

Weighty Matters: Exploring the Economic Ramifications of Obesity, Abdominal Bloating, and Spinal Deformities in Pakistan

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Abstract



This study conducted in Pakistan from December 2020 to December 2022 addresses the rising health issues associated with abdominal bloating (AB), spinal deformities (ST), and obesity. With risk factors including improper diet, sedentary lifestyles, and abnormal posture, the research aims to provide valuable insights into the complications and diseases linked to these health concerns. The observational study involved 50 males categorized into three age groups (50-60, 61-70, 71-75), with 48 classified as obese and 2 non-obese participants. Utilizing data tabulation and GraphPad Prism 9.5.2, the study employed econometric research methods and descriptive statistics, including ANOVA variance, for parametric analysis. Results indicated a positive association between AB and health diseases, with a slight association observed with ST. Participants exhibited varying levels of ST and AB, revealing potential links between these factors. The study concludes that factors like improper diet and sedentary lifestyles increase the risk of obesity, which, in turn, may progress to AB and lead to ST, potentially causing a range of chronic health issues.

Keywords: Abdominal Bloating, Spinal Deformities, Healthcare Issues, Obesity, Economic Ramifications

JEL Classification: A13, D00, B41

Introduction

Abdominal bloating (AB) is emerging as a pervasive health concern among the elderly in Pakistan, affecting 30-50% of the population and imposing negative impacts on health, including an inferiority complex and various social issues (Ali et al., 2022). This largely unnoticed condition contributes to several chronic diseases, such as spinal deformities, irritable bowel syndrome (IBS), lower back pain, thoracic pain, stomach disorders, and constipation (Ali et al., 2022). Excessive gas, frequent burping, and abdominal rumbling are identified as key causes of AB (Ali et al., 2022). Shockingly, WHO reports indicate that 58.1% of the Pakistani population is overweight, while 43.9% suffer from obesity, posing a substantial health risk and emphasizing the critical need for awareness and preventive measures? This study sheds light on the prevalence and consequences of AB in Pakistan's elderly population, urging attention to the importance of early detection and intervention to mitigate the associated health risks.

This study unveils the substantial economic burden posed by obesity in Pakistan, as evidenced by the 2019 world obesity statistics. In that year, the economic cost attributable to obesity reached a staggering 3.41 Billion USD, equivalent to 16 USD per capita and 1.1% of the GDP. Distinguishing between direct and indirect costs, the study reveals that 8.4% of the country's GDP is spent directly on managing obesity-related issues, while the remaining 91.6% accounts for indirect costs. Projecting forward to 2060, the estimated cost is a whopping 52 Billion USD, translating to 141 USD per capita and 2.6% of the GDP. This study underscores the urgent need for comprehensive strategies and interventions to curb obesity rates, not only for the well-being of individuals but also to mitigate the escalating economic burden on the nation.

According to findings from the global observatory survey, the direct medical costs allocated for treating obese patients amounted to 0.27 billion USD in 2019, with projections soaring to 0.59 billion USD by 2030 and a staggering 3.28 billion USD by 2060 (Gokdemir, 2022). In addition to

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these medical expenditures, non-medical costs for 2019 were recorded at 0.02 billion USD, expected to rise to 0.03 billion USD by 2030, and 0.1 billion USD by 2060. Considering the substantial financial resources devoted to obesity treatment, it raises pertinent questions about the potential redirection of these funds toward other critical sectors. Table 8 in the study conducted by Marz and Chen (2022) provides a comprehensive breakdown of the various expenses associated with obesity, shedding light on the complete cost landscape.

65% of Pakistan's population is living below the poverty line, meanwhile, 70% of the population is suffering from obesity because of high obesity levels a big amount portion of finance is also spent on obesity-related diseases while recovering and treating the entire situation is contradictory a few portions of the public are living below the poverty line whereas another suffering from obesity (overeating) so because of that balance of society also suffered (Ali et al., 2022). In the present study, we will analyze the situation of obesity in Pakistan and the current financial and economic situation of Pakistan in the context of obesity, recently Pakistan also suffered from different natural disasters in the form of flood and COVID-19 (Ali et al., 2022) which have very devastating economic and socioeconomic impacts on Pakistan economy as well as on health sector hospitals and other health centers (Ali, et, al 2022). The present study is the exclusive focus on elderly male participants, which may limit the generalizability of the findings. Including a more diverse sample concerning age, gender, and socio-economic background could enhance the applicability of the results to a broader population.

