ORIGINAL ARTICLE

Micronutrient Intake and Diet Quality of Overweight/Obese Filipino Adults in the National Capital Region, Philippines

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ABSTRACT

Objectives. This study aims to describe the micronutrient intake and diet quality of overweight and obese Filipino adults in the National Capital Region (NCR). Specifically, it seeks to assess micronutrient inadequacy among these individuals and analyze differences in food intake based on their sociodemographic profiles and lifestyle habits.

Methods. This analytical cross-sectional study utilized data from the Expanded National Nutrition Survey (ENNS) conducted in 2018, 2019, and 2021 by the Department of Science and Technology-Food and Nutrition Research Institute (DOST-FNRI). A total of 3,154 overweight and obese subjects were included. ANOVA and Kruskal-Wallis tests were employed to analyze the food groups consumed by these adults.

Results. Majority of overweight and obese adults were found to be inadequate in vitamin A (81.7%), vitamin C (88.4%), thiamin (62.5%), riboflavin (70.7%), iron (69.8%), and calcium (88.7%). Significant differences were observed in the mean intake of various food groups across different age groups, sexes, civil statuses, wealth quintiles, educational attainments, employment statuses, and smoking and drinking statuses.

Conclusion. Filipino adults who are overweight and obese, and residing in urban settings face significant challenges related to micronutrient inadequacy. When their food intake was assessed based on sociodemographic and lifestyle characteristics, it was found that their diets were more calorie-dense than nutrient-dense. To address this issue, it is recommended to encourage a wider variety of nutrient-dense foods among overweight and obese adults.

Keywords: food intake, micronutrients, overweight/obesity, nutritional status

INTRODUCTION

Overweight and obesity are significant public health concerns worldwide, including in the Philippines.[1] The increasing prevalence of these conditions is associated with various non-communicable diseases (NCDs) such as Type II Diabetes Mellitus, cardiovascular diseases, and certain types of cancer.[1] In the National Capital Region (NCR) of the Philippines, urbanization and lifestyle changes have contributed to dietary patterns that are often high in calories but low in essential nutrients, escalating the problem of overweight and obesity.[2]

The Philippines faces a triple burden of malnutrition, which includes undernutrition, micronutrient deficiencies, and overnutrition.[2,3] While undernutrition and micronutrient deficiencies remain prevalent, particularly among children and pregnant women, overnutrition is rapidly increasing among

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adults, leading to higher rates of overweight and obesity among them.[1,4,5] This complex malnutrition scenario poses a unique challenge for public health initiatives, requiring a multifaceted approach to address the diverse nutritional needs of the population.

Understanding the food intake of overweight and obese individuals is crucial for developing effective nutritional interventions and policies. Previous studies have shown that dietary quality, which includes the variety, balance, and adequacy of nutrient intake, plays a significant role in managing and preventing obesity.[6-9] However, there is a limited amount of local research that comprehensively examines the nutrient intake and diet quality of overweight/obese Filipino adults in urban setting, especially when considering socio-demographic and lifestyle factors.

This study aims to fill this gap by describing the micronutrient intake and diet quality of overweight/obese Filipino adults in the NCR. It will explore how socio-demographic profiles and lifestyle habits including physical activity, smoking, and alcohol consumption can influence dietary patterns. By identifying these differences, the study seeks to provide insights that can help tailor nutritional guidelines and interventions to overweight and obese populations. Ultimately, these findings will contribute to better health outcomes and the reduction of obesity-related diseases in the Philippines, addressing the broader challenge of the triple burden of malnutrition.

METHODS

Research Design

This study employed a cross-sectional analytic study design and utilized data from the Expanded National Nutrition Survey (ENNS) conducted by the Department of Science and Technology-Food and Nutrition Research Institute (DOST-FNRI) in 2018, 2019, and 2021. The ENNS employed the 2013 Master Sample from the Philippine Statistics Authority (PSA), using a two-stage cluster sampling method.[10] In the first stage, primary sampling units consisting of small barangays were selected, followed by the selection of secondary sampling units, which included housing units.[10] All household members within the sampled units were included, covering all age groups. Replicated sampling was also employed, grouping provinces and highly urbanized cities (HUCs) with similar characteristics to produce national-level estimates for each year.[10]

Study Design Participants

Initially, 654,425 participants were deemed eligible; however, 651,271 were subsequently excluded. Exclusions composed of individuals who did not reside in NCR, those living in non-Highly Urbanized Cities (HUCs) within NCR, individuals aged <19 or >60 years, pregnant or lactating women, those lacking anthropometric, clinical, or dietary data, and non-overweight/obese adults. Following these exclusions, only 3,154 subjects remained included in the study. Figure 1 shows the process of selection of study participants.

