07/005956).
- Informed consent was taken from parents and the subjects.
- Confidentiality of information provided by subjects and anonymity was maintained.

Data collection

Data was collected in six months after taking consent and first the parameters were taken. Then the tools were administered.

Data management

Data obtained as hard copy were transformed to soft copy by coding and scoring into a Microsoft Excel spread sheet 2007. All entries were checked for any error.

Data analysis

Data analysis was done using SPSS version 18. Both descriptive and inferential statistics were used for analysis.

Descriptive statistics used include frequency, percentage, and measures of central tendency for describing the demographic variables and Pearson correlation test to find out the relationship between BMI and anxiety, depression and coping scores. The Independent Samples T test, Chi-Square test and One Way ANOVA with Bonferroni were used to find out the relationship between underweight, normal weight, overweight and obese with selected variables. p-value of <0.05 and <0.01 was taken as statistically significant.

Analysis and Interpretation

(n=845)

Demographic variables of Adolescents		Mean ± SD	Min-Max
Age in years	Early Adolescent (12-14)	13.11 ± 0.902	12-14
	Late Adolescent (15-18)	16.26 ± 0.945	15-18
	All	14.38 ± 1.80	12-18
Weight in Kg		47.03 ± 12.15	19-89
Height in Cm		157.46 ± 10.523	123-185
BMI		18.79 ± 3.78	9.97-36.62
		Frequency (f)	**Percentage (%)**
Age in years	Early Adolescent	503	59.52
	Late Adolescent	342	40.47
Gender	Male	460	54.4
	Female	385	45.6
Class	7	170	20.1
	8	146	17.3
	9	131	15.5
	10	143	16.9
	11	149	17.6
	12	106	12.5
Monthly Family income (`)	< 25000	187	22.1
	25000 – 50000	467	55.3
	50000-100000	153	18.1
	>1lac	38	4.5
Type of family	Nuclear	675	79.9
	Extended/Joint	170	20.1
Place of residence	Rural	21	2.5
	Urban	785	92.9
	Semi-urban	39	4.6

Table 1: Demographic profile of Adolescents

Findings are presented as per the objectives of the study:

To assess BMI of adolescents of selected schools of New Delhi (Figure 1) (Table 2)

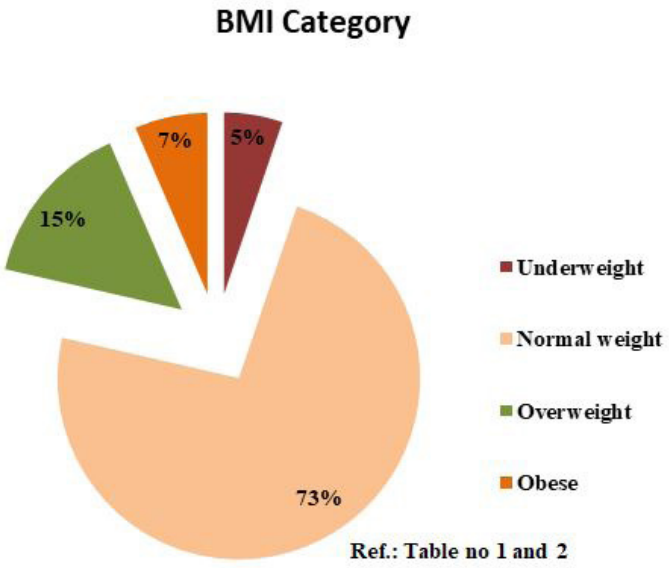

Figure 1: Frequency distribution of BMI of adolescents (n=845)

(n=845)

