

Exploring the Influence of Income Levels on Dietary Choices and Obesity Risk: A Comprehensive Analysis of Food Category Preferences and Food Baskets

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Abstract

This study explores the influence of income levels on the composition of food baskets and its implications for dietary choices and obesity risk. A total of 350 male and female adult participants were included in the study. Convenience sampling was employed as the method for participant selection. Measures and Face-to-face interviews were conducted by a proficient interviewer. Correlations between variables were analyzed using Spearman's correlation coefficient and Khi-square test. The obtained results were analyzed using SPSS software version 25 and presented with 95% confidence intervals (CI). The significance level was established at $p < 0.05$. Descriptive statistics, such as mean \pm SD and frequencies (percentages) were calculated. Analyzing data from socioeconomic disparities in food preferences and the composition of food baskets, we observed significant differences in food category choices between low and high-income individuals. Low-income individuals tend to purchase more cereals and sugary products, which are affordable but calorie-dense and nutrient-poor. On the other hand, higher income individuals include more fruits, vegetables, dairy, and lean meats in their food baskets, promoting a nutrient-dense and healthier diet. The study emphasizes the importance of considering socioeconomic aspects when addressing obesity, as high food prices and limited access to nutritious foods may lead to less healthy dietary choices in low-income communities. To address these disparities, nutrition education, policy interventions, and community-based initiatives are essential in promoting healthier food choices and reducing the prevalence of obesity across all income groups.

Keywords: *obesity, income levels, food choices, eating behaviours, socioeconomic disparities.*

1. Introduction

In recent decades, the global prevalence of obesity has reached epidemic proportions, posing significant challenges to public health worldwide[1]. This increase in obesity rates has raised questions about its potential correlation with socioeconomic factors, particularly income and dietary habits. Rapid economic growth in numerous countries has brought significant changes in both lifestyle choices and dietary behavior. These changes are widely believed to be the primary catalysts behind the alarming rise in major non-communicable diseases, such as obesity[2]. The global market is experiencing a steady increase in food prices. As per the UN Food Price Index, the prices of food in May 2021 were 4.8% higher compared to April, marking the most significant monthly escalation since October 2010. Moreover, these prices were a staggering 39.7% higher than those observed in May 2020[3]. In addition, the demand for a specific food item is influenced by various factors, including its price, the prices of other goods, income levels (purchasing power) and individual preferences. Consequently, any changes in the relative prices of different food items, such as the contrast between healthy and non-healthy choices, are expected to have an impact on the demand for these products[4]. The increase in the cost of food has significant effects on public health, whereby consumers for whom food prices become unaffordable respond by reducing the nutritional quality and quantity of the food they consume. This, in turn, has consequences for health, as it contributes to the obesity epidemic, since rising food prices and the decline in dietary quality is a clear indication of the impact on health[5]. The potential connections between obesity and socioeconomic status may be attributed to the density of dietary energy and its associated cost. Refined grains, added sugars, and added fats tend to be the most cost-effective sources of dietary energy. Not only are they affordable, but they also offer a pleasant taste and convenient accessibility. On the other hand, nutrient-dense options such as lean meats, fish, fresh vegetables, and fruits generally come with a higher price tag. The inverse correlation between the energy density of foods and their cost suggests that diets with higher energy density are linked to lower daily food expenses. Therefore, opting for energy-dense diets may prove to be a practical way to save money[6]. Thus the cost of food can be a barrier to healthy eating, especially for individuals with lower incomes, which is proved by Various studies that found healthier food choices, such as fruits and vegetables, tend to be more costly compared to less nutritious processed foods[7], [8]. It was found after the examination of multiple countries that healthier diets were more expensive than less healthy ones. Furthermore, it was revealed that food prices played a substantial role in predicting food insecurity among low-income households. This suggests that households with lower incomes would have a lower overall nutritional quality in their food purchases, with a reduced amount of fruits and vegetables and an increased consumption of sugar-sweetened beverages when compared to households with higher incomes[9]. Which explain why low-income individuals are more likely to be overweight or obese than those with higher incomes[4]. The correlation between income and obesity is intricately linked to what is known as nutrition transition. This term refers to the changes in dietary patterns that occur alongside economic progress and development[10]. Over the past few decades, numerous countries in Africa and Asia, which have typically been low- or middle-income nations, have transitioned from facing famine to adopting more high-calorie diets, particularly those that are rich in fat. This shift in dietary patterns indicates a shift in priorities, with a greater emphasis on quality

