e-ISSN: 2349-2678, p-ISSN:2961-6050

available online on www.ijpba.in

International Journal of Pharmaceutical and Biological Science Archive

NLM (National Library of Medicine ID: 101732687)

Index Copernicus Value 2023: 75.83

Volume 13 Issue 2; 2025; Page No. 1-8

Evaluation of Obesity Prevalence and Health Status in School Children

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Article Info: Received: 24-03-2024 / Revised: 17-04-2024 / Accepted: 26-04-2025
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Conflict of interest statement: No conflict of interest
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Abstract

A study was carried out in Greater Noida, Gautam Budh Nagar, Uttar Pradesh, India, to understand the prevalence of obesity and identify healthy individuals among schoolchildren. The research involved 125 students between the ages of 10 and 15 years. Obesity was defined by assessing weight, Body Mass Index (BMI), body fat percentage, fat mass, and subcutaneous fat levels. Conversely, healthy status was characterized by measurements of muscle mass, bone mass, protein mass, total protein content, water weight, subcutaneous fat, body weight, and BMI.

Key Words: *Obesity, healthy people, Body Mass Index, fat percentage, and subcutaneous fat levels.*

Introduction

Obesity affects over 650 million adults globally, it represents a substantial challenge to public health (1). Increased dietary fat intake can lead to both an increase in the number of fat cells (adipocyte hyperplasia) and their size (adipocyte hypertrophy). This expansion of adipose tissue results in greater fat accumulation, elevating the risk of developing type 2 diabetes, cardiovascular disease, and kidney disease. Its impact extends beyond mere weight gain, as it can disrupt normal physiological processes and potentially reduce lifespan, leading some to classify it as a disease. Obesity is a complex health issue that significantly impacts overall well-being. It's characterized by an excessive accumulation of body fat, which can lead to a range of serious health problems. Obesity is typically assessed using the Body Mass Index (BMI), which calculates body fat based on height and weight. A BMI of 30 or higher is generally considered obese and is also associated with mortality (2-5). Overweight – 85th to less than the 95th percentile. Obese (class 1) – 95th percentile or greater. Severe (class II) obesity –> 120% of 95th percentile (99th percentile) or ≥ 35 kg/m^2 (whichever is lower). Class III obesity is a subcategory of severe obesity and is defined as BMI ≥140 % of the 95th percentile or ≥ 40 kg/m^2 (6).

Childhood obesity is a serious and growing public health concern with significant implications for the health and well-being of school-aged children. Childhood obesity rates have risen sharply, presenting a significant concern. Globally, the overall prevalence of obesity has increased triple times since 1975. However, the increase is even more striking among children and adolescents aged 5 to 19 years, where the burden of obesity has grown eightfold between 1975 and 2016 (7). A combination of factors contributes to obesity in school children, including Unhealthy dietary patterns (high-calorie, processed foods), Lack of physical activity, Genetic predisposition,

Certain medical conditions, some medications, and socioeconomic factors. Increased consumption of high-calorie, low-nutrient foods (fast food, processed snacks, sugary drinks) (8). Marketing and advertising of unhealthy foods targeted at children. Stress, emotional eating, and depression can contribute to weight gain in school children. Leptin and ghrelin hormones also regulate food intake and obesity. According to estimates from the Global Burden of Disease study, elevated Body Mass Index (BMI) contributed to 4 million deaths worldwide in 2015. Notably, cardiovascular disease (CVD) accounted for approximately 2.3 million fatalities (9). Recently role of transient receptor potential vanilloid channel type IV (TRPV4) linked with ghrelin hormone regulation was also observed. These channels are also located in different areas of the brain (10). TRPV4 is non non-selective cationic ion channel that preferably allows calcium ions inside the cell.

