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**RESEARCH ARTICLE**

# 'Heavy' life satisfaction: Unveiling the intricate relationships between obesity and well-being in Abu Dhabi

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## ABSTRACT

The study investigates the intricate relationship between obesity and well-being among residents in Abu Dhabi. Obesity is recognized as a significant public health concern worldwide, with potential implications for individuals' overall well-being. Understanding the complex associations between obesity and various aspects of well-being is essential for developing effective interventions to promote healthier lifestyles and improve overall quality of life. The research employs path analysis to explore the direct associations between obesity and multiple well-being indicators. Data is collected from residents in Abu Dhabi, focusing on subjective health, subjective mental health, life satisfaction, physical exercise, and satisfaction with social relationships. Path analysis allows for a comprehensive examination of the relationships between obesity and well-being indicators, providing valuable insights into the potential impacts of obesity on individuals' overall well-being. The path model reveals significant direct associations between self-perceived obesity and various well-being indicators. Specifically, obesity demonstrates direct impacts on life satisfaction, subjective mental health, subjective health, physical exercise, and satisfaction with social relationships. Notably, obesity is negatively associated with life satisfaction (-0.017) but positively associated with mental health (0.111), albeit within a negatively framed context. This suggests that obesity may adversely affect mental health despite its positive association. The findings underscore the complexity of the relationship between obesity and well-being among residents in Abu Dhabi. While obesity negatively impacts life satisfaction, it paradoxically shows a positive association with mental health, albeit within a negatively framed context. These results emphasize the importance of addressing obesity as part of efforts to promote overall well-being and improve quality of life among residents in Abu Dhabi. Future interventions should focus on promoting healthier lifestyles and addressing the psychological impacts of obesity to enhance residents' overall well-being and happiness.

***Keywords:*** obesity; well-being; path analysis; life satisfaction; mental health; Abu Dhabi

## 1. Introduction

Obesity represents a significant public health challenge worldwide, with far-reaching implications for individuals' well-being across various dimensions. There is a consensus on the recognition of obesity as a

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multifaceted phenomenon that extends beyond its physical health consequences to encompass a wide range of issues that profoundly influence individuals' subjective experiences and overall quality of life[1,2]. While growing research studies have reported the influence of overweight or obesity on individuals' life satisfaction, relationships with family and friends, physical activity levels, subjective health perceptions, and mental health status[3-5], researchers continue to advocate for a thorough investigation of the diverse, interconnected relationships between obesity and well-being factors to elucidate the intricate dynamics shaping individual and community well-being[6].

The core focus of our research is to investigate the multifaceted connections between obesity and well-being among residents in Abu Dhabi. Obesity is a pressing public health issue globally, extending beyond physical health to encompass various dimensions of individuals' overall well-being. Previous studies have shed light on the associations between obesity and well-being, highlighting implications for mental health, subjective well-being, and overall quality of life[4,5]. These findings hold significant implications for social policymakers and healthcare policymakers alike, emphasizing the importance of holistic approaches to address obesity and promote well-being. By understanding the intricate relationships between obesity and various dimensions of well-being, policymakers can develop targeted interventions and policies to improve overall health outcomes and enhance residents' quality of life in Abu Dhabi. Thus, this study seeks to contribute to the existing body of research by providing valuable insights that can inform evidence-based policy decisions and interventions to address obesity and promote well-being in the region.

Obesity is a complex and multifaceted issue with far-reaching implications for an individual's overall well-being, encompassing not only physical health but also various socio-psychological dimensions. Our study builds upon the existing body of research by incorporating a comprehensive set of indicators in a path model, including self-perceived obesity, life satisfaction, satisfaction with social relationships, family life, frequency of physical exercise, consumption of a healthy diet, subjective health, subjective mental health, time spent online, and feelings about the surrounding physical environment. By examining the relationships between these indicators, our study aims to provide a nuanced understanding of how obesity influences overall well-being in Abu Dhabi. This research makes significant contributions to obesity and well-being research by offering a holistic perspective on the relationships between obesity and various dimensions of well-being. Integrating diverse indicators allows us to uncover nuanced associations and pathways that may have been overlooked in previous studies, advancing our understanding of the complex interplay between obesity and well-being. Additionally, our findings provide valuable insights for policymakers, highlighting the importance of addressing obesity as a multifaceted issue that extends beyond physical health. By elucidating the links between obesity and subjective well-being, mental health, social relationships, and other dimensions of well-being, our research can inform evidence-based interventions and policies aimed at promoting holistic well-being and improving the quality of life for residents in Abu Dhabi. Overall, this study contributes to the growing body of literature on obesity and well-being, offering actionable insights to guide policy and practice in addressing this pressing public health concern.

In recent years, the Emirate of Abu Dhabi, like many other regions worldwide, has witnessed a growing concern for obesity and its implications for well-being. As a rapidly evolving cosmopolitan hub, Abu Dhabi faces unique challenges and opportunities in addressing obesity and promoting holistic well-being among its diverse population. To aid in the understanding of the broader impact of obesity on individuals' lives, this research seeks to explore the intricate interplay between obesity and well-being in Abu Dhabi. Through path analysis, it attempts to unravel the direct and indirect associations between and among self-perceived obesity and holistic well-being factors that are specific in the context of Abu Dhabi. In doing so, this research also

endeavors to provide invaluable insights into informing targeted interventions and policies aimed at promoting comprehensive well-being and mitigating the adverse effects of obesity on individuals and society.

# 2. Review of literature

## 2.1. Social determinants of obesity

The complex relationships between obesity and well-being have been a subject of diverse findings within the research community. In line with the social determinants approach that has advanced in various fields including health[7,8] to understand how social and economic factors such as socio-economic status, community characteristics, social relationships, and living environment influence well-being, the extant literature has extended its focus to the association between obesity and mental health[1,3,9], the environment[2], social connections[10], socioeconomic status[11,12], in addition to the relationships between obesity and physical health[13], and lifestyle such as physical activities[1] and healthy diets[2].