Demographic variables of Adolescents		Categories of BMI of adolescents				p- value
		Underweight Mean ± SD	Normal Weight Mean ± SD	Overweight Mean ± SD	Obese Mean ± SD	
Age in years [a]		13.93 ± 1.84	14.33 ± 1.76	14.54 ± 1.87	15.05 ± 1.86	0.007**
						Normal vs Obese α
						0.024*
Height in cm [a]		154.05 ± 10.89	157.24 ± 10.72	159.21 ± 9.23	158.60 ± 10.14	0.029*
						Normal vs Underweight α
						0.022*
		Frequency (%)				
Age in years χ2	Early Adolescent (12-14)	32 (6.4)	374 (74.4)	73 (14.5)	24 (4.8)	0.026*
	Late Adolescent (15-18)	12 (3.5)	246 (71.9)	53 (15.5)	31 (9.1)	
Gender χ^2	Male	21 (4.6)	329 (71.5)	74 (16.1)	36 (7.8)	0.179
	Female	23 (6.0)	291 (75.6)	52 (13.5)	19 (4.9)	
Monthly Family income(Rs)χ^2	< 25000	14 (7.5)	149 (79.7)	13 (7.0)	11 (5.6)	0.006**
	25000 – 50000	25 (5.4)	335 (71.7)	76 (16.3)	31 (6.6)	
	50000-100000	4 (2.6)	112 (73.2)	30 (19.6)	7 (4.6)	
	>1lac	1 (2.6)	24 (63.2)	7 (0.8)	6 (15.8)	
Type of family χ^2	Nuclear	34 (5.0)	491 (72.7)	101 (15.0)	49 (7.3)	0.351
	Extended/Joint	10 (5.9)	129 (75.9)	25 (14.7)	6 (3.5)	
Place of residence χ^2	Rural	1 (4.8)	17 (81.0)	2 (9.5)	1 (4.8)	0.982
	Urban	41 (5.2)	576 (73.4)	117 (14.9)	51 (6.5)	
	Semi-urban	2 (5.1)	27 (69.2)	7 (17.9)	3 (7.7)	

([a] One-Way ANOVA with [α] Bonferroni, χ^2Chi-Square test *p<0.05, **p<0.01)

Table 2: Demographic profile of Adolescents according to their BMI category

To assess the anxiety, depression and coping of adolescents of selected schools of New Delhi (Figures 2,3 and 4) (Tables 3 and 4)

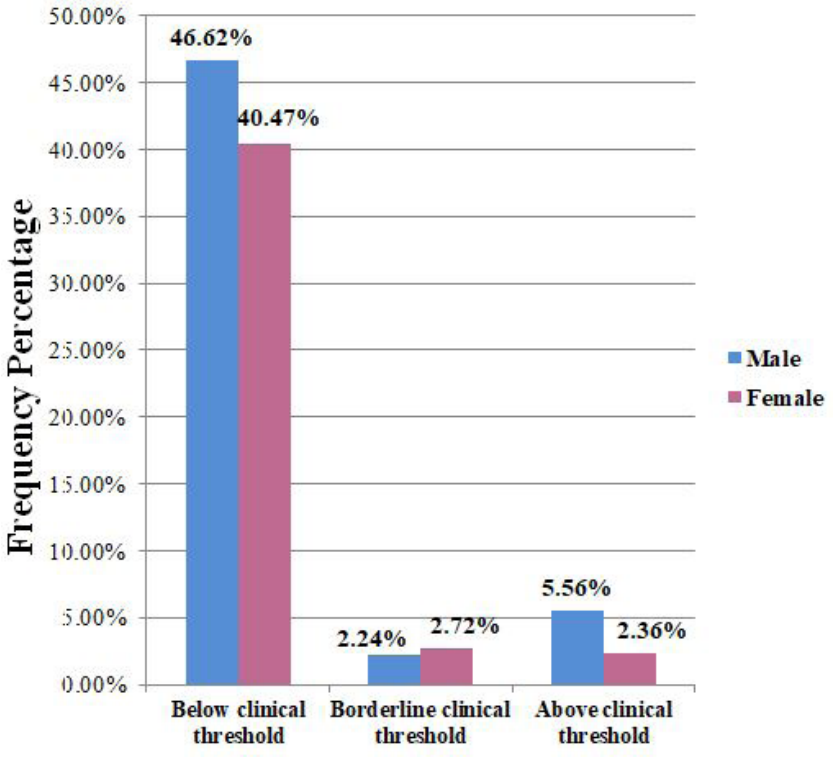

Figure 2: Anxiety levels of adolescents according to Gender (n=845)