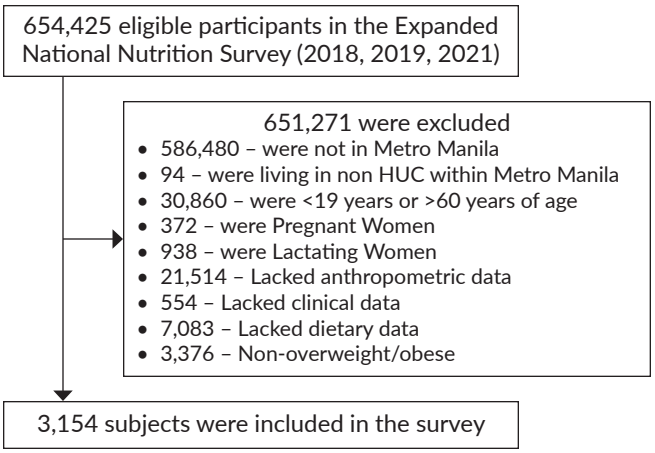

Figure 1. Flowchart for the Selection of Study Participants.

Data Collection and Processing

The data utilized in this research were obtained from the Public Use Files accessible on the e-nutrition website of the DOST-FNRI. The researcher selected the relevant dataset(s) necessary for the study from the available pool of data. Anthropometric, clinical, dietary, and socio-demographic (individual and household) datasets were collected. Specific methods of obtaining these datasets were enumerated below:

Anthropometric Data

To obtain the body mass index (BMI) of the adults, weight and height measurements were taken. Weight was measured using a digital scale with a capacity of 150-200 kilograms, and height was measured using a stadiometer. Trained nutritionists and allied health professionals followed standard protocols for these measurements. BMI was then calculated and categorized according to the 2010 WHO criteria. And only participants classified as overweight or obese were included in the study.

Clinical and Health Data

Physical activity, smoking, and alcohol consumption were assessed during face-to-face interviews. Physical activity was categorized as active or inactive. Individuals who did not meet the criteria, such as engaging in 5 or more vigorous to moderate intensity activities for at least 30 minutes a day, were considered physically inactive. Smoking status was categorized as lifetime abstainer, current smoker, or former smoker. Lifetime abstainers were individuals who had never smoked, current smokers were those who smoked at least one cigarette per day regularly, and former smokers were those who had smoked in the past but not within the year prior to the survey. Alcohol consumption was categorized as lifetime abstainer, current drinker, or former drinker. Lifetime abstainers had never consumed alcohol, current drinkers consumed alcohol

during the survey period, and former drinkers had consumed alcohol in the past but not within the previous 12 months prior to the survey.

Dietary Data

To obtain food intake data, dietary recalls were employed. The interviews used common household measurements such as cups and tablespoons. Subsequently, the data were used to compute calorie and nutrient values based on the Philippine Food Composition Table.

To assess micronutrient inadequacy, this study computed the Nutrient Adequacy Ratio (NAR) for each micronutrient. The NAR is determined by dividing the actual intake of a specific micronutrient by its Recommended Nutrient Intake (RNI) from the Philippine Dietary Reference Intake (PDRI), with a maximum value capped at one. A NAR below 0.70 indicates inadequacy for that particular nutrient.

In evaluating overall micronutrient inadequacy, the study utilized the Mean Adequacy Ratio (MAR) as an indicator. The MAR is calculated by summing the NAR values across all vitamins and minerals and dividing this total by the number of nutrients assessed. A MAR value below 0.50 signifies overall inadequacy in micronutrient intake.[11,12]

Socio-demographic Data

The socio-demographic data were collected through face-to-face interviews, gathering information on age, sex, civil status, educational level, and employment status. Additionally, a wealth index was derived using Principal Component Analysis based on socio-economic survey data, which included factors such as housing characteristics, access to basic services, ownership of durable goods, and other household assets.