Hypothesis

Overweight elderly individuals are more prone to develop spinal deformities or twisting, such as scoliosis, kyphosis, or lordosis, due to increased pressure and misalignment. The supporting muscles and ligaments of the spine may deteriorate due to worsening changes associated with aging coupled with obesity, leading to spinal abnormalities. Moreover, older individuals with obesity may encounter balance and gait problems, which can force them to make postural or movement adjustments that may further strain the spine (Marzo et al., 2021). To address the above possible correlation, this study suggests the following hypothesis:

H0: There is no association between obesity and spinal deformities.

Next, the degree of abdominal bloating and spinal deformities do not correlate. Spine deformities, such as scoliosis, kyphosis, or lordosis, primarily occur due to spinal miss-alignment and abnormal curvature, whereas, AB is characterized by inflammation or distension of the stomach, often by gas, fluid, or other factors. However, in certain circumstances, excessive AB or distension may adjust spinal alignment and result in postural changes that potentially worsen pre-existing spinal deformities or increase the risk of developing them. Individuals may need to adjust their posture or gait due to severe bloating, leading to a change in weight distribution and increased strain on the spine. In conclusion, although there is no direct association between AB and spinal deformities, excessive bloating can indirectly affect spinal alignment and raise the likelihood of spinal complications. To address the possible relationship between spinal deformities and abdominal, we proposed the following hypothesis:

H1: There is an association between the level of spinal deformities and the level of abdominal bloating (AB).

H2: There is no association between the level of spinal deformities and the level of abdominal bloating (AB).

Obesity is a condition associated with an increased risk of chronic and non-chronic diseases which makes individuals vulnerable to short-term ailments that can be cured with medical assistance. Acute disease can be caused by a weakened immune system resulting from obesity. This weakened immune system can lead to an increased likelihood of infections and slower recovery from injuries. Chronic diseases, long-term ailments that require continuous management and attention, are also worsened by obesity, which serves as a significant risk factor. Chronic diseases, including type 2 diabetes, hypertension, heart disease, and certain cancers, can severely affect overall health. Excess body fat, inflammation, insulin resistance, and other metabolic changes associated with obesity can all contribute to the development of chronic illnesses. The following hypotheses are developed to test the above relationship between obesity and non-chronic diseases (NCD) and chronic disease (CD):

H3: There is a significant association between obesity and non-chronic diseases (NCD) and chronic disease (CD) disease.

H4: There is no significant association between obesity and non-chronic diseases (NCD) and chronic disease (CD) disease.

Methodology

Study design, setting, and participants

The current research was undertaken within a hospital district situated in a rural area of Pakistan, focusing on the elderly population grappling with obesity and its associated health issues such as abdominal bloating (AB), spinal deformities, stomach problems, and kidney issues. Employing an econometric research approach, the study aimed to substantiate its findings with robust statistical analysis. The participants included in the research were individuals aged 50 and above, who not only exhibited obesity but also suffered from spinal deformities and abdominal bloating. Those participants who did not manifest these specific health issues were deliberately excluded from the study. The research spanned from December 2020 to December 2022, providing a comprehensive examination of the prevalent health concerns among the elderly in the specified rural area.

Ethical Approval

It's crucial to emphasize that ethical considerations were diligently addressed and that ethical approval was obtained from the Management Research Center Board at Al-Madinah International University, Malaysia. This underscores the commitment to conducting research under ethical standards and guidelines, ensuring the protection and well-being of participants involved in the study.

Statistical Analysis

Data tab and graph prism 9.5.2 were used for descriptive statistical analysis including analysis of variance ANOVA for generalization of parametric tests.