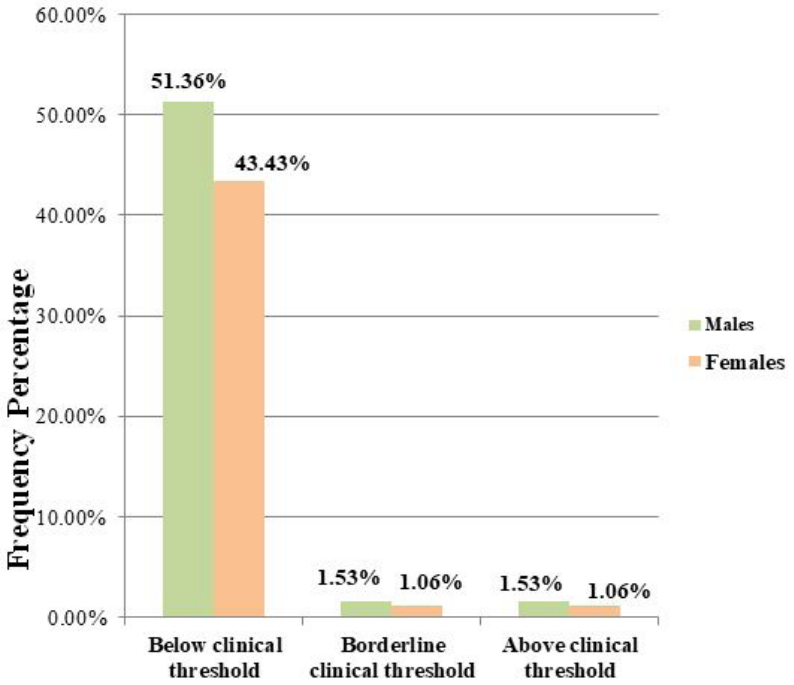

Figure 3: Depression levels of adolescents according to Gender (n=845)

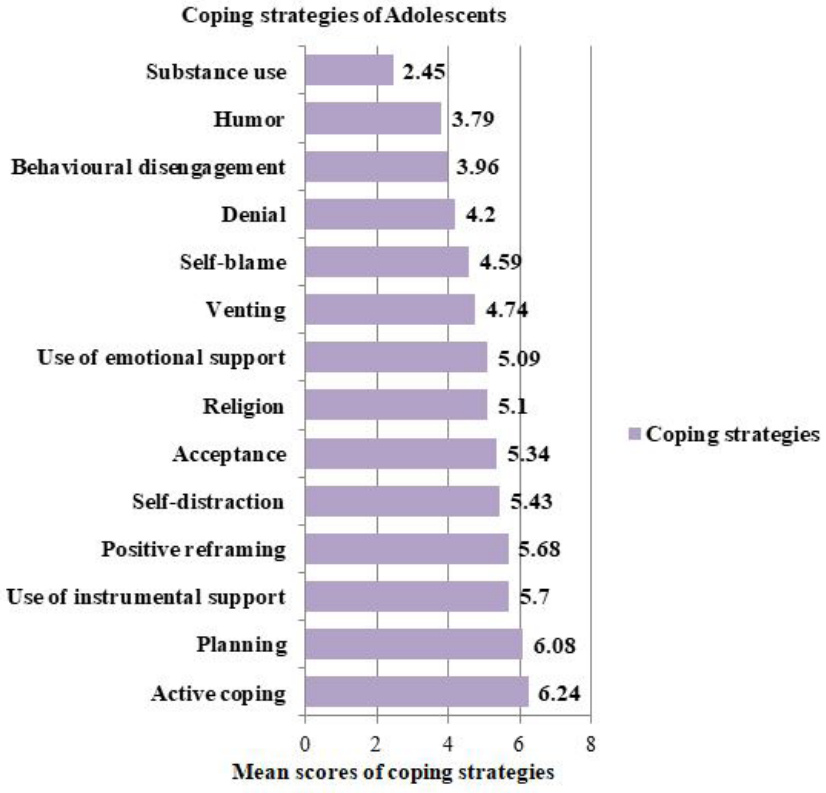

Figure 4: Mean scores of coping strategies used by adolescents according to rank order (n=845)