## 2.2. Obesity and life satisfaction

Overall, research has consistently demonstrated a negative correlation between obesity and life satisfaction, with individuals who are overweight or obese often reporting lower levels of life satisfaction compared to those within the normal body mass index (BMI)[6,14,15]. Research further elucidated this association but noted that weight loss among overweight individuals is not associated with higher life satisfaction [16]. A relevant study uncovered gender differences in the relationship between BMI and life satisfaction, noting that overweight men are less likely to report dissatisfaction with life compared to men with normal weight, while obese women are more prone to dissatisfaction compared to women with normal weight [17]. In a large sample of older adults in England, overweight and obese older adults tended to become progressively vulnerable to poor well-being[13]. These findings underscore the complex interplay between obesity and life satisfaction, moderated by various factors.

## 2.3. Health risks and obesity

BMI is commonly scrutinized concerning various health outcomes, including self-rated health, morbidity, and mortality. Studies consistently underscore the heightened risk of severe diseases and health conditions among overweight and obese individuals compared to those with a healthy weight [18,19]. A report by the Centers for Disease Control and Prevention succinctly outlines numerous health challenges associated with obesity, spanning mortality, hypertension, stroke, cancers, alongside bodily pain and impaired physical functioning [20]. Concurrently, the World Health Organization underscores the substantial health ramifications of being overweight or obese [21].

## 2.4. Well-being and obesity

The relationship between obesity and mental well-being has been a central focus in scientific research, with numerous studies examining various aspects of this association [4,22]. A study explored several dependent variables including depression, self-assessment, body image, and quality of life, highlighting the complex interplay between obesity and psychological well-being[3]. Similarly, Rindler et al.[23] investigated the associations between overweight, obesity, and mental health in older adults, revealing significantly decreased quality of life and increased depression scores among individuals with obesity. Other studies have also shown that obesity is linked to higher risks of depression and low self-esteem[22,24]. Sarwer and Polonsky[25] underscored the emotional distress experienced by individuals with obesity, which can impact treatment-seeking behavior and outcomes, emphasizing the need for comprehensive approaches to address both physical and mental aspects of obesity-related concerns. Research investigated the role of physical activity and mental health as mediators in childhood obesity [1]. While childhood obesity was found to be associated with higher

levels of adverse childhood experiences, the study did not find evidence of mediation or moderation by mental health or physical activity.

### 2.5. Physical activity and obesity

Obesity often coincides with cardiometabolic comorbidities that can diminish quality of life, making exercise a crucial lifestyle intervention to sustain a healthy weight [26]. However, individuals with higher body fat percentages tend to exhibit lower levels of physical activity [27,28]. Advocating for maintaining an active lifestyle to promote health and weight loss, a study conducted by the Harvard School of Public Health underscores the significance of sports and physical activity in combating obesity [29]. A study by Raiman et al. [30] summarized evidence supporting the role of physical activity in obesity management, emphasizing both aerobic and resistance training's importance. The study by Pojednic et al. [31] explored the benefits of physical activity for individuals with obesity, citing emerging correlational data indicating its positive effects on critical health markers. Furthermore, extensive literature underscores the beneficial impacts of exercise on physical health, as well as cognitive and emotional well-being, across all age groups [32,33].

### 2.6. Environmental and social factors affecting obesity

Recent research also considers environmental characteristics encompassing both natural and built surroundings that shape individuals' daily lives [2,34,35]. A study by Lee et al. [36] offered evidence suggesting that both social and environmental factors contribute to obesity. In a study [1], positive neighborhood environments were linked to increased physical activity and reduced mental health problems. Specifically, research indicates that the design and condition of the environment can influence obesity rates in rural areas[37], particularly among children. Research by An et al. [38] shed light on the built environment's role in physical activity and obesity among Chinese children and adolescents, advocating for urban design interventions such as new exercise facilities and improved accessibility to existing ones to promote physical activity and combat childhood obesity in China.

### 2.7. Social relationships and obesity

An expanding body of literature underscores the significant role of interpersonal relationships in influencing obesity and associated risks across various life stages [39,40]. Research indicates that social ties throughout one's life course are intricately linked to health and health-related behaviors [41]. Moreover, evidence suggests that leveraging social networks can be effective in mitigating obesity and related risks during adolescence and adulthood [42]. Qualitative investigation delves into the impact of social relationships and activities on the health of obese adults, revealing how different relationships can influence both the development and management of weight [9]. A relevant study Christakis & Fowler [40] focuses on network relationships pertinent to the transmission and alleviation of obesity through social ties, particularly emphasizing the influence of close ties such as friends and spouses.

### 2.8. Nutritional patterns and obesity

According to research conducted by Moschonis & Trakman [43], several dietary factors have been identified as risk factors for weight gain and obesity, including snacking frequency, limited access to fresh produce, alcohol consumption, and emotional eating. A study provided evidence of the association between eating patterns and obesity in a free-living US adult population, revealing that a higher frequency of eating episodes per day is correlated with a reduced risk of obesity [5]. These findings underscore the importance of dietary habits in managing weight and preventing obesity.

### 2.9. Digital influences

In addition, numerous studies highlight the relationship between obesity and excessive time spent online. Ramírez-Coronel [44] suggests that the obesity-promoting effects of prolonged screen time may stem from its association with increased food intake. Additionally, Aghasi et al. [45] conducted a meta-analysis revealing a significant positive correlation between high levels of Internet use and overweight/obesity compared to lower levels of use. Excessive screen time and associated sedentary behaviors contribute to weight gain by reducing the necessity for physical activity and hindering engagement in exercise. Furthermore, research underscores the prevalence of Internet-related well-being issues, including various mental health problems such as anxiety, depression, stress, and attention-deficit/hyperactivity disorder [46]. These findings collectively highlight the multifaceted impact of excessive internet usage on both physical health and mental well-being.

### 2.10. Prevalence and demographics

The prevalence of obesity is notably linked to various biographical factors such as sex, ethnicity, and socioeconomic status, giving rise to intricate interrelations among these characteristics. A study conducted multiple-group path analyses to investigate gender differences in obesity, finding that males fit the model significantly better than females [9]. Similar research explored the relationship between Hispanic ethnic concentration and obesity prevalence, concluding that this association varies by socioeconomic environment[12]. Their findings led them to suggest that promoting education and healthful living training could help combat obesity trends in Hispanic and other ethnic communities. From the aging perspective, the National Council of Aging [47] highlights the overlooked impact of obesity on mental and emotional health in older individuals, suggesting that they may experience more severe mental health issues than those without obesity. According to the findings of Lee et al. [36], the influence of social and environmental factors on obesity is frequently underestimated.