Results

The study population consisted of 50 participants, systematically categorized into three distinct age groups: 50-60 years, 61-70 years, and 71-75 years. Within this cohort, 48 individuals were identified as obese, determined by their Body Mass Index (BMI), while the remaining 2 participants fell outside the obese category and belonged to the age group of 50-60 years. This stratified approach to participant selection allows for a comprehensive analysis across different age brackets, contributing to a nuanced understanding of the impact of obesity, abdominal bloating, and spinal deformities within the elderly population.

Obesity

Analysis

In the initial age group of 50-60 years, participants exhibited an average weight ranging from 80-110kg and an average height between 165-180cm. Moving to the second age group of 61-70 years, participants' average weight fell within the 70-100kg range, accompanied by heights ranging from 163-173cm. The final age group, encompassing individuals aged 71-75 years, displayed an average weight of 65-75kg and average height in the 160-172cm range. Across all age groups, participants, when compared to the normal Body Mass Index (BMI), were categorized as obese. Notably, all participants experienced spinal twists (ST), with variations in the onset age among them (Marzo, & Aye, 2022). The type of spinal deformity exhibited variability but was consistently linked to abdominal bloating (AB) and obesity. The study found a positive correlation: higher levels of AB or obesity were associated with an increase in spinal deformity, and vice versa. The consequences of ST were manifold, causing lower back pain leading to disrupted sleep, difficulty working, and discomfort when sitting for extended periods due to backbone pain. Specific ailments such as severe knee pain and hip bone pain were reported by individual participants. Sleep disturbances, lethargy, nausea, and frequent yawning were also prevalent among the participants, with the types of ailments varying due to AB. Table 1 provides a detailed breakdown of respondents based on age group, average weight (kg), height level (cm), and their classification into obese and non-obese categories (Ali et al., 2022).

Variables

In this research study, we used obesity as an independent variable, AB as a mediator variable, ST spinal deformities as a moderator, and Economy as considered a dependent variable. Further, we used health disease as the control variable to check whether it was a communicable disease (CD) or non-communicable (NCD).

Table 1 Total number of respondents according to average weight and height including demographic representation with age group

Econometric Analysis (EA)

Gender	Age group	Number of respondents	Obese	Non-Obese	Average weight (Kg)	Average height (cm)
Male	50-60	22	20	2	80-110	165-180
Male	61-70	17	17	0	70-100	163-173
Male	71-75	11	11	0	65-75	160-172

Econometric analysis of respondents according to the level of Spinal deformities and AB

We categorized the participants according to their level of ST spinal deformities and AB (Gokdemir, & Bhattacharya, (2020). We considered using 3 levels of ST and AB: low-level, middle-level, and high-level. Table 2 presents the measurement of each respondent according to the low, middle, and high-level levels of ST spinal deformities and AB.

Table 2 Number of respondents according to low, middle, and high levels of AB abdominal bloating and ST spinal deformities co-relation

Age groups	Total number of respondents	Low level of spinal deformities	Low Level of abdominal bloating
50-60	22	6	4
61-70	17	2	3
71-75	11	2	3
Age groups	Total number of respondents	Middle-level spinal deformities	Middle Level of abdominal bloating
50-60	22	5	5
61-70	17	5	4
71-75	11	4	4
Age groups	Total Number of respondents	High level of spinal deformities	High Level of abdominal bloating
50-60	22	11	13
61-70	17	10	10
71-75	11	5	4

Spinal Deformities

Spinal deformity (ST) is a common and increasing issue in Pakistan especially in elderly people because of this their body posture looks crooked and the upper part of the waist bulges outward, due to which they have to face a lot of difficulty in walking, sitting, defecating sleep disorder and other routine errands. These issues happen because of obesity and its level, Table 3 shows the correlation Pearson-r test of spinal deformities, and Table 5 comprises the statistical result of Spinal deformities.