(n=845)

Variables of Adolescents [t]	Gender of Adolescents		p- Value
	Male Mean ± SD	Female Mean ± SD	
Anxiety	53.98 ±10.779	52.23 ±9.627	0.013*
Depression	48.57 ±9.135	47.46 ±8.854	0.076
Coping Strategies			
Self- distraction	5.39 ±1.713	5.68 ±1.472	0.008**

Variables of Adolescents [t]	Gender of Adolescents		p- Value
	Male Mean ± SD	Female Mean ± SD	
Active coping	6.25 ±1.652	6.24 ±1.580	0.952
Denial	4.22 ±1.593	4.17 ±1.596	0.677
Substance use	2.46 ±1.175	2.19 ±0.775	0.000**
Use of emotional support	4.96 ±1.608	5.24 ±1.611	0.011*
use of instrumental support	5.61 ±1.776	5.81 ±1.653	0.097
Behavioral disengagement	4.04 ±1.641	3.87 ±1.635	0.125
Venting	4.68 ±1.727	4.81 ±1.639	0.257
Positive reframing	5.68 ±1.682	5.68 ±1.646	0.995
Planning	6.08 ±1.622	6.09 ±1.438	0.977
Humor	4.18 ±1.906	3.33 ±1.754	0.000**
Acceptance	5.23 ±1.709	5.46 ±1.630	0.050
Religion	4.93 ±1.778	5.30 ±1.828	0.002**
Self-blame	4.64±1.716	4.52±1.702	0.315

([t] Independent-samples T Test, *p<0.05, **p<0.01)

Table 3: Relationship of gender of adolescents with Anxiety, Depression and Coping strategy scores

(n=845)

Variables of Adolescents [t]	Categories of BMI of Adolescents	Gender of Adolescents		p-Value
		Male Mean ± SD	Female Mean ± SD	
Anxiety	Underweight	53.19 ±9.62	52.04 ±10.21	0.704
	Normal weight	54.44±11.001	52.27 ±9.745	0.010*
	Overweight	51.74 ±9.65	52.02 ±8.57	0.869
	Obese	54.86 ±11.33	52.32 ±10.52	0.421
Coping strategies				
Self-distraction	Underweight	5.10 ±1.78	5.74 ±1.71	0.229
	Normal weight	5.45 ±1.66	5.67 ±1.44	0.81
	Overweight	5.34 ±1.78	5.88 ±1.55	0.077
	Obese	5.08 ±1.94	5.21 ±1.31	0.800
Substance use	Underweight	2.71 ±1.18	2.22 ±1.04	0.147
	Normal weight	2.46 ±1.14	2.18 ±0.70	0.001**
	Overweight	2.39 ±1.19	2.35 ±1.08	0.826
	Obese	2.42 ±1.42	2.00 ±0.001	0.209
Use of emotional support	Underweight	4.62 ±1.83	4.65±1.19	0.943
	Normal weight	4.96±1.58	5.33±1.58	0.004**
	Overweight	5.05±1.75	5.21±1.73	0.618
	Obese	4.92±1.46	4.63±1.95	0.543
Use of instrumental support	Underweight	6.05±1.85	5.39 ±1.80	0.241
	Normal weight	5.57±1.76	5.84±1.59	0.049*
	Overweight	5.53±1.74	6.08±1.77	0.086
	Obese	5.89±1.87	5.11±1.88	0.148
Humor	Underweight	4.14±1.74	3.30±2.03	0.151
	Normal weight	4.17±1.91	3.33±1.74	0.001**
	Overweight	4.16 ±1.85	3.48 ±1.80	0.043*
	Obese	4.31±2.08	3.05±1.39	0.022*
Religion	Underweight	4.62±1.46	5.04±2.05	0.439
	Normal weight	4.95±1.73	5.26±1.81	0.030*
	Overweight	4.84±2.06	5.63±1.80	0.027*
	Obese	5.03±1.73	5.32±1.79	0.565