rather than quantity, once basic energy requirements have been met. Additionally, in wealthier nations, there is a positive correlation between higher income and education levels and healthier eating habits, characterized by the consumption of foods such as whole grains, lean meats, fish, low-fat dairy products, as well as fresh fruits and vegetables[11]. The impact of socioeconomic factors, specifically income, on individuals' access to nutritious or unhealthy foods, as well as their purchasing habits and dietary intake, is a subject of interest for many researchers. However, the precise mechanisms or pathways through which these factors influence these outcomes are still not fully understood[12]. Thus, the interplay between incomes, food basket choices, and obesity is a complex topic that demands a comprehensive exploration. This article aims to shed light on the intricate relationship between these factors and how they collectively contribute to the obesity epidemic.

2. Methods

2.1. Study design and participants

We conducted a cross-sectional analysis, examining the initial characteristics of 350 adult participants both males and females. To ensure accuracy, we excluded individuals with missing relevant variables or implausible anthropometric values. These participants were chosen through convenience sampling. Face-to-face interviews were then conducted by the interviewer. Before distributing the surveys, the purpose of the research was clearly explained, and formal written consent was obtained from each participant. It was emphasized that participation was voluntary, and all personal information provided was handled with the utmost confidentiality and anonymity.

2.2. Instrument

After conducting initial observations and conducting an extensive review of existing literature, a questionnaire was developed. The survey consisted of two distinct sections. The first section, known as Section A, aimed to collect information regarding various socioeconomic and demographic factors, such as age, gender, educational background, household income. In Section B of the survey, the primary area of investigation centred around the evaluation of Food Basket choices in order to gauge the state of food security by evaluating both the cost and accessibility of a specific set of food items included in the participants' shopping basket.

2.3. Measures

The collection of anthropometric measurements was conducted by a researcher who had received proper training. These measurements encompassed the weight and height of the participants, in accordance with established protocols. Body Mass Index (BMI) was computed by dividing the weight in kilograms by the square of the height in meters. Participants with a BMI exceeding 30 kg/m^2 were classified as obese, while those with a BMI surpassing 25 kg/m^2 were deemed overweight. All other respondents with a BMI below 25 kg/m^2 were categorized as having a normal weight. Our primary focus centred on the collective group of overweight and obese individuals, whom we compared to those with a healthy body weight.

2.4. Statistical analyses

The prevalence of obesity, determined through the use of BMI cut-offs in kg/m², was considered as the dependent variable in this study. The independent variables included income levels and the various food categories found in the participants' shopping baskets. To examine the correlation between body weight status, income, and food basket choices, multivariate analyses using Spearman's correlation coefficient and Khi-square test were conducted. Statistical analyses were performed using SPSS software version 25.0 (IBM Corp., Armonk, NY, USA). Significance was determined at $p < 0.05$. Descriptive results were presented as mean \pm standard deviation (SD) or frequencies (percentages) depending on the nature of the variables.

3. Results

Table 1. Descriptive Statistics of the Group Study

		Female	Male	p-value
Sex		200 (57.1%)	150 (40.9%)	
Age		35,9 \pm 12,6	40,2 \pm 9,8	0,01
Weight (kg)		72,6 \pm 15,3	82,4 \pm 13,1	0,000
Height (m)		1,62 \pm 0,06	1,75 \pm 0,06	0,000
BMI (kg/m ²)		27,7 \pm 5,7	26,8 \pm 3,9	
Income	Low	97 (48.5%)	75 (50%)	0,001
	Middle	94 (47%)	52 (34.7%)	
	High	9 (4.5%)	23 (15.3%)	
Body weight status	Overweight	69 (34.5%)	42 (28%)	
	Obesity	131 (65.5%)	108 (72%)	