Table 3 Results of Pearson-r of all respondents according to low, middle, and high ST spinal deformities

Co-relation Pearson-r	Total Number of respondents	Low Level	Middle Level	High Level
Total Number of respondents	1.000	0.839	0.891	0.951
Low Level	0.839	1.000	0.500	0.629
Middle Level	0.891	0.500	1.000	0.988
High Level	0.951	0.629	0.988	1.000

Abdominal Bloating

Abdominal Bloating (AB) is directly linked with obesity, It is caused by sitting for long hours not exercising, and eating too much and at irregular times. Table 4 shows the correlation Pearson-r test of AB level and Table 6 shows the statistical results of AB levels in participants.

Table 4 Results of Pearson-r of all respondents according to low, middle, and high AB abdominal bloating

Co-relation Pearson-r	Total Number of respondents	Low Level	Middle Level	High Level
Total Number of respondents	1.000	0.839	0.839	0.991
Low Level	0.839	1.000	1.000	0.756
Middle Level	0.891	1.000	1.000	0.756
High Level	0.991	0.756	0.756	1.000

Descriptive Statistical Analysis and Results ST

Table 5: Descriptive Statistical results of respondents according to a low, middle, and high level of ST spinal deformities

Statistical results data 1		Low level	Middle Level	High Level
Number of values	3	3	3	3
Minimum	11.00	2.000	4.000	5.000
25% Percentile	11.00	2.000	4.000	5.000
Median	17.00	2.000	5.000	10.00
75% Percentile	22.00	6.000	5.000	11.00
Maximum	22.00	6.000	5.000	11.00
Range	11.00	4.000	1.000	6.000
95% CI of median				
Actual confidence level	75.00%	75.00%	75.00%	75.00%
Lower confidence limit	11.00	2.000	4.000	5.000
Upper confidence limit	22.00	6.000	5.000	11.00
Mean	16.67	3.333	4.667	8.667
Std. Deviation	5.508	2.309	0.5774	3.215
Std. Error of Mean	3.180	1.333	0.3333	1.856
A lower 95% CI of mean	2.985	-2.404	3.232	0.6813
The upper 95% CI of mean	30.35	9.070	6.101	16.65
Coefficient of variation	33.05%	69.28%	12.37%	37.09%
Lower 95% CI of geo. mean	6.711	0.5967	3.370	2.813
Upper 95% CI of geo. mean	38.26	13.94	6.392	23.86

Table 6 Descriptive Statistical results of respondents according to a low, middle, and high level of AB abdominal bloating

Statistical results data 2	Low-level	Middle-Level	High-Level
Number of values	3	3	3
Minimum	11.00	3.000	4.000
25% Percentile	11.00	3.000	4.000
Median	17.00	3.000	4.000
75% Percentile	22.00	4.000	5.000
Maximum	22.00	4.000	5.000
Range	11.00	1.000	1.000
95% CI of median			
Actual confidence level	75.00%	75.00%	75.00%
Lower confidence limit	11.00	3.000	4.000
Upper confidence limit	22.00	4.000	5.000
Mean	16.67	3.333	4.333
Std. Deviation	5.508	0.5774	0.5774
Std. Error of Mean	3.180	0.3333	0.3333
A lower 95% CI of the mean	2.985	1.899	2.899
The upper 95% CI of the mean	30.35	4.768	5.768
Coefficient of variation	33.05%	17.32%	13.32%
Lower 95% CI of geo. mean	6.711	2.186	3.129
Upper 95% CI of geo. mean	38.26	4.988	5.934

Table 7 Variation of health diseases in different age groups with different categories of CD Communicable and NCD Non-Communicable diseases among all the respondents

Age group	Health Disease and Issue number of respondents	CD Communicable disease	Non-communicable disease NCD
50-60	22	Diabetes, Heart shooting problem, Lung disease, BP	Stomach disorder, digestion problem, hip bone or cartilage pain
61-70	17	TB tuberculosis, Hepatitis, influenza, Cough, Nausea, Diabetes, Heart Attack problems, Asthma, Mental stress, Chronic Lung disease,	Cardiovascular disease CD, preventable cancer, Indigestion, lower back pain, hip bone pain,

71-75	11	Heart Disease, Hypertension, Asthma, Mental stress	Indigestion, Lower back pain, hip bone pain, Kidney problems,
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Discussion

Our results deduced a positive correlation between AB and ST spinal deformities; moreover, we also found out that the correlation further depends upon the size of AB and ST. This relation is shown by the fact that at a high level of AB, the mean was 37.41%, and at the same level (high) the ST mean was 23.86%. In the case of the lower level, AB was found to be at 4.988%, and ST at the same level was 13.94%, which shows a gap of more than double. Lastly, in the middle level, AB was 5.934% and ST was 6.392%, the ratio of responses was nearly the same, 13 and 14.