([t] Independent-samples T Test, *p<0.05, **p<0.01)

Table 4: Relationship of anxiety, depression and coping strategy scores of adolescents according to BMI categories and their gender

To correlate BMI with anxiety, depression and coping of adolescents of selected schools of New Delhi (Tables 5,6 and 7)

(n=845)

Variables of Adolescents	BMI of Adolescents	
	r	p-value
Anxiety	0.029	0.394
Depression	0.043	0.214
Coping Strategies		
Self- distraction	-0.018	0.603
Active coping	0.053	0.123
Denial	-0.031	0.366
Substance use	0.008	0.827
Use of emotional support	-0.043	0.210
use of instrumental support	-0.048	0.160
Behavioral disengagement	-0.013	0.695
Venting	0.006	0.863
Positive reframing	0.090	0.009**
Planning	-0.024	0.489
Humor	0.046	0.186
Acceptance	0.054	0.115
Religion	-0.019	0.585
Self-blame	0.006	0.863

(Pearson correlation, **p<0.01)
Table 5: Relationship between BMI of Adolescents with their Anxiety, Depression and coping strategy scores

(n=845)

Variables of Adolescents	Categories of BMI							
	Under Weight		Normal weight		OverWeight		Obese	
	r	p-value	r	p-value	r	p-value	r	p-value
Anxiety	0.016	0.916	0.067	0.095	0.096	0.286	0.100	0.470
Depression	0.013	0.932	0.096	0.017*	0.158	0.077	0.064	0.640
Coping Strategies								
Self- distraction	-0.073	0.638	0.028	0.489	0.113	0.207	-0.021	0.877
Active coping	-0.191	0.215	0.045	0.261	0.027	0.766	0.060	0.664
Denial	-0.116	0.454	0.000	0.997	0.139	0.112	-0.092	0.503
Substance use	-0.202	0.189	0.076	0.060	0.075	0.403	-0.201	0.141
Use of emotional support	-0.045	0.772	-0.053	0.190	-0.040	0.659	-0.185	0.176
use of instrumental support	-0.271	0.075	-0.061	0.131	-0.021	0.814	-0.284	0.036*
Behavioral disengagement	-0.114	0.460	0.080	0.046*	-0.118	0.189	0.109	0.427
Venting	-0.168	0.276	0.017	0.665	-0.032	0.718	-0.108	0.433
Positive reframing	-0.179	0.245	0.113	0.005**	0.157	0.079	-0.022	0.875
Planning	-0.108	0.487	-0.044	0.279	-0.040	0.655	-0.042	0.759
Humor	-0.115	0.316	0.101	0.012*	-0.079	0.377	-0.101	0.462
Acceptance	0.265	0.083	0.067	0.098	0.206	0.020*	0.044	0.751
Religion	-0.069	0.657	-0.072	0.075	0.103	0.250	-0.321	0.017*
Self-blame	-0.065	0.676	0.028	0.493	0.097	0.279	-0.082	0.553

(Pearson correlation, *p<0.05, **p<0.01)
Table 6: Relationship between categories of BMI of adolescents with their anxiety, depression and coping

(n=845)