Table 1 presents data on various variables related to sex, age, weight, height, BMI, income and body weight status (overweight or obesity) for both female and male participants. Indicating the statistical significance of the differences observed between females and males of these variables. Our study includes 200 females (57.1% of the total sample) and 150 males (40.9% of the total sample), indicating that there is a difference in the distribution of sex between females and males. The difference in mean age between females (35.9 \pm 12.6) and males (40.2 \pm 9.8) is statistically significant ($p=0.01$), suggesting that there is a significant age difference between the two groups. The difference in the means of weight and height between females and males is highly statistically significant ($p=0.000$), indicating that there is a significant difference in weight and height between the two groups. The study categorizes income into three levels, low, middle and high. The percentages of each income group are provided for both females and males. The difference in income distribution between females and males is statistically significant ($p=0.001$), indicating that there is a significant difference in income levels between the two groups. The study classifies participants into two categories

based on their BMI "Overweight" and "Obesity." it shows that more males fall into the "Obesity" category (72%), while more females are classified as "Overweight" (34.5%)

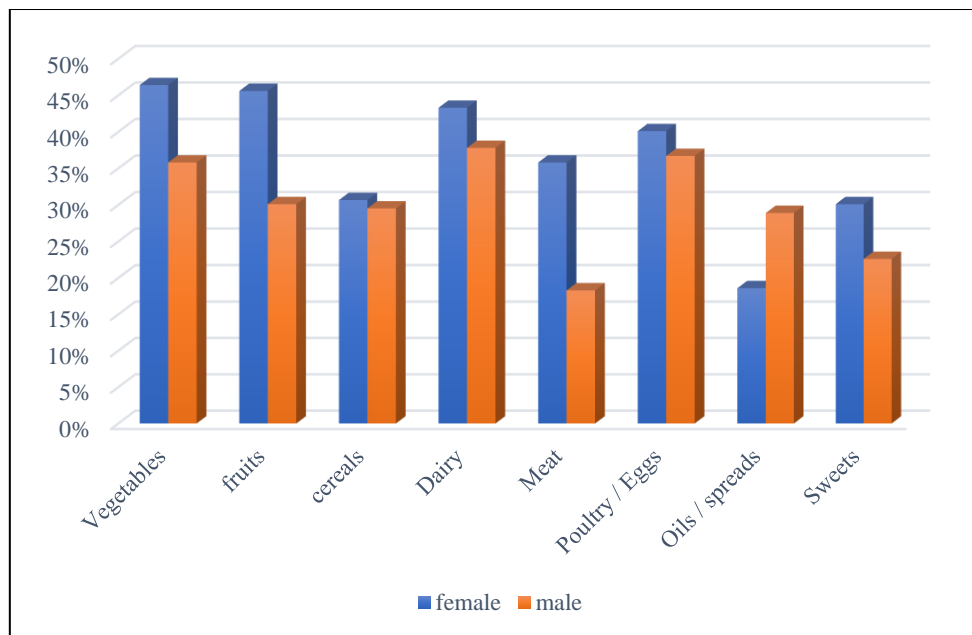


Figure 1. Relative Composition of Food Baskets of Female and Male Consumers, Based on the Number of Items in Each Category

Findings in figure 1 show that there are some notable differences in food categories choices between females and males. Females appear to have higher percentages of fruits (45.6%), vegetables (46.4%), dairy (43.3%), meat (35.8%) and sweets (30.1%). On the other hand, males have higher percentages of oils/spreads (28.9%) Additionally, there are no significant gender differences in cereal and poultry/eggs. These results may be influenced by various factors, including cultural norms, societal expectations, and individual preferences, among others.