Apart from ST, AB causes many chronic CDs and NCDs, the ratio of which varies between different participants. The most common chronic diseases among all age groups were hypertension, heart disease, stomach disorders, lower backbone pain, and knee pain. Some participants had more than one or multiple diseases which depend upon their natural condition and physical fitness.

We perceived that an increase in age is also related to psychological problems such as mental stress, illness, or mental disorder. Moreover, staying at home for too long a time can lead to irritability, dementia, psychosis, and craziness, and sitting for a long time also causes bloating problems, which are prevalent among the majority of the elderly population in Pakistan (Ali et al., 2023).

In the first group of participants, ages between 50-60 years, only 6 had low-level ST, whereas, 11 had high-level ST. In the second group, of ages between 61-70 years, 2 had a low level of ST, 5 had a middle level of ST, and 10 had a high-level of ST, which shows that a major proportion of participants had a high-level of ST. In the last group, ages between 71-75 years, 2 participants had low-level of ST, 4 had middle-level, and 5 had high-level ST. The low level of ST participants is only 11 and a high level of ST exists in groups 61-70 years other 2 groups are near high-level of ST.

The entire country suffers from obesity and its related issues, health diseases especially the obesity level is increasing in urban areas of Pakistan rapidly, and for females, obesity is an emerging issue domestic women spend most of their time at home so they become obese in a very short time (Tanzil, & Jamali, 2016). Obesity is the issue of all ages but elder people suffer compared to young or adolescents (Ali et al., 2024).

A heightened fat intake poses health risks for the elderly, as it exhibits a direct correlation with increased weight. Consuming a diet rich in fats has been linked to obesity and elevated Body Mass Index (BMI). Additionally, opting for a low-fat diet incurs comparatively lower economic costs, as highlighted (Siddiqui et al., 2018).

Unhealthy dietary habits, lack of physical activity, prolonged periods of sedentary behavior such as extended TV watching and constant newspaper reading and a generally inactive lifestyle are factors contributing to the rising levels of obesity in the elderly population (Sherin, 2014).

Awareness regarding physical activity is crucial for the elderly as incorporating a healthy diet and engaging in regular physical activity can contribute to reducing obesity. Additionally, adopting an active lifestyle helps prevent various mental health issues such as stress, depression, and psychosis. In rural areas, there is a lack of understanding among elderly individuals about the connection between physical activity and obesity, as well as the broader associations between obesity and other diseases. Moreover, there is a general unawareness of the economic implications of obesity. Providing education on these aspects is essential to promote better health outcomes in the elderly population (Laar & Shi, 2020).

Economically, obesity entails several losses. Initially, there is expenditure related to the consumption of high-calorie items. Subsequently, as individuals become obese, there is a loss of time due to the lethargy associated with this condition. Lastly, substantial financial resources are directed toward healthcare assessments and the treatment of Chronic Diseases (CDs) or Non-Communicable Diseases (NCDs). Table 8 illustrates the overall economic impact on the country, encompassing both current and projected losses up to 2030 and 2060. These projections underscore significant economic repercussions stemming from obesity (Ali et al., 2023).