The human gut harbours trillions of microorganisms, collectively known as the gut microbiome. Changes in this complex community can contribute to weight gain through various mechanisms (11-12). The most abundant bacteria in the gut are Firmicutes and Bacteroidetes (comprising about 90% of the population), along with Proteobacteria, Actinobacteria, and Fusobacteria. The gut microbiota is widely considered a key factor in maintaining our health (13). These microorganisms have a mutually beneficial relationship with their host. Their composition and function can be influenced by factors such as gestational age at birth, premature rupture of membranes, delivery method, feeding type and practices, and antibiotic use. The gut microbiota develops from birth into adulthood, shaped by genetics, diet, lifestyle, and environmental factors. This microbial community plays crucial roles in maintaining the intestinal barrier, aiding nutrient digestion (particularly the production of short-chain fatty acids), and modulating the immune response against pathogens (14). An imbalance in the gut microbiome, termed dysbiosis, which can result in increased short-chain fatty acid production, has been associated with the development of obesity and other health issues, including type 2 Diabetes Mellitus, metabolic syndrome, anxiety, and depression.

A cornerstone of obesity management involves adopting healthy lifestyle habits. Consuming a balanced diet rich in fruits, vegetables, and whole grains. Increased physical activity**:** Regular exercise to burn calories and improve overall fitness. In some cases, medical interventions may be necessary to aid weight loss. Weight-loss surgery (bariatric surgery) procedures is also used to reduce stomach size or alter the digestive system. Promoting healthy eating habits and regular physical activity from a young age can help reduce the prevalence of obesity(15). Obesity is a chronic disease that requires ongoing management. A holistic approach that addresses both physical and mental health is essential. Seeking guidance from healthcare professionals is crucial for developing personalized treatment plans. It is important to remember that obesity is a complex issue, and there can be many contributing factors. It is important to treat those affected with respect and understanding.

Materials and Methods

Materials: Stethoscope, Weight Machine, LA FORTE Smart Digital Weighing Scale, Measure 12 Body Metrics, Bluetooth & App Connectivity.

Methods: The study was performed on school children in Greater Noida, Gautam Budh Nagar, Uttar Pradesh, India. The following parameters have been observed: body weight, BMI, Body fat, Fat mass, Muscle mass, bone mass, protein mass, protein, water weight, and subcutaneous fat. A total of 125 students were included in the study. Obesity was measured by assessing weight, Body Mass Index (BMI), body fat percentage, fat mass, and subcutaneous fat levels. Conversely, healthy status was characterized by measurements of protein mass, total protein content, water weight, muscle mass, bone mass, BMI, subcutaneous fat, and body weight.

Results

The protein mass, muscle mass, and bone mass of most of the students are low, while the visceral mass of most students is standard or excellent. Among 125 students, 75 were male

and 50 were female. Overall, out of 125 students, 10 students were found to be obese while 115 were non obese. The average body weight of 10 students was 45kg. The prevalence of obesity was found to be 0.08 %. The average BMI of 115 students was 10.235. The average body weight of 115 students was 28kg. The body weight and BMI of 115 students show that these students are characterized as thin, which means unhealthy. The body fat, protein mass, bone mass, water weight, muscle mass, and subcutaneous fat were found to be lower than the standard category in all 115 students, which places them in the thin category.

Table 1: Illustrates the data (Body Weight, BMI, protein%, Bone Mass, and Fat %) of 115 Students