### 2.11. Path analysis in obesity research

As already noted, path analysis has gained increasing popularity in studies investigating the complex relationships between obesity and various aspects of well-being. For instance, research employed path analysis to assess the mediating role of physical activity/mental health and moderating effects of psychosocial factors in childhood obesity stemming from adverse childhood experiences[1]. A study applied path analysis to examine a stress-related health behavior model in the context of binge eating and obesity among African Americans [9]. Similarly, a study employed path analysis to investigate the psychosocial impact of obesity or overweight among adolescents in Surakarta, Central Java [3]. Additionally, research utilized path analysis to provide a comprehensive understanding of the socioeconomic and intrapersonal factors and health behaviors that influence body weight[11].

### 2.12. The subjective well-being homeostasis theory

The SWB Homeostasis Theory, largely developed by psychologist Robert Cummins [48,49], suggests that individuals possess a genetically determined set-point of well-being [50,51] that their psychological systems strive to maintain. This set-point, which is relatively stable over time, governs the general level of happiness an individual experiences and is influenced by personality[52], life conditions[53], genetics, cultural background[52], and physical activity[54]. Like physiological homeostasis that maintains stable bodily conditions, SWB homeostasis involves psychological mechanisms that regulate mental health and emotional stability.

To maintain the set-point of well-being, individuals attempt to use various psychological buffers. These include positive perceptions such as overly favorable self-views (like inflated self-esteem or optimism), attentional control which involves focusing attention away from negative stimuli and toward positive ones,

and mood regulation techniques [48]. These activities or practices, such as engaging in exercise, hobbies or social interactions, help enhance mood and emotional well-being [55].

The theory also posits internal feedback mechanisms that continuously assess deviations from the SWB set point. When discrepancies arise, whether due to external events or internal changes, these mechanisms activate appropriate psychological processes to restore SWB to its baseline level, thus maintaining overall emotional equilibrium. Long-term stressors pose a greater challenge to SWB homeostasis by continuously engaging the body's coping mechanisms. This persistent "wear and tear" can lead to a recalibration of the set-point if the individual's psychological buffers are overwhelmed, resulting in a new, often lower, baseline for well-being. Obesity can be considered as a chronic stressor as it gradually deteriorates health over long periods of time [56,57]. Therefore, the SWB homeostasis is an adequate fit with the research questions posed in this study.

# 3. Methods and design

## 3.1. Instrument and survey

This study used data from the fourth cycle of the Abu Dhabi Quality of Life survey (QoL-4), which comprehensively incorporated subjective indicators drawn from prominent sources such as the OECD's Better Life Index, the World Happiness Report, the Gallup Global Well-being Survey, and the European Quality of Life Survey [58,59,60]. Additionally, QoL-4 introduced a diverse array of dimensions and factors thought to influence the well-being of Abu Dhabi residents, encompassing dimensions ranging from housing, household income, employment, and to health, education, safety, and social connections.

Conducted online from January to June 2023, the QoL-4 covered residents aged 15 and above across all regions of the Emirate of Abu Dhabi. Ethical approval for the survey was granted by both the Department of Community Development and the Statistic Center Abu Dhabi. The online survey was disseminated to individuals registered in various accessible databases maintained by government agencies, community associations, as well as private institutions. Measures were taken to avoid duplications as well as to ***prevent ballot box stuffing*.** Appropriate quality control procedures were followed during the data collection process to guarantee that designated members of the sample were reached. Over 90 thousand respondents participated in the survey.

## 3.2. Preliminary data analysis and variables

Initial descriptive analysis was carried out to determine the distribution of the data. Missing data patterns were examined and there are no systematic differences between respondents with missing data and those with complete data. We conducted normality tests of all dimensions included in the study. Natural logarithm transformation was conducted in cases where the normality assumptions showed some deviations.

The two main variables in this study are self-perceived obesity, an item that asks a respondent to self-evaluate his/her extent of obesity with the scale ranging from 1 (not obese) to 5 (very obese), and life satisfaction. Following the literature review, we selected relevant well-being determinants from the survey for the current analysis. These determinants were assumed to be associated with obesity and constitute various aspects of well-being. Given that the survey contains many variables related to well-being, initial analysis, including correlation analysis and linear regression, was performed to reduce the list of variables associated with obesity and life satisfaction. Data were standardized before performing further analysis since the survey used different scales.

A step-by-step path analysis was then followed with self-perceived obesity as the variable of interest. At every step, one individual variable was introduced. Certain statistics were considered to keep the variable in the path model or eliminate it completely. For each individual variable, three basics statistical values were

considered, the magnitude of the standardized coefficient, the t-statistics, and the level of significance. The variables that did not reflect any significance were eliminated from further considerations. **Table 1** provides the final list of variables staying in the path analysis model with related descriptive statistics. Providing means and standard deviations serves as a basis for comparison with future studies or interventions. These numerical values could establish a benchmark against which future research findings can be compared. Researchers can track changes in means and standard deviations over time to assess the effectiveness of interventions or policy changes aimed at improving well-being determinants. This longitudinal approach enables researchers to evaluate the social impacts of specific policies or interventions by observing how they influence the well-being indicators measured in the study.

**Table 1.** Final list of variables in the path model.

| | Survey item and scale | Mean | Standard deviation |
|---|---|---|---|
| Self-perceived obesity | In your opinion, to what extent do you consider yourself obese? (1 not obese to 5 very obese) | 1.769 | 1.032 |
| Life satisfaction | From a scale of 0-10, all things considered, how satisfied are you with your life as a whole nowadays? (0 extremely unsatisfied to 10 extremely satisfied) | 6.932 | 2.599 |
| Satisfaction with social relationships | In general, I am satisfied with my relationships with other people I know (including acquaintances, friends, workmates, and neighbors). (1 strongly disagree to 5 strongly agree) | 3.815 | 0.863 |
| Satisfaction with family life | In general, I am satisfied with my family life. (1 strongly disagree to 5 strongly agree) | 4.030 | 1.064 |
| Frequency of doing physical exercise | How often do you do physical exercise (minimum of 30 minutes) in the last 4-6 months? (1-6: never, rarely, about once per month, about once per week, most days of the week, and daily) | 3.307 | 1.572 |
| Frequency of eating healthy diet | How often do you think you eat a healthy diet? (1 never to 5 all the time) | 3.418 | 0.891 |
| Subjective health | In general, how do you personally assess your current health status? (1-5: poor, fair, good, very good, excellent) | 3.491 | 1.067 |
| Subjective mental health | During the past four weeks, how much of a problem did you have with the following: feeling depressed, worry or anxiety, concentrating or remembering things, fear, loneliness, boredom, physical pain? (1 not at all - 5 to a great extent) | 2.193 | 0.979 |
| Time spent online | On average, how many hours do you usually spend online a day? (Numerical number of hours) | 6.090 | 4.806 |
| Feelings about surrounding physical environment | How do you feel about your surrounding living environment? (1 very bad to 5 very good) | 3.956 | 1.029 |