Upon collecting and selecting a specific dataset and variables, the researcher was required to accept the FNRI disclaimer user agreement, which outlined the terms and conditions of access. This agreement stipulated the user's responsibility for utilizing the public files, emphasizing that the data should be used solely for the user's intended research purposes.

Statistical Analysis

All measured variables from the received PUF files were assessed, categorized, and aggregated using Microsoft Excel 2021. Descriptive statistics such as mean and proportion were employed to fulfill the study objectives. Proportions were utilized to characterize overweight and obese adults in terms of socio-demographic and lifestyle factors. Means were used to estimate the average intake of various food groups among the participants.

Sampling weights provided in the ENNS surveys for 2018, 2019, and 2021 were utilized in the study. These weights were computed based on the product of base weights, non-response adjustment, and post-stratified calibration adjustment. Base weights were initially assigned to each survey participant to account for the selection probability within the sampling design. Additionally, the data were adjusted to compensate for respondents who did not participate in the survey, increasing the weights of those who did participate to compensate for missing data. The final adjustment ensured that the survey sample reflected the actual population proportions based on characteristics such as age, sex, or region, sourced from the PSA.

For weight application, provincial sampling weights were employed in the study. It is important to note that national weights were only used within each survey year. Since the study used data from the ENNS surveys conducted in 2018, 2019, and 2021, it is appropriate to use provincial weights as they have already been calibrated to reflect the national population structure, and combining data across years might not significantly alter those proportions.

Additionally, a one-way Analysis of Variance (ANOVA) using STATA v15 was conducted to examine significant differences in mean food group intake based on socio-demographic and lifestyle factors. The Bonferroni test was used for post-hoc analysis. To address the violation of the homogeneity of variance assumption, the Kruskal-Wallis procedure was also performed.

Ethical Consideration

The University of Manila Research Ethics Board (UPMREB) was consulted to obtain ethics approval for this study. The study protocol, UPMREB 2024-0242-01, was approved on April 2, 2024.

RESULTS

Socio-demographic Profile and Lifestyle Characteristics of the Study Participants

It was observed that over half (51.6%) were in middle adulthood, with a majority (62.5%) being female. Additionally, a significant portion (75.6%) were either married, in a common-law relationship, or cohabiting. Moreover, the majority (65.0%) belonged to the richest wealth quintile, and almost half (48.1%) had achieved at least a high school education. Furthermore, the majority (88.6%) were engaged in employment or self-employment (Table 1).

In terms of lifestyle characteristics, a majority (67.5%) were lifetime abstainers from smoking, while more than half (54.8%) were current drinkers. Lastly, over half (51.0%) were physically active (Table 2).

Micronutrient Intake of Overweight/Obese Adults in the National Capital Region, Philippines

Among overweight and obese participants, the majority showed inadequacies in several essential nutrients, including vitamin A (81.7%), vitamin C (88.4%), thiamin (62.5%), riboflavin (70.7%), iron (69.8%), and calcium (88.7%). On the other hand, the majority were considered sufficient in niacin (84.3%). Overall, half (50.6%) were found to have inadequate micronutrient intake (Table 3).

Differences in the Food Intake of Overweight/Obese Adults in the National Capital Region According to Socio-demographic and Lifestyle Characteristics

Significant differences in consumption were noted across various food groups when participants were grouped according to different socio-demographic and lifestyle characteristics. In terms of age, significant differences were observed in food consumption patterns. Early adults showed a higher mean intake of starchy staples (p = 0.018), organ meat (p = 0.001), meat, poultry, and fish (p = 0.001), eggs (p = 0.003), and legumes, nuts, and seeds (p = 0.001). In contrast, middle-aged adults exhibited higher mean intake of dark green leafy and yellow vegetables (p = 0.001) and other fruits and vegetables (p = 0.009).

In addition to age, significant differences in food consumption were also observed by sex. Males demonstrated a higher mean intake of starchy staples (p = 0.001), dark green leafy and yellow vegetables (p = 0.018), organ meat (p = 0.001), and meat, poultry, and fish (p = 0.001). Conversely, females showed a higher mean intake of other vitamin C-rich fruits (p = 0.011) compared to males.