Variables of Adolescents	Genderwise Categories of BMI			
	Male		Female	
	r	p-value	r	p-value
Anxiety	0.017	0.717	0.052	0.305
Depression	0.065	0.167	0.023	0.655
Coping strategies				
Self- distraction	-0.043	0.357	0.007	0.895
Active coping	0.064	0.173	0.041	0.419
Denial	-0.019	0.687	-0.044	0.392
Substance use	0.000	0.998	0.034	0.503
Use of emotional support	0.003	0.955	-0.101	0.047*
use of instrumental support	-0.045	0.332	-0.057	0.264
Behavioral disengagement	-0.048	0.308	0.029	0.575
Venting	0.036	0.445	-0.032	0.529
Positive reframing	0.067	0.154	0.118	0.021*
Planning	-0.014	0.772	-0.037	0.468
Humor	0.063	0.180	0.046	0.368
Acceptance	0.026	0.572	0.082	0.108
Religion	-0.015	0.751	-0.031	0.542
Self-blame	0.048	0.301	-0.039	0.445

(Pearson correlation, *p<0.05)

Table 7: Relationship between BMI of male and female adolescents with their Anxiety, Depression and Coping strategies

Discussion

Major findings

• Prevalence of overweight and obesity among adolescents was at 15 and 7 percent respectively. The prevalence of underweight was found to be at 5 percent.
• Categories of BMI were found to have significant relationship between age, height and family income.
• The prevalence of anxiety (borderline clinical threshold and above clinical threshold) among adolescents was at 13 percent.
• The prevalence of depression (borderline clinical threshold and above clinical threshold) among adolescents was at 5 percent.
• Healthy coping strategies like active coping, planning and other such coping strategies were most often used by adolescents than unhealthy coping strategies like substance use, behavioural disengagement and other similar coping strategies.
• Gender of adolescents had a significant relationship with anxiety and coping strategies self-distraction, substance use, use of emotional support, humor and religion.
• BMI of adolescents had a significant positive relationship with coping strategy positive reframing but no significant relationship between BMI of adolescents and anxiety, depression and other coping strategies.
• BMI in normal weight category of BMI of adolescents had a significant positive relationship with depression and coping strategies behavioural disengagement, positive reframing and humor.
• BMI in overweight category of BMI of adolescents had a significant positive relationship with coping strategy acceptance.
• BMI in obese category of BMI of adolescents had a significant negative relationship with coping strategies use of instrumental support and religion.
• BMI of males and females had no significant relationship with anxiety and depression.
• BMI of females had a significant negative relationship with coping strategies use of emotional support and positive reframing.

In the present study, prevalence of overweight and obesity among adolescents was at 15 (males-8.8% and females-6.2%) and 7 (males-4.3% and females-2.2%) per cent respectively. These findings are almost consistent with previous study findings which reported a prevalence of overweight and obesity in adolescents at 12.9% in boys and 13.4% in females and prevalence of overweight and obesity in a regional private school at 21.4 percent [7,16]. While a conflicting finding reported a prevalence of overweight in peri-urban, urban and highly urban at 1.7, 12.7 and 9.1 respectively [17]. High prevalence of overweight and obesity among adolescents could be due to sedentary lifestyle. Watching television, playing video games and surfing the internet are the leisure time activities of adolescents instead of outdoor activities.

Underweight prevalence is at 5% (males-2.5% and females-2.7%) in adolescents. This finding is almost in agreement with a report of a prevalence of 3.9 percent [8] while a conflicting finding reported prevalence in peri-urban, urban and highly urban at 30.2, 14.1 and 9.8 percent respectively [17]. The study found that there is an association between monthly family income of the adolescents

and the categories of BMI of the adolescents. Low prevalence of underweight among adolescents could be because most of the adolescents had a monthly family income above `25000.

Anxiety and depression prevalence among adolescents were at 13 and 5 per cent respectively. This is not in agreement with the findings that anxiety and depression prevalence was at 58.7 and 62.6 per cent respectively [11]. However this finding was almost in line with the report that 11 per cent of adolescents had depression [18]. The level of anxiety and depression in current study could be due to the use of healthy coping strategies by adolescents. The study found that coping strategies like active coping which includes taking action to make a stressful situation better and planning which includes developing a strategy to deal with stressful situation were used more by adolescents.