### 3.3 Path analysis

We used LISREL to carry out path analysis by utilizing the covariance matrix (**Table 2**). A path analysis model determines the statistical significance, if any, of the path coefficients. Many aspects of LISREL helped develop the optimal path model for the study, including several goodness-of-fit statistics such as the Degrees of Freedom and the Maximum Likelihood Ratio Chi-Square. Other fit statistics used were those that appear in most path analysis structures. They included the P-Value for Test of Close Fit, the Root Mean Square Error of

Approximation or (RMSEA), the Comparative Fit Index (CFI), the Normed Fit Index (NFI), the Non-Normed Fit Index (NNFI), the Goodness of Fit Index (GFI), and the Adjusted Goodness of Fit Index (AGFI), and the Root Mean Square Residual (RMR).

**Table 2.** Covariance matrix of the variables in the path model.

| | LF | MH | SH | OT | EN | SR | FL | PE | HD | OB |
|---|---|---|---|---|---|---|---|---|---|---|
| LF: Life satisfaction | 1.009 | | | | | | | | | |
| MH: Mental health | .307 | 1.025 | | | | | | | | |
| SH; Subjective health | -.458 | -.328 | .962 | | | | | | | |
| OT: Online time | -.061 | .045 | .188 | 1.044 | | | | | | |
| EN: Environment | .325 | .191 | -.255 | -.069 | 1.038 | | | | | |
| SR: Social relationships | .388 | .256 | -.362 | -.045 | .272 | 1.015 | | | | |
| FL: Family life | ..488 | .281 | -.410 | -.060 | .286 | .10 | .987 | | | |
| PE: Physical exercise | .085 | .207 | -.138 | -.061 | .035 | .104 | .090 | .922 | | |
| HD: Healthy diet | .183 | .145 | -.223 | -.150 | .132 | .165 | .171 | .266 | .912 | |
| OB: Obesity | -.066 | -.171 | .162 | .061 | -.059 | -.066 | -.070 | -.123 | -.133 | 1.078 |

An important aspect of the path model is the illustration of the two types of associations: direct and indirect. When a variable has an arrow directed toward the dependent variable, it suggests a direct association; when a variable has association with the dependent variable through another variable, then it indicates an indirect association. The total association of a variable thus includes both the direct and indirect coefficients. It is worth emphasizing that a variable may not have a direct association with the dependent variable, but it may have an indirect association.

# 4. Results

Prior to delving deeper into the results of the path analysis, it is imperative to present an overview of the respondents' profiles and their variations in obesity. **Table 3** delineates the biographic profiles of the respondents who provided their details.

Among the respondents, males constituted 53.4%. In terms of age distribution, the largest proportion was observed in the 35-39 age group (16.8%), followed by the 40-44 age group (16.3%), and the 30-34 age group (14.3%). Older respondents aged 55 and above accounted for approximately 9.7% of the sample. The majority of respondents were married (65.5%), while singles comprised 26.6%. Regarding educational attainment, the two predominant categories were bachelor's degree holders (33.7%) and secondary degree holders (31.3%). Emiratis comprised 46.5% of the respondents, whereas non-Emiratis constituted 53.5%. **Table 3** also presents the mean self-perceived obesity levels across respondent categories along with the corresponding ANOVA scores.

**Figure 1** portrays the final path model. All goodness-of-fit statistics are favorable for the model. The Degrees of Freedom (1) has the Maximum Likelihood Ratio Chi-Square of 2.4, with a P-Value for Test of Close Fit of 0.398. The RMSEA is 0.0395, the NFI is 0.985, the NNFI is 0.955, the CFI is 0.985, the RMR is 0.062, the GFI is 0.995, and the AGFI is 0.983. All measures are well above the recommended levels [61]. **Table 4** provides the details of paths present in the final model with their estimates, t-values, and significance levels.

The path model illustrates direct associations between the self-perceived level of obesity and five well-being indicators. Specifically, obesity exhibits direct impacts on life satisfaction, subjective mental health,

subjective health, physical exercise, and satisfaction with social relationships. Notably, obesity displays a negative association with life satisfaction (-0.017) and a positive association with mental health (0.111), which is negatively framed indicator; thus, indicating that obesity adversely influences mental health. Additionally, Figure 1 highlights the most substantial negative impact of satisfaction with social relationships on subjective health (-0.155). However, no direct or indirect associations are observed between obesity and satisfaction with family life. Furthermore, the figure underscores the role of increased sports and physical activities in mitigating obesity. Intriguingly, no direct or indirect relationships are observed between obesity and online time. Similarly, obesity does not exhibit direct associations with healthy dietary habits but indirectly relates to it through increased physical exercise levels. Lastly, no direct or indirect connections are discerned between obesity and the physical environment.