Serial no.	Body weight (Kg)	BMI (Kg/m2)	Fat mass (%)	Protein %	Bone Mass Kg	BMR (Kcal)
1	27	10.1	4%	13.9	1.7	933
2	37	13.6	4%	21	1.3	1033
3	27	10	4%	22.2	2	929
4	27	10.1	4%	25	0.5	858
5	27	10.1	5%	22.4	2.2	1371
6	34	9.4	4%	18.1	2	933
7	24	12.7	4%	27.5	1.9	899
8	15	9	4%	17.6	2.3	1005
9	20	7.5	4%	18.3	1.5	945
10	28	10.5	4%	19.4	0.5	964
11	21	7.7	6%	20	2.2	987
12	32	12	4%	13.8	2	989
13	32	5.8	4%	21	1.9	1101
14	25	11.7	4%	22.1	1.7	908
15	32	9.3	4%	25	1.3	929
16	28	11.3	4%	21.4	2	902
17	33	10.6	4%	18.1	0.5	970
18	23	7.9	4%	25.5	2.2	946
19	20	12.4	4%	17.6	1.7	868
20	21	8.7	4%	22.2	1.3	999
21	34	7.3	4%	25	2	892
22	21	7.1	9%	22.4	0.5	851
23	37	13.8	4%	18.1	2.2	863
24	34	7.9	4%	27.5	2	1037
25	31	12.7	4%	17.6	1.9	868
26	31	11.5	4%	18.3	2.3	1004
27	31	14.5	4%	19.4	1.5	933
28	32	11.4	4%	20	0.5	899
29	27	10.1	11%	13.8	2.2	858
30	37	13.6	4%	21	2	868
31	27	10	4%	22.1	1.9	933
32	27	10.1	4%	25	1.7	899
33	27	10.1	4%	21.4	1.3	1003
34	34	9.4	4%	18.1	2	945
35	24	12.7	4%	25.5	0.5	964
36	15	9	4%	17.6	2.2	987
37	20	7.5	6%	22.2	1.7	1001
38	28	10.5	4%	25	1.3	1101
39	21	7.7	4%	22.4	2	908
40	32	12	4%	18.1	1.7	929
41	32	5.8	4%	27.5	1.3	902
42	25	11.7	4%	17.6	2	970
43	32	9.3	4%	18.3	0.5	946
44	28	11.3	4%	19.4	2.2	868

45	33	10.6	4%	20	2.3	999
46	23	7.9	4%	13.8	0.5	902
47	20	12.4	5%	18	2.2	970
48	21	8.7	4%	22.1	2	946
49	34	7.3	4%	25	1.9	868
50	21	7.1	4%	21.4	1.7	985
51	37	13.8	4%	18.1	1.3	933
52	34	7.9	4%	25.4	2	899
53	31	12.7	4%	17.6	0.5	1003
54	31	11.5	4%	20	2.2	945
55	31	14.5	4%	14.8	1.7	964
56	32	11.4	4%	21	1.3	987
57	27	10.1	6%	20.1	2	1100
58	37	13.6	4%	25	2.1	990
59	27	10	4%	21.4	0.5	908
60	27	10.1	4%	18.1	1.5	929
61	27	10.1	4%	23.5	0.5	902
62	34	9.4	4%	17.6	2.2	970
63	24	12.7	4%	22.7	2	946
64	15	9	4%	25	1.9	868
65	20	7.5	4%	19.4	1.7	999
66	28	10.5	4%	18.1	1.3	902
67	21	7.7	5%	27.5	2	970
68	32	12	4%	17.6	0.5	946
69	32	5.8	4%	18	2.2	868
70	25	11.7	4%	20.2	1.7	1010
71	32	9.3	4%	25	1.3	933
72	28	11.3	4%	22.6	2	899
73	33	10.6	4%	18.1	1.7	1005
74	23	7.9	5%	20	1.3	945
75	20	12.4	4%	13.8	1.4	964
76	21	8.7	4%	23	1.6	987
77	34	7.3	4%	22.1	1.8	1256
78	21	7.1	4%	25	1.3	1105
79	37	13.8	4%	20.4	2	908
80	34	7.9	4%	18.1	0.5	929
81	31	12.7	5%	25.5	2.2	902
82	31	11.5	4%	17.6	1.7	970
83	31	14.5	4%	22.2	1.3	946
84	32	11.4	4%	26	2	868
85	27	10.1	4%	22.4	1.7	999
86	37	13.6	4%	18.4	1.3	944
87	27	10	4%	27.5	1.5	933
88	27	10.1	4%	17.6	0.5	899
89	27	10.1	4%	18.3	2.2	1005
90	34	9.4	4%	27.5	2	945
91	24	12.7	4%	17.6	1.9	964
92	15	9	4%	17.5	1.7	987
93	20	7.5	5%	22.2	1.7	890
94	28	10.5	4%	24	1.9	880
95	21	7.7	4%	22.4	1.8	908
96	32	12	4%	16	2	929
97	32	5.8	4%	20	1.3	902
98	25	11.7	4%	13.8	2	970
99	32	9.3	4%	21	0.5	946
100	28	11.3	4%	17	2.2	868
101	33	10.6	4%	25	2	867