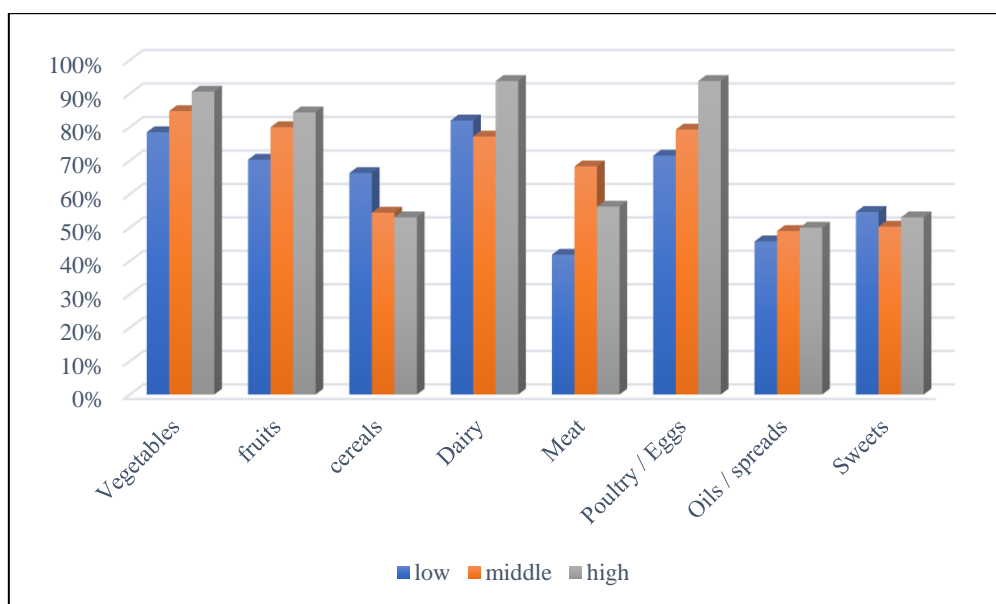


Figure 2. Relative Composition of Food Baskets of the Three Incomes Levels Consumers

Findings in figure 2 present the percentage of food dietary choices in the three income categories low, middle, and high. It shows that individuals with higher incomes tend to have healthier food choices, as evidenced by higher consumption of vegetables (90.6%), fruits (84.4%), dairy (93.8%), meat, poultry and eggs (93.8%). Conversely, individuals with lower incomes show higher consumption of cereals and sweets and relatively lower consumption of meat and poultry/eggs. The consistency in oils/spreads consumption across all income levels suggests that these food groups may not be as significantly influenced by income levels.

Table 2. Correlation between basket choices of different food groups and income levels in relation to BMI

BMI	Food groups							
	Vegetables	Fruits	Cereals	Dairy	Meat	Poultry/ Eggs	Oils / spreads	Sweets
Income	0,051	0,021	0,031	0,814	0,00	0,007	0,618	0,667

The statistical analysis reveals that the p-value for the relationship between vegetable purchase and income is 0.051, slightly exceeding the conventional significance level of 0.05. This suggests that there is a weak or borderline association between the two variables. On the other hand, the p-value for the association between fruits purchase and income is 0.021, falling below the significance level. This indicates a statistically significant relationship. Moreover, there is a statistically significant correlation between cereal purchase and income levels. Lastly, there is a highly statistically significant association between meat, poultry and eggs purchase and income. There is no statistically significant association between income and dairy, oils/spreads and sweets purchase.

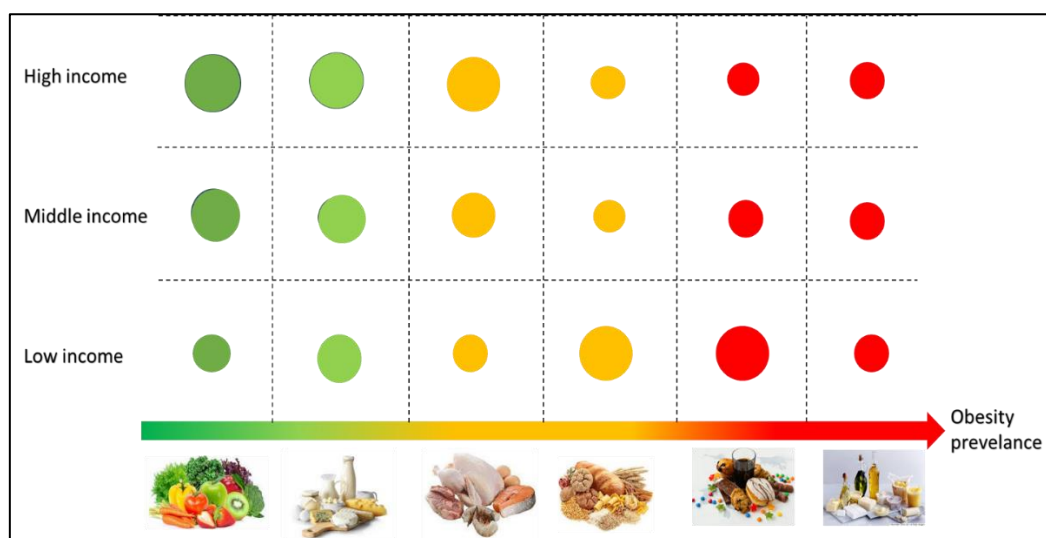


Figure 3. Food Group Consumption in the Three Income Levels: Low, Middle, and High in Relation with Obesity