**Table 3.** Profile of respondents and ANOVA results.

| | **Number** | **Percent** | **Mean Obesity** | **ANOVA F-value** | **Significance** |
|---|---|---|---|---|---|
| **Gender:** | | | | | |
| Male | 43,359 | 53.4% | 1.756 | 15.442 | 0.001 |
| Female | 37,791 | 46.6% | 1.789 | | |
| **Age:** | | | | 78.758 | 0.001 |
| 15-19 | 11,781 | 12.7% | 1.650 | | |
| 20-24 | 3,861 | 4.2% | 1.565 | | |
| 25-29 | 7,930 | 8.6% | 1.622 | | |
| 30-34 | 13,219 | 14.3% | 1.754 | | |
| 35-39 | 15,532 | 16.8% | 1.831 | | |
| 40-44 | 15,110 | 16.3% | 1.891 | | |
| 45-49 | 9,759 | 10.5% | 1.899 | | |
| 50-54 | 6,368 | 6.9% | 1.859 | | |
| 55-59 | 3,328 | 3.6% | 1.802 | | |
| 60 or older | 5,688 | 6.1% | 1.636 | | |
| **Marital status** | | | | 50.206 | 0.001 |
| Single | 21,621 | 26.6% | 1.669 | | |
| Married | 53,201 | 65.5% | 1.869 | | |
| Divorced | 4,084 | 5.0% | 1.801 | | |
| Separated | 674 | 0.8% | 1.761 | | |
| Widow/widower | 1,570 | 1.9% | 1.761 | | |
| **Education** | | | | 105.477 | 0.001 |
| Read and write | 2947 | 3.7% | 1.533 | | |
| Primary level | 2521 | 3.1% | 1.455 | | |
| Intermediate level | 5635 | 6.9% | 1.589 | | |
| Secondary level | 25391 | 31.3% | 1.705 | | |
| Bachelor's degree | 27350 | 33.7% | 1.869 | | |
| Master's degree | 8530 | 10.5% | 1.933 | | |
| Doctorate | 1574 | 1.9% | 1.799 | | |
| Illiterate | 1449 | 1.8% | 1.552 | | |
| **Nationality** | | | | 19.651 | 0.001 |
| Emirati | 37,493 | 46.5% | 1.790 | | |
| Non-Emirati | 43,221 | 53.5% | 1.753 | | |

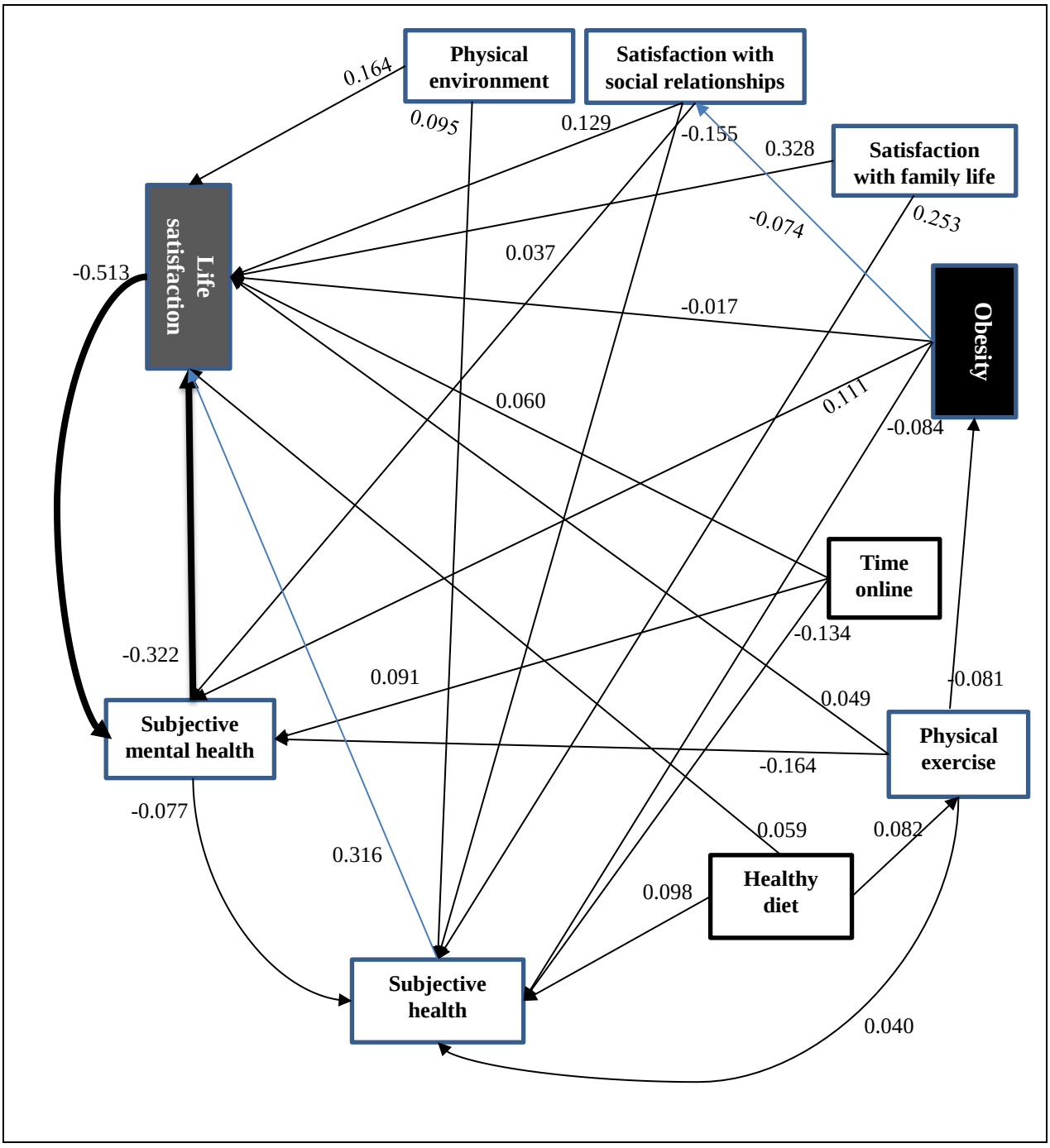


**Figure 1.** The final path model.

Results also point to the direct associations between life satisfaction and all other indicators in the path model. Significant effects are observed between life satisfaction and satisfaction with family life (0.328), subjective health (0.316), the physical environment (0.164), satisfaction with social relationships (0.129), time spent online (0.060), healthy dietary habits (0.059), and engagement in physical exercise (0.049). Most notably, life satisfaction negatively influences mental health, exhibiting a robust coefficient of -0.513. Conversely, mental health demonstrates a significant negative effect on life satisfaction, indicated by a coefficient of -0.322. Thus, our study elucidates a bidirectional association between life satisfaction and subjective mental health.

The construct of subjective mental health exhibits a pivotal role within the path model, displaying significant associations with various indicators. Alongside its bidirectional relationship with life satisfaction,

mental health demonstrates direct correlations with five additional indicators. Its most substantial negative impact is observed on life satisfaction (-0.322), followed by a negative effect on subjective health (-0.077). It is noteworthy to consider the directional paths directed towards mental health. The model indicates that mental health is positively influenced by satisfaction with social relationships (0.037) and increased time spent online (0.091). Conversely, engaging more frequently in exercise and physical activities exhibits a noteworthy negative effect on mental well-being (-0.164).