Gender of adolescents had a significant relationship with anxiety and coping strategies self-distraction, substance use, use of emotional support, humor and religion. Though the mean score of depression of adolescents was higher in males than in females there was no significant relationship. This was contradictory to the finding that mean score of depression is significantly higher for girls compared to boys [19].

BMI of adolescents had a significant positive relationship with coping strategy positive reframing but no significant relationship between BMI of adolescents and anxiety, depression and other coping strategies. This was not in congruent with the findings that there is a positive relationship between anxiety and depression and BMI of adolescents [11]. Also, this does not agree with finding that a significant relationship exists between BMI levels and depressive symptoms [20]. The contradiction may be due to the use of healthy coping strategy of positive reframing which includes trying to find good thing in bad situation by the adolescents which serves as an insulation against anxiety and depression.

There was no significant relationship between anxiety and depression and BMI in overweight category of BMI of adolescents. This was not in congruent with findings that overweight is related to depressive symptoms [21]. This incongruence could be due to a positive relationship between coping strategy acceptance and BMI in overweight category of adolescents.

There was a significant negative relationship between BMI in obese category of BMI of adolescents and coping strategies use of instrumental support and religion. This finding is supported by the report that obese girls showed particularly decrease social-support seeking behavior and media use increased in obese boys [10]. As obese adolescents use healthy coping strategy like taking help or advice from others when in stress could protect them from anxiety and depression. This study also found no significant relationship between BMI in obese BMI category of adolescents and anxiety and depression. The study found that there was no relationship between BMI in obese category of BMI of adolescents and anxiety and depression. This is contradictory to the finding that obesity has a positive relationship with anxiety [10].

Females had no significant relationship between BMI and anxiety and depression. This finding is contradictory to the finding that there is a positive correlation with body weight and depression [13].

Males had no significant relationship between BMI and anxiety and depression. This is in line with the finding that BMI of males have no relationship with anxiety and depression [13].

Conclusion

The prevalence of underweight, overweight and obesity among adolescents were at five per cent, 15% and seven per cent respectively. The prevalence of anxiety and depression were at 13% and 5 per cent respectively. Overall BMI does not have any relationship with anxiety, depression and coping strategies whereas in one coping strategy of positive reframing had a significant positive relationship with BMI of adolescents. However, underweight BMI had no relationship with anxiety, depression and coping strategies. Normal weight BMI had positive relationship between coping strategies behavioral disengagement, positive reframing and humor. Overweight BMI had positive relationship between coping strategy acceptance. Obese BMI had negative relationship between coping strategies use of instrumental support and religion. BMI of male adolescents had no significant relationship with anxiety, depression and coping strategies while BMI of female adolescent had a negative relationship with coping strategy of use of emotional support and a positive relationship with coping strategy of positive reframing.

Implications

- Adolescents should take counseling from appropriate professionals such as school doctors, school health nurse and psychologist and other counselors regarding anxiety, depression and coping besides abnormal weight status.
- Parents and teachers should observe adolescents for any abnormality in growth and development and take adequate measures. This would facilitate early identification and prevention of any physical or mental issues.
- School administration should organize educational programs regarding mental health for both adolescents and their parents, appropriate services of nurses, doctors and counselors to meet physical and mental health needs of the adolescents in time is essential and ensure a balance of physical activities and academics.
- Media should project importance of healthy life style and avoid negative propagation of thinness and obesity.
- Doctors, nurses and all other health care personnel could sensitize adolescents and their parents about healthy lifestyle and mental hygiene.

Strength of the study

- Large sample size.
- Only standardized tools were used for data collection.

Limitations

- The number of Subjects in low BMI and high BMI category were limited hence bigger sample size could help for better interpretation.
- Only one type of School setting-the Kendriya vidyalaya could have restricted the possibility of more subjects in high and low BMI group.

Recommendations

- Studies could be conducted to develop and test self instruction modules regarding adolescent health issues.
- Similar study can be conducted including multilevel settings.
- Similar can be replicated in a community setting.

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