As we can see in figure 3, when it comes to individuals with middle and higher incomes are more likely to include healthier and nutrient-dense foods like fruits, vegetables, dairy, and lean meats in their food choices, promoting better overall nutrition and health, staying far from obesity. Conversely, individuals with lower incomes may rely more on affordable, energy-dense, and processed foods, such as sugar, and refined grains, which are often high in added sugars, unhealthy fats, and sodium. These food choices can lead to a higher calorie intake and a lower intake of essential nutrients, contributing to weight gain and an increased risk of obesity.

4. Discussion

The findings presented in Figure 1 demonstrate clear gender-based differences in food category choices, indicating that males and females have distinct dietary preferences. The higher consumption of vegetables and fruits, dairy, meat, and sweets among females compared to males can be influenced by a combination of biological, cultural, societal, psychological, and health-related factors. Biologically, men and women may have different nutrient requirements and metabolic differences that can influence their food preferences. Women, on average, tend to have higher iron and calcium needs due to menstruation and pregnancy, which could lead to a greater inclination towards foods like meat and dairy that are rich in these nutrients[13]. Moreover, women, traditionally, have been more involved in meal planning and preparation. As a result, they may have a greater influence on the food choices for themselves and their families, leading to higher consumption of vegetables, fruits, and other nutrient-rich foods[14]. Dietary choices can also be influenced by psychological and emotional factors. Emotional eating, which involves consuming comfort foods to cope with stress or emotions, may play a role in the higher consumption of sweets among females. Women may be more prone to emotional eating, leading to a preference for sweet and indulgent treats during times of stress or emotional upheaval. Furthermore, food advertising and media portrayal of gender roles can also influence dietary choices. By targeting specific gender demographics, promoting certain foods as more suitable for either males or females. For instance, advertisements for sweets and confectionery may be more frequently targeted at women[15]. Lastly, women, in general, may be more health-conscious and proactive about making nutritious choices to maintain their well-being. This heightened health awareness may contribute to their higher consumption of nutrient-dense foods like fruits and vegetables, which provide essential vitamins and minerals that may be particularly appealing to women, as they play crucial roles in supporting overall health, including hormonal balance and skin health[16]. It is important to note that these are general trends and that individual food choices can vary widely based on personal preferences, cultural backgrounds, and other factors. Additionally, societal norms and attitudes towards food choices are evolving, and both men and women are increasingly breaking away from traditional gender-based stereotypes when it comes to their diets[17].

As it is shown in figures 2, income levels have a profound influence on the composition of food baskets also known as grocery baskets or shopping baskets, they represent the collection of foods and beverages that individuals or households typically purchase and consume over a given period, such as a week or a month. Furthermore, they provide a comprehensive snapshot of an individual's or a household's dietary choices by examining the types and quantities of

foods included in their baskets. Analyzing the composition of food baskets allows researchers and policymakers to assess dietary choices and identify potential associations with obesity[18]. However, the reasons behind dietary patterns may be further illuminated by considering the socioeconomic aspects of food habits, specifically the high costs associated with certain food groups. This financial factor can be seen as a contributing piece to the overall puzzle. Consequently the composition of food baskets may be significantly affected by income levels[2]. Understanding the reasons underlying the correlation between the composition of food baskets with income levels when addressing Obesity begins with understanding the relative shifts in price structure that have occurred around the world due to different agricultural policies, which can have significant impacts on individuals' incomes and food budgets, affecting their purchasing power and overall financial well-being. Thus, Individuals may need to adjust their food budgets to accommodate higher prices. This can lead to difficult choices, such as buying cheaper, lower-quality food options or reducing the quantity and variety of the food consumed[19]. This disproportionate increase in food prices affects vulnerable populations, such as low-income individuals, families, and those living in poverty may face economic constraints that impact their food choices. Which makes them rely more on affordable, energy-dense, and processed foods that are often high in added sugars, unhealthy fats, and sodium. These food choices can lead to a higher calorie intake and a lower intake of essential nutrients, contributing to weight gain and an increased risk of obesity[20].