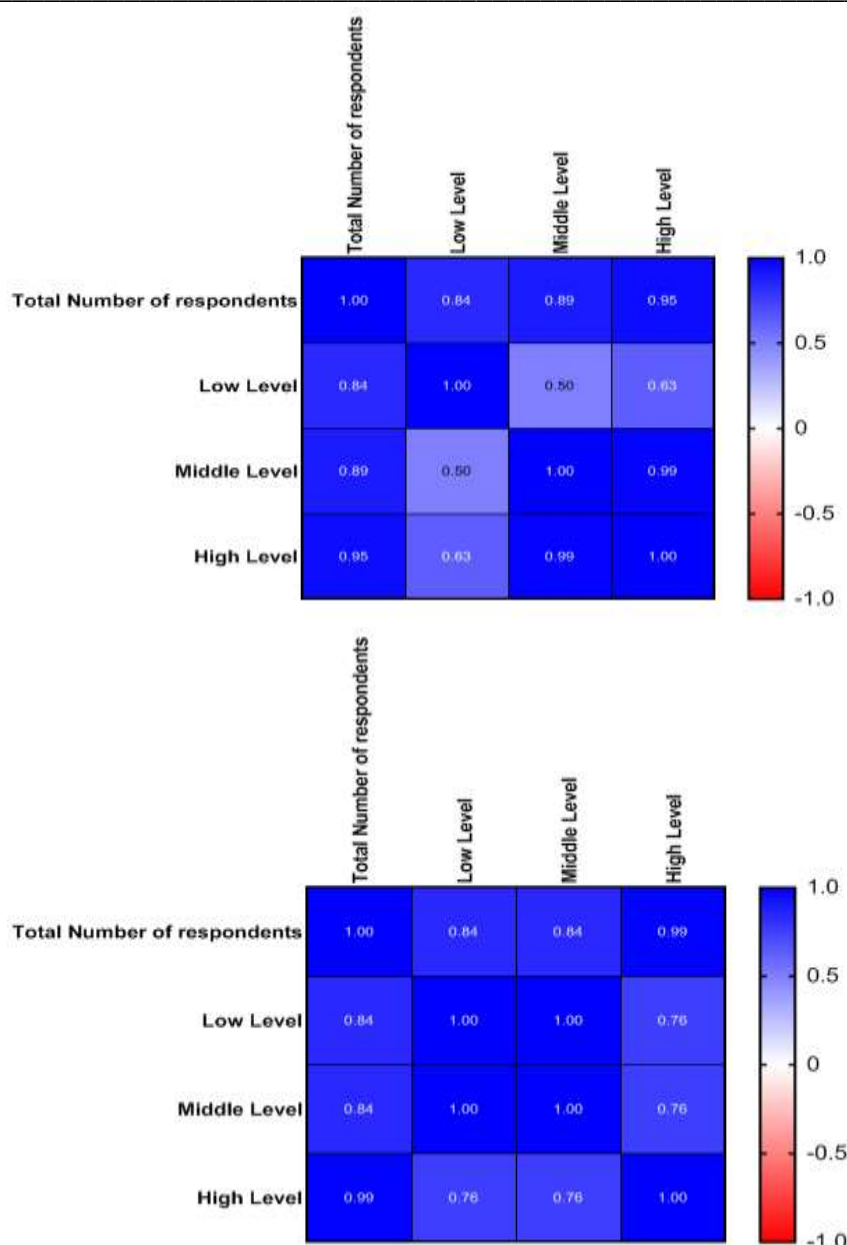


Fig 1 and 2: Pearson-r correlation heat-map between AB abdominal bloating and spinal deformities ST. Fig 1 and 2 indicate the co-relation of AB and ST according to the level of AB.

Source: Author Research

Table 8: Background of the economic cost incurred on obesity, AB abdominal bloating, Medical cost for treatment non-medical, and other overheads of obesity

	2019	2030 (projected)	2060 (projected)
Total economic cost (direct + indirect costs):	\$3.41bn \$7.67bn \$51.32bn	\$7.67bn	\$51.32bn
Total economic cost as % of GDP	1.06%	1.52%	2.57%
Total economic cost per capita:	\$16	\$29	\$140
Total direct costs:	\$0.29bn	\$0.62bn	\$3.38bn
Direct medical costs:	\$0.27bn	\$0.59bn	\$3.28bn
Direct-non-medical costs:	\$0.02bn	\$0.03bn	\$0.1bn
Total indirect costs:	\$3.12bn	\$7.05bn	\$47.95bn
Premature mortality costs:	\$2.33bn	\$5.24bn	\$36.46bn
Absenteeism costs	\$0.16bn	\$0.36bn	\$2.37bn
Presenteeism costs:	\$0.63bn	\$1.45bn	\$9.12bn