**Table 4.** The final path model and the standardized estimates.

| Path from | Path to | estimate | t-value | Sig. |
|---|---|---|---|---|
| Satisfaction with social relationships | Life satisfaction | 0.129 | 28.037 | 0.001 |
| Satisfaction with social relationships | Subjective health | -0.155 | -37.236 | 0.001 |
| Satisfaction with social relationships | Subjective mental health (-) | 0.037 | 6.204 | 0.001 |
| Satisfaction with family life | Life satisfaction | 0.328 | 67.236 | 0.001 |
| Satisfaction with family life | Subjective health | 0.253 | 58.646 | 0.001 |
| Physical environment | Life satisfaction | 0.164 | 40.620 | 0.001 |
| Physical environment | Subjective health | 0.095 | 25.763 | 0.001 |
| Obesity (-) | Life satisfaction | -0.017 | -4.420 | 0.001 |
| Obesity (-) | Subjective mental health (-) | 0.111 | 27.643 | 0.001 |
| Obesity (-) | Subjective health | -0.084 | -24.024 | 0.001 |
| Obesity (-) | Satisfaction with social relationships | -0.074 | -35.834 | 0.001 |
| Time online | Life satisfaction | 0.060 | 14.871 | 0.001 |
| Time online | Subjective health | -0.134 | -24.385 | 0.001 |
| Time online | Subjective mental health (-) | 0.091 | 22.255 | 0.001 |
| Physical exercise | Life satisfaction | 0.049 | 11.001 | 0.001 |
| Physical exercise | Subjective mental health (-) | -0.164 | 37.621 | 0.001 |
| Physical exercise | Obesity (-) | -0.081 | -21.733 | 0.001 |
| Physical exercise | Subjective health | 0.040 | 10.123 | 0.001 |
| Healthy diet | Life satisfaction | 0.059 | 13.751 | 0.001 |
| Healthy diet | Subjective health | 0.098 | 24.549 | 0.003 |
| Healthy diet | Exercise and activities | 0.082 | 20.94 | 0.001 |
| Subjective mental health (-) | Life satisfaction | -0.322 | 30.761 | 0.001 |
| Subjective mental health (-) | Subjective health | -0.077 | -14.443 | 0.001 |
| Subjective mental health (-) | Satisfaction with social relationships | 0.037 | 6.044 | 0.001 |
| Subjective health | Life satisfaction | 0.316 | 54.923 | 0.001 |
| Life satisfaction | Subjective mental health (-) | -0.513 | 47.691 | 0.001 |

**Table 5** presents a comprehensive overview of the direct, indirect, and total associations among the indicators. The highest total association is observed between life satisfaction and mental health (0.513), followed by the association between life satisfaction and satisfaction with family life (0.4079). Other notable total associations include the bidirectional effect of mental health on life satisfaction (0.3463), the association between subjective health and life satisfaction (0.316), between satisfaction with family life and subjective health (0.2611), and between the physical environment and life satisfaction (0.1940). Moreover, **Table 5** highlights instances where certain associations solely manifest through direct pathways without any indirect

links, such as from mental health to subjective health, from mental health to satisfaction with social relationships, from subjective health to life satisfaction, from physical exercise to obesity, from healthy diet to physical exercise, and from life satisfaction to mental health.

Given the focus of this present research, it becomes evident that comparing the means of self-perceived obesity between and among respondent groups using the analysis of variance tests warrants attention. The ANOVA results presented in **Table 1** indicate significant differences in the means of obesity across gender, age, marital status, education, and nationality groups. Specifically, females exhibit a higher self-perceived obesity level than males, with mean scores of 1.789 and 1.756, respectively. The highest self-assessed obesity levels are observed among individuals aged 45-49 (1.899) and 40-44 (1.891), while the lowest mean obesity scores are reported for the 20-24 (1.565), 25-29 (1.622), and 60 and older (1.636) age groups. In terms of differences among marital status groups, married individuals display the highest mean obesity score (1.869), whereas singles have the lowest (1.669). It is evident that those with lower education levels, including illiterates, primary level, and basic literacy, report lower mean obesity scores (1.455, 1.533, and 1.552, respectively), whereas individuals with a master's or a bachelor's degree had higher mean scores (1.933 and 1.869, respectively). Additionally, Emiratis exhibit a higher obesity score compared to non-Emiratis, with mean scores of 1.790 and 1.753, respectively.

**Table 5.** Type of associations between the well-being indicators.

| From | To Variables | Direct association | Indirect association | Total association |
|---|---|---|---|---|
| Subjective mental health | Life satisfaction | 0.322 | 0.0243 | 0.3463 |
| | Subjective health | 0.077 | ----- | 0.0770 |
| | Satisfaction with social relationships | 0.037 | ----- | 0.0370 |
| Subjective health | Life satisfaction | 0.316 | ----- | 0.3160 |
| Satisfaction with social relationships | Life satisfaction | 0.129 | 0.0609 | 0.1899 |
| | Subjective health | 0.155 | 0.0093 | 0.1643 |
| Satisfcation with family life | Life satisfaction | 0.328 | 0.0799 | 0.4079 |
| | Subjective health | 0.253 | 0.0081 | 0.2611 |
| Obesity | Life satisfaction | 0.017 | 0.0718 | 0.0888 |
| | Subjective mental health | 0.111 | 0.0081 | 0.1168 |
| | Subjective health | 0.084 | 0.0080 | 0.0926 |
| Physical environment | Life satisfaction | 0.164 | 0.0300 | 0.1940 |
| | Subjective health | 0.095 | 0.0065 | 0.1015 |
| Physical exercise | Life satisfaction | 0.049 | 0.0442 | 0.1034 |
| | Subjective mental health | -0.164 | 0.0466 | 0.2106 |
| | Obesity | -0.081 | -------- | 0.0810 |
| | Subjective health | 0.040 | 0.01332 | 0.0533 |
| Healthy diet | Life satisfaction | 0.059 | 0.03633 | 0.0953 |
| | Subjective health | 0.098 | 0.05105 | 0.1490 |
| | Physical exercise | 0.082 | --------- | 0.0820 |
| Time online | Life satisfaction | 0.060 | 0.04668 | 0.1617 |
| | Subjective health | 0.134 | 0.00937 | 0.1434 |
| | Subjective mental health | 0.091 | 0.03083 | 0.1218 |
| Life satisfaction | Subjective mental health | -0.513 | --------- | 0.5130 |

# 5. Discussions

This study delves into the complex interplay between self-perceived obesity and various well-being indicators through a comprehensive path analysis. By examining a multitude of determinants, our model provides insights into the nuanced relationships between obesity and overall well-being. Importantly, the results suggest that overlooking indirect associations between obesity and other well-being determinants could lead to incomplete understandings of the broader impact of obesity on individuals' lives.