102	23	7.9	4%	21.4	1.9	907
103	20	12.4	5%	19	2.3	908
104	21	8.7	4%	23	1.5	929
105	34	7.3	4%	17.6	2.1	902
106	21	7.1	4%	22.2	1.6	980
107	37	13.8	4%	25	2.2	946
108	34	7.9	4%	21	2.2	868
109	31	12.7	4%	27.5	1.9	876
110	31	11.5	6%	17.6	1.6	908
111	31	14.5	4%	22	1.8	930
112	32	11.4	4%	17	2.3	902
113	15	9	4%	25	2	970
114	20	7.5	4%	23	1.8	946
115	28	10.5	5%	21	2	868
	Average (27.8) kg	**Average (10.20) (Kg/m2)**	**Average 4.2 %**	**Average 20.84%**	**Average 1.66 kg**	**Average 946.9Kcal**

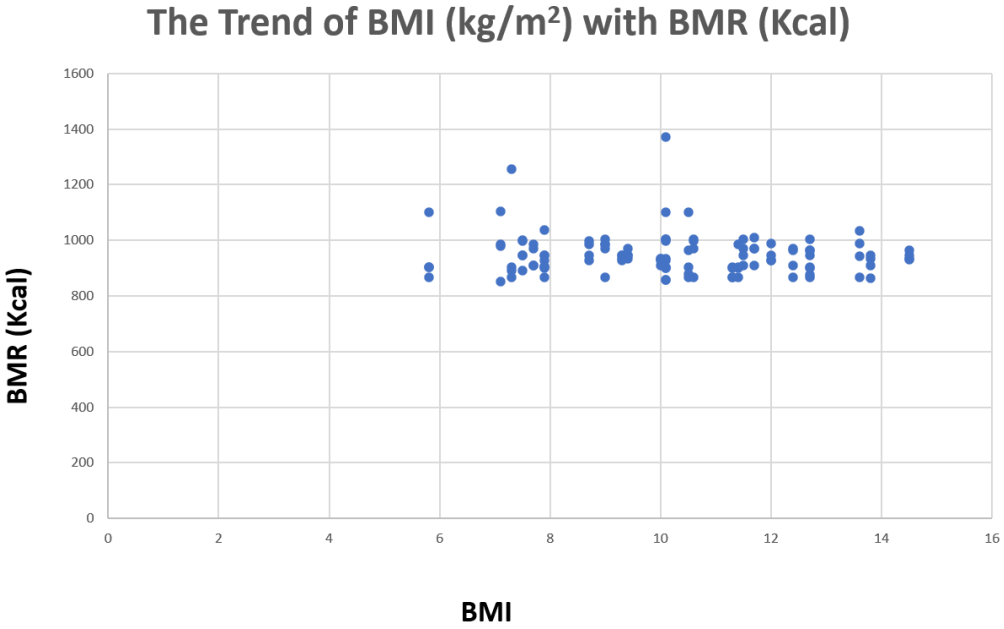

Figure 1: Shows the trend of BMI with Body weight in 115 students.