Source: Global Obesity Observatory

Conclusion

In conclusion, a myriad of factors, including poor dietary habits, a sedentary lifestyle, and immediate sleep after dinner, prolonged TV watching, and extensive newspaper reading, contribute to the escalation of obesity levels. This, in turn, gives rise to dyspepsia and abdominal bloating (AB), which can act as precursors to spinal twist (ST) (Aljounaidi, & Ali, 2023). The consequences of ST may extend to chronic conditions such as thoracic pain, kidney, and liver problems. Notably, injuries sustained by individuals with higher body mass indexes are reported to be more painful and entail lengthier recovery times. Managing obesity and its associated complications proves to be a costly endeavor. Therefore, it becomes imperative to implement proactive measures aimed at addressing the root causes, including AB and ST, along with other health issues that have the potential to progress into chronic diseases. Failing to address these issues may exacerbate outcomes and perpetuate a significant portion of the economic burden currently spent on obesity-related diseases.

Policy Recommendation

Initiate all-encompassing health education programs that emphasize the significance of physical activity and the cultivation of healthy eating habits as a means to counteract the prevalence of obesity in Pakistan. Formulate strategies aimed at alleviating the economic repercussions associated with obesity and external shocks such as the COVID-19 pandemic, thereby ensuring the stability of the healthcare system and the broader economy. Allocate resources to preventive healthcare initiatives targeting abdominal bloating, spinal deformities, and other health issues linked to obesity, to reduce the economic strain on the healthcare system. Advocate for sustained investments in research and data collection endeavors to continually assess and appraise the efficacy of implemented policies and interventions in addressing obesity and its associated health challenges in Pakistan.

Abbreviations

AB	Abdominal Bloating
EA	Econometric Analysis
OA	Obesity Analysis
CD	Communicable Disease
NCD	Non-Communicable Disease
CD	Chronic Disease
NCD	Non-Chronic Disease
CD	Cardiovascular Disease
IBS	Irritable Bowel Syndrome
BOS	Balance of Society

Declarations

Ethical Approval & Consent to Participate

The present research study has been meticulously crafted, scrutinized, and endorsed by the Management Research Board of Al-Madinah International University (MEDIU). We steadfastly adhere to the principles of Research Ethics and Governance. I, Muhammad Ali, serve as the Principal Investigator leading the research team in the execution of the current research project. Each co-author actively contributed throughout the entire duration of the project, from initiation to completion. It is hereby affirmed that our involvement is exclusive to the specified health research project focusing on "Weighty Matters: Exploring the Economic Ramifications of Obesity, Abdominal Bloating, and Spinal Deformities in Pakistan."

Consent to publish

Not applicable due to the research study having no identifying information and respondent confidentiality.

Availability of data and materials

The disclosure of data is precluded to uphold the confidentiality of the respondents. Nevertheless, in cases of urgent necessity, authors may obtain access with explicit permission and consent from the respondents, subject to a reasonable request made by the author. For data requests, please contact "MUHAMMAD ALI" via email at alimuhammad1447@gmail.com.

Competing Interest

There is no competing interest exists between authors.

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We sincerely acknowledge that the ownership of the current scientific research lies with the Principal Investigator, Dr. Muhammad Ali, and his research team. Our research paper is unequivocally devoid of plagiarism, data fabrication, paraphrasing, and any other form of malpractice. We are submitting this research paper to your esteemed journal for consideration.

Author Contributions

Dr. Muhammad Ali, the principal investigator, initiated and oversaw the research project, spearheading a comprehensive survey in Pakistan. The results were subsequently analyzed and concluded by Zubair Ahmad utilizing statistical data. All authors played a significant role in both reviewing and contributing to the writing of the entire research paper.

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