A significant insight gleaned from the path analysis conducted in this study is the imperative to approach obesity from a multifaceted perspective, considering a diverse array of well-being determinants. The analysis reveals the intricate web of direct and indirect associations between obesity and various aspects of individuals' well-being, underscoring the need to adopt a comprehensive approach that transcends simplistic viewpoints. By incorporating a broad spectrum of well-being determinants, such as life satisfaction, family and social relations, mental health, subjective health, the physical environment, time spent online, physical exercise, and dietary habits, this study highlights the complexity of obesity and its multifactorial nature. Recognizing the interconnectedness of these determinants offers invaluable insights for developing holistic interventions and policies aimed at addressing the root causes of obesity and promoting comprehensive well-being. This underscores the importance of adopting a nuanced and inclusive approach to understanding and addressing the challenges posed by obesity, ultimately leading to more effective strategies for improving public health and well-being.

Similarly, our findings highlight the profound impact of various well-being determinants on life satisfaction. This again underscores the interconnectedness of different dimensions of individuals' lives and their collective influence on overall life experiences. Recognizing the holistic nature of life satisfaction and its susceptibility to diverse well-being determinants, policymakers and healthcare professionals can develop targeted interventions aimed at promoting comprehensive well-being and enhancing individuals' overall quality of life [14,17]. The findings of this research lend support to other research that emphasize the importance of adopting a multifaceted approach to addressing well-being concerns, considering the complex interplay between various factors that contribute to life satisfaction [15].

Consistent with the literature [6,16,62], this study confirms the negative relationships between obesity and life satisfaction. Moreover, through meticulous analysis, it reveals the intricate connection between body weight and subjective well-being. Thus, this finding underscores the far-reaching implications of obesity beyond its physiological ramifications, highlighting its substantial impact on individuals' overall satisfaction with life. Recognizing this relationship is essential for developing targeted interventions aimed at not only addressing the physical health aspects of obesity but also bolstering individuals' sense of fulfillment and contentment.

A significant finding of this study is the identification of reciprocal relations between mental health and life satisfaction. The path model shows that mental health not only influences an individual's life satisfaction but is also influenced by it in return. This bidirectional relationship underscores the interconnectedness of mental well-being and subjective perceptions of overall life. Individuals with better mental health status tend to report higher levels of life satisfaction, while those experiencing lower life satisfaction may face challenges in maintaining positive mental health. A few other studies also identified such bidirectional relations. For example, Joshanloo and Blasco-Belled[63] found reciprocal relationships between life satisfaction and depressive symptoms. Similarly, King et al. [62] observed significant reciprocal effects of life satisfaction and depressive symptoms within long-wed couples over time. A similar study Cai et al. [64] provided evidence of a longitudinal positive reciprocal relationship between social rhythm and positive mental health in younger adult

populations. Understanding these reciprocal relations is crucial for developing comprehensive strategies to promote well-being, emphasizing the importance of addressing mental health concerns to enhance overall life satisfaction and fostering resilience in individuals' mental well-being.

Another significant finding revealed through path analysis in this study is the substantial impact of obesity on two crucial well-being determinants: subjective health and mental health. This observation resonates with previous research that has investigated the correlations between obesity and physical and mental health [3,16,25]. This finding suggests that individuals with obesity are more likely to experience challenges related to their mental health compared to those with a healthier weight status. It underscores the intricate interplay between physical and psychological health factors, highlighting the importance of addressing mental well-being as part of obesity management and intervention efforts. The understanding of the profound impact of obesity on subjective health and mental well-being is essential for developing targeted interventions aimed at mitigating the adverse effects of obesity and promoting holistic health and happiness for affected individuals [1,23].

A surprising finding from the study is the absence of a significant association between obesity and satisfaction with family life, which does not confirm with other findings [65]. Indeed, the transmission effect of close social ties such as friends and family on obesity could be different [40]. Despite this, a significant direct association was observed between obesity and satisfaction with social relationships, which is congruent with other studies [42,66]. This suggests that while obesity does not appear to have a notable impact on the quality of family relationships, it does have a discernible effect on other social relationships such as friendships. Therefore, the importance of considering different social dynamics when examining the impact of obesity on interpersonal relationships is underscored. A study highlights the influential role of informal networks, such as family and friends, in obesity awareness and management, while also noting the potential negative impact of formal networks, including healthcare professionals[9]. There is a clear need for further research to investigate the nuanced effects of weight status on social well-being.

An additional noteworthy discovery in the study is the significant association between time spent online and various aspects of well-being, including mental health, life satisfaction, and subjective health, although no direct or indirect relationships between obesity and online time are observed. The lack of evidence to indicate the obesity-promoting effects of prolonged screen time may be due to various factors such as the mediating effect of food intake [44] or other dietary factors[43]. Nevertheless, the findings support other research that suggest that increased screen time is correlated with changes in mental well-being, life satisfaction levels, and subjective health perceptions[45,46]. This emphasizes the influence of digital engagement on overall psychological and subjective well-being [46]. Further research into the specific mechanisms underlying this association could inform interventions aimed at promoting healthier online habits and improving well-being outcomes.

The findings of this research further emphasize the importance of additional well-being determinants and their correlation with obesity. Notably, frequency of physical exercise demonstrates a direct relationship with obesity and healthy dietary habits exhibit an indirect association with obesity through increased physical exercise levels. These results align with prior research, reinforcing the multifaceted nature of the relationship between obesity and lifestyle factors [31,43]. The relationship between obesity and the physical environment is not supported by this research, an area that warrants further research.