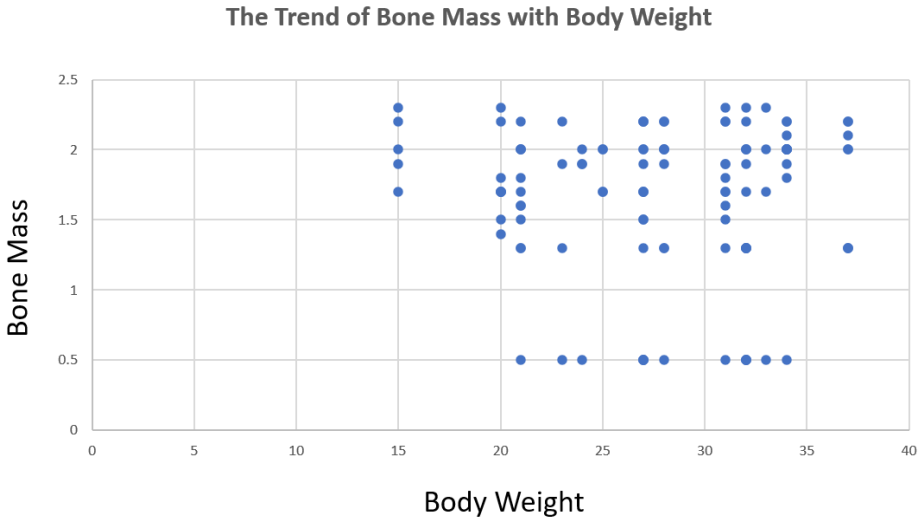

Figure 2: Shows the trend of Bone mass with Body weight in 115 Students.

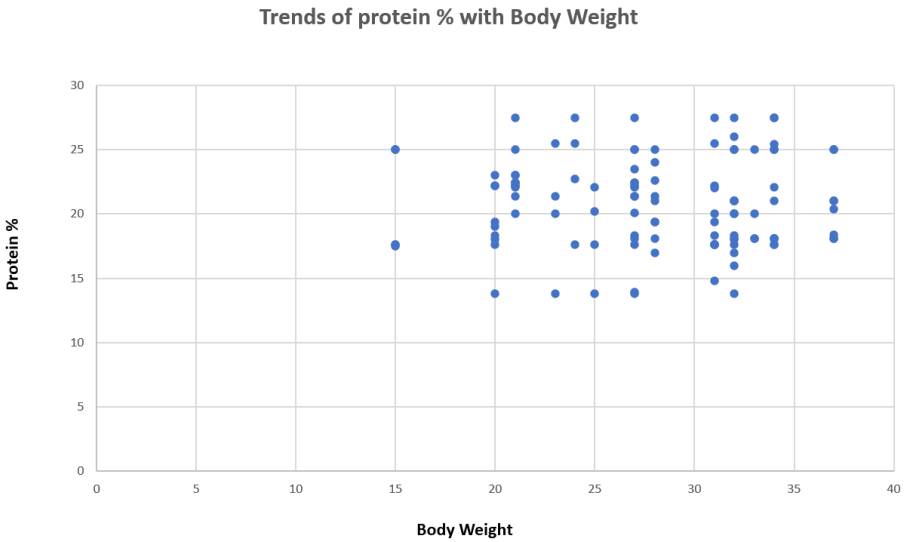

Figure 3: Shows the trend of protein% with Body weight in 115 students.