We observed similar findings in our study (table2 and figure3) for the intake of Cereals, sweets, and sugary products regarding the risk of adiposity in the low-income group. Many cereals and refined carbohydrate products, such as white bread, white rice, and sugary breakfast cereals, have a high calorie density. They provide a significant number of calories in small serving sizes, making it easy to consume excess calories without feeling satiated. As a result, individuals may feel less satisfied after consuming these foods, leading to increased hunger and potential overeating[1]. These products tend to be more affordable than fresh fruits, vegetables, and healthier food options and as low-income individuals may face financial constraints and limited purchasing power, leading them to opt for cheaper, calorie-dense, and processed foods to stretch their food budgets and fill their stomachs with more affordable food choices, which often includes refined cereals and sugary products[21]. Additionally, low-income neighborhoods may have limited access to grocery stores or markets that offer a variety of fresh and nutritious food options. Instead, these areas may have an abundance of convenience stores or fast-food outlets that predominantly offer cheaper, processed, and sugary foods[22] and with limited time due to multiple jobs, long working hours, or other responsibilities. As a result, they may rely on fast and convenient options, such as sugary snacks and refined cereals, which require minimal preparation[23] Also Sugary products and cereals are often heavily marketed and advertised, especially to children and low-income communities. The marketing of these products may influence consumption patterns, as individuals may be more exposed to these food options through media channels[5], and as it is known, individuals' taste preferences and eating habits are shaped by their upbringing, culture, and past experiences. Low-income individuals may have grown up with a diet that includes more cereals and sugary products, leading to habit formation and familiarity with these foods. And due to financial difficulties and other challenges. Stress can influence food choices, as some individuals may turn to sugary

foods as a coping mechanism to temporarily alleviate stress and improve mood[24]. Besides, nutrition education and knowledge about healthy food choices may be limited in low-income communities, Thus without proper guidance, individuals may not fully understand the importance of a balanced diet and may opt for readily available, convenient, and cheaper food options[25]. Conversely, individuals with higher incomes generally have more financial resources and purchasing power, which can influence their food choices, allowing them to have access to a wider variety of foods, including fresh produce, lean proteins, and healthier options. Consequently, higher-income individuals are more likely to include nutrient-dense foods like fruits, vegetables, dairy and lean meats in their food baskets. These food choices are associated with a higher intake of essential vitamins, minerals, and dietary fibre, promoting better overall nutrition and health. A diet rich in fruits, vegetables, dairy, and lean proteins tends to be lower in calorie density and higher in nutrient density. Consuming these foods can promote satiety, leading to a reduced overall calorie intake and a healthier body weight[26]. As fresh fruits, vegetables, dairy, and lean meats are often perceived as premium or higher-priced food items, makes them more accessible to those with higher incomes[5]. On top of that, higher-income neighborhoods and areas typically have better access to grocery stores, farmers' markets, and specialty food outlets. These locations offer a broader range of fresh and high-quality produce[27]. Higher income individuals may prioritize health and well-being, viewing food as an investment in their overall health. They are more likely to adopt a "health-conscious" approach to their diet, emphasizing nutrient-dense foods such as fruits, vegetables, dairy, and lean meats[9]. Cultural norms and lifestyle choices can also impact food preferences. In some cultures, fruits, vegetables, dairy, and lean meats are considered essential components of a balanced diet and are associated with a higher socioeconomic status. Thus, higher-income individuals may be more inclined to maintain these dietary practices, contributing to their food choices[28]. In addition, social interactions and peer influences can play a role in food choices, as higher income individuals are more likely to interact with others who also prioritize healthier foods, reinforcing their dietary preferences[29]. They may also have more flexibility and resources to prepare meals at home, allowing them to incorporate a wider variety of fresh and nutritious ingredients, and more time to plan and cook meals, which can influence their food choices [30].

5. Conclusion

While the socioeconomic gradient influences dietary habits and access to healthy foods, individual dietary choices play a crucial role in obesity risk. Addressing this complex interplay will necessitate collaboration between policymakers, healthcare professionals, communities, and individuals to create an environment that supports healthier lifestyles. Nutrition education, outreach programs, and policy initiatives that promote healthier food environments can help bridge the gap and encourage healthier dietary patterns and reduces the prevalence of obesity among all income groups. Additionally, addressing broader socioeconomic factors such as income inequality and food insecurity can contribute to improving the overall dietary quality and health outcomes of lower-income individuals.

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