Finally, the importance of various biographic variables in understanding the relationship between obesity and well-being is also highlighted. Notable disparities are evident across demographic segments, with certain groups exhibiting significantly higher rates of self-perceived obesity, including females, middle-aged individuals, married individuals, Emiratis, and those with education levels below college degrees. These

findings echo previous studies, which have urged policymakers to consider such differences carefully when formulating strategies and interventions aimed at addressing obesity [9,12,36].

This study's application of comprehensive path analysis outlined the correlations between self-perceived obesity and various well-being indicators such as life satisfaction, mental health, and subjective health. Through the framework of SWB Homeostasis Theory, these findings underscore the complex impact obesity has on maintaining stable subjective well-being. As mentioned earlier, the theory posits that individuals strive to maintain a baseline level of well-being (set-point). The findings in this study suggest that obesity challenges homeostasis by introducing physical and psychological stressors that can disrupt emotional and cognitive stability [66,67].

The path analysis results emphasize the need for a multifaceted approach when addressing obesity, considering not just physical health but also the interconnectedness of social, environmental, and psychological factors. This aligns with SWB Homeostasis Theory, which suggests that effective management of well-being requires comprehensive strategies that account for all aspects influencing an individual's life satisfaction [68]. By identifying both direct and indirect associations between obesity and well-being determinants, the study promotes a holistic view that is crucial for developing targeted interventions [69] for the residents of Abu Dhabi.

A significant observation from the study is the profound impact of obesity on subjective health and mental well-being. The theory explains that deviations from the set-point of well-being prompt psychological adaptations to restore balance. However, obesity can lead to chronic disruptions that might overwhelm these adaptive processes, resulting in sustained impacts on mental health and life satisfaction. Recognizing these effects is crucial for developing comprehensive obesity management strategies that include support for mental as well as physical health. These findings further support the theoretical foundations of the SWB homeostasis theory. Consistent with previous research [70,71], this study emphasizes the direct relationship between obesity and physical exercise and an indirect association through dietary habits. This supports SWB Homeostasis Theory by highlighting physical activity and nutrition as key elements in maintaining or restoring well-being set-points disrupted by obesity. Interventions that enhance access to physical activity and promote healthy eating can therefore be effective in supporting well-being homeostasis among obese individuals.

Interestingly, the study found no significant direct relationship between obesity and satisfaction with family life, though there was a notable impact on other social relationships. This might suggest that family dynamics provide a buffer that helps maintain well-being homeostasis against the stresses posed by obesity, which aligns with the theory's emphasis on social supports as critical to maintaining subjective well-being and increasing an individual's resiliency [51]. Another potential factor at play here is culture, as it was demonstrated by Cummins [67] that culture plays a role in the measurement and interpretation of data. Therefore, a more accurate measurement of family satisfaction may elicit the relationship between obesity and family life satisfaction.

The study reveals a reciprocal relationship between mental health and life satisfaction, which is central to SWB homeostasis framework [72]. This bidirectionality suggests that improving mental health can enhance life satisfaction and vice versa, thereby supporting well-being homeostasis. The findings concerning the relationship between time spent online and well-being, without a direct link to obesity, prompt further consideration within the SWB Homeostasis framework. Increased screen time has been correlated with changes in mental well-being and life satisfaction, possibly acting as both a stressor and a moderator in the relationship between lifestyle behaviors and subjective well-being. This area offers potential for interventions aimed at improving online habits to support better overall well-being, consistent with homeostatic principles.

# 6. Conclusions

In conclusion, the utilization of the path model in this study has elucidated a wealth of significant associations beyond obesity, encompassing key determinants of well-being such as life satisfaction, subjective health, mental health, physical activities, online time, the physical environment, and dietary habits. By integrating these diverse factors into the analysis, our understanding of the complex interrelationships between obesity and well-being has been substantially enriched. Notably, the findings underscore the intricate web of influences that extend far beyond mere physical health indicators, emphasizing the importance of considering holistic well-being in obesity research and interventions.

This comprehensive approach not only deepens our insight into the multifaceted nature of obesity but also provides invaluable guidance for the development of targeted strategies aimed at enhancing overall well-being and mitigating the adverse effects of obesity on individuals and society. By understanding how obesity influences life satisfaction through the crucial pathways, healthcare practitioners and policymakers can better tailor health promotion strategies, policies, and interventions to enhance holistic well-being and quality of life for individuals affected by obesity.

As a limitation of the current study, it is important to acknowledge that future research endeavors could aim to include more technical health indicators to further enhance the comprehensiveness of the study. For instance, incorporating indicators related to substance abuse, such as alcohol consumption, consumption of foods rich in sugar and fat, and illicit drug use, could provide valuable insights into their potential associations with obesity and overall well-being. Research has shown that substance abuse, particularly alcohol excess, can significantly impact brain functioning and may contribute to obesity and related health conditions, such as hepatic steatosis, particularly when combined with negative eating behaviors and illicit drug dependence [73]. Therefore, integrating such indicators into future studies could offer a more comprehensive understanding of the intricate relationships between obesity and well-being among individuals in Abu Dhabi.

Building upon the foundational insights provided by this study, future research directions should focus on gaining a deeper understanding of the differences in well-being determinants according to various demographic and socio-economic factors. Specifically, exploring how gender, age, education, marital status, economic status, and region of living intersect with the identified well-being determinants can offer invaluable insights into the nuanced complexities of obesity and overall well-being. By examining these factors in a multi-group path analysis, researchers can uncover disparities in how individuals experience and are impacted by obesity-related well-being outcomes, as well as how various demographic factors influence the pathways leading to obesity, thus informing targeted interventions and policies aimed at addressing this complex issue across diverse populations.

# Authors contribution

MB. HA and MA participated in Conceptualization. MA, GY, and MAB participated in the methodology. MB. and AA participated in using the software. MAB, MB, MA, and GY participated in the validation. MB, MAB, and GY participated in the formal analysis. MB and GY participated in a formal investigation. AA participated in data curation. MA and MAB participated in writing-original draft preparation. MA, GY, and MAB participated in writing reviews and editing. MB, MAB, and AA participated in visualization. MA and HA participated in supervision. GY, HA, and AA participated in project administration. All authors have read and agreed to the published version of the manuscript.

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## Conflict of interest

The authors have no conflict of interest to declare.

## Ethical approval

Ethical consent regarding the protocol of the study was granted by the Department of Community Development (DCD) and the Statistic Center Abu Dhabi (SCAD)

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