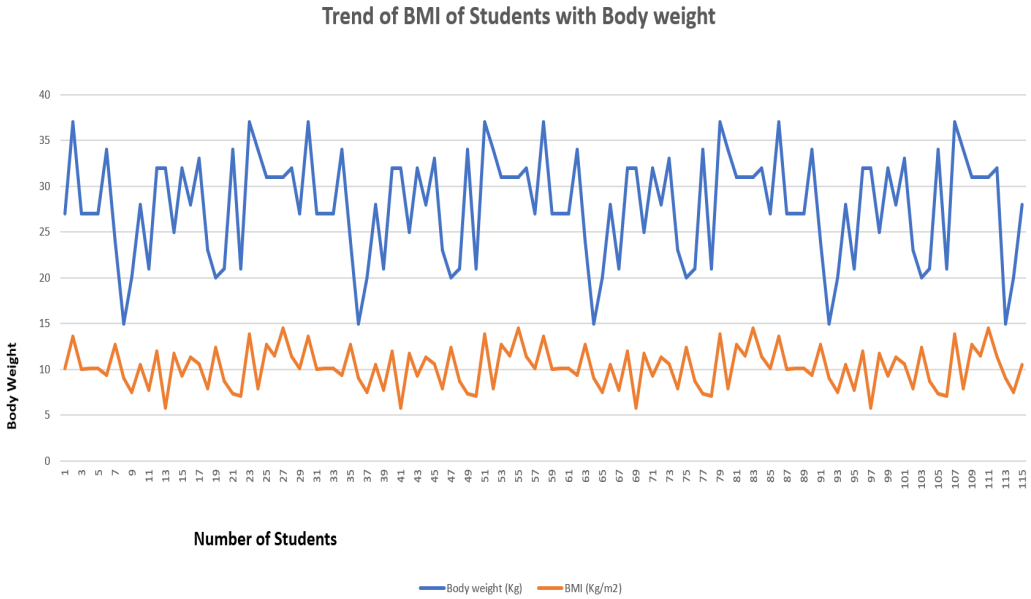

Figure 4: Shows the trend of BMI with Body weight in 115 students.

Discussion

The systematic evaluation of obesity prevalence and the multifaceted aspects of healthy status among school children serves as a crucial cornerstone for understanding and addressing a significant public health challenge. The data gleaned from these assessments not only quantifies the extent of overweight and obesity within this vulnerable population but also illuminates critical trends, disparities, and correlations with various lifestyle factors and health outcomes. These findings underscore the urgent need for targeted and evidence-based interventions that extend beyond individual behaviours to encompass supportive environments within schools, families, and communities. Moving forward, sustained surveillance, innovative prevention strategies, and a commitment to addressing health inequities are paramount to reversing the trajectory of childhood obesity and fostering a healthier future for all school children. The insights gained from ongoing evaluation will be instrumental in shaping effective policies and allocating resources strategically to promote long-term well-being and mitigate the potential for chronic diseases in later life.

Obesity significantly contributes to the development and progression of kidney disease through various mechanisms. Increased Workload: Obesity increases the metabolic demands on the kidneys. To compensate, the kidneys increase their filtration rate (hyperfiltration). While this initially seems like increased efficiency, it can damage the delicate filtering units (glomeruli) over time. Hemodynamic Changes: Obesity can lead to changes in blood flow within the kidneys, increasing pressure within the glomeruli. This high pressure can cause damage and scarring. Metabolic Abnormalities: Obesity is often associated with Type 2 diabetes. High blood sugar levels can damage the blood vessels in the kidneys. Hypertension (high blood pressure): This puts extra strain on the kidneys' blood vessels. These conditions are major risk factors for chronic kidney disease (CKD). Inflammation: Obesity can trigger chronic low-grade inflammation throughout the body. This inflammation can also damage the kidneys. Direct Kidney Damage: Research indicates that obesity itself, independent of diabetes and hypertension, can directly harm the kidneys. Excess body fat, particularly visceral fat, can release substances that contribute to kidney damage. Chronic Kidney Disease (CKD): Obesity is a significant risk factor for developing CKD. End-Stage Renal Disease (ESRD): In severe cases, obesity can contribute to ESRD, requiring dialysis or a kidney transplant. Increased Risk of Complications: For people with existing kidney disease, obesity can worsen their condition and increase the risk of complications.

Author Contributions: R.Y. and A.R. are responsible for conceptualizing and writing the draft. R.Y. for illustration of the figure. B.A, S.S., N.K.M. have reviewed and edited the manuscript. All authors have read and agreed to the published version of the manuscript.

Acknowledgement: We appreciate the support of Sharda University, which enabled this Community Connect research.

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