Examining civil status further, significant differences in food consumption were evident. Singles exhibited a higher mean intake of starchy staples (p = 0.001), organ meat (p = 0.011), meat, poultry, and fish (p = 0.003), and eggs (p = 0.001). Conversely, those who were married or in a relationship showed higher intake of dark green leafy and yellow vegetables (p = 0.001) and other vitamin C-rich fruits (p = 0.024). Participants who were widowed or had experienced the loss of a partner had a higher mean intake of other fruits and vegetables (p = 0.039).

Investigating further by wealth quintile revealed significant differences in food consumption patterns. The richest quintile showed consistently higher mean intake across all food groups, including dark green leafy and yellow vegetables (p = 0.001), other vitamin C-rich fruits (p = 0.001), other fruits and vegetables (p = 0.001), organ meat (p = 0.001), meat, poultry, and fish (p = 0.001), and milk and milk products (p = 0.001), except for eggs, where the rich quintile had higher mean consumption.

Educational attainment showed significant differences in the consumption of various food groups, including starchy staples (p = 0.001), vitamin C-rich fruits (p = 0.001), other

Table 1. Socio-demographic Characteristics of 20–59 Years Old Overweight and Obese Adults in National Capital Region, Philippines

Socio-demographic Characteristics	Total (n = 3,154), n (%)
Age group (years)	
20–39	1312 (48.4)
40–59	1842 (51.6)
Sex	
Male	1148 (37.5)
Female	2006 (62.5)
Civil Status	
Single	558 (17.9)
Married/ Common-Law/Live-in	2329 (75.6)
Widow/ Widower/ Separated/ Divorced/Annulled	267 (6.5)
Wealth Quintile	
Poor	567 (13.5)
Middle	383 (8.4)
Rich	641 (13.1)
Richest	1563 (65.0)
Educational Attainment	
At least Elementary Level	345 (10.3)
At least High School Level	1519 (48.1)
At least College Level	998 (32.9)
Others	292 (8.7)
Employment Status	
Unemployed	370 (11.4)
Employed	2784 (88.6)

Table 2. Lifestyle Characteristics of 20–59 Years Old Overweight and Obese Adults in National Capital Region, Philippines

Lifestyle Characteristics	Total (n = 3,154), n (%)
Smoking Status	
Lifetime Abstainer	2159 (67.5)
Current Smoker	265 (19.3)
Former Smoker	430 (13.2)
Drinking Status	
Lifetime Abstainer	794 (28.9)
Current Drinker	1714 (54.8)
Former Drinker	646 (16.3)
Physical Activity	
Physically Inactive	1416 (49.0)
Physically Active	1738 (51.0)

Table 3. Proportion of Mean Nutrient Adequacy Ratio (NAR and MAR) of 20–59 Years Old Overweight and Obese Adults in National Capital Region, Philippines

Micronutrients	Mean	Adequate	Inadequate
Vitamin A (mcg RE)	564.60	519 (18.3)	2635 (81.7)
Vitamin C (mg)	19.70	335 (11.6)	2819 (88.4)
Thiamin (mg)	0.78	1104 (37.5)	2050 (62.5)
Riboflavin (mg)	0.80	846 (29.3)	2308 (70.7)
Niacin (mg)	18.30	2636 (84.3)	518 (15.4)
Iron (mg)	8.80	885 (30.2)	2269 (69.8)
Calcium (mg)	312.70	310 (11.3)	2844 (88.7)
MAR	0.52	1466 (49.4)	1688 (50.6)

Note: A Nutrient Adequacy Ratio (NAR) cutoff point of <0.7 indicates inadequacy. Similarly, a Mean Adequacy Ratio (MAR) cutoff point of <0.5 also indicates inadequacy.

fruits and vegetables (p = 0.026), organ meat (p = 0.001), meat, poultry, and fish (p = 0.001), eggs (p = 0.010), legumes, nuts, and seeds (p = 0.012), and milk and milk products (p = 0.001). Specifically, participants with at least a high school education showed the highest mean intake of starchy staples, whereas those with at least a college education had the lowest intake in this category. Individuals with college-level education exhibited the highest mean intake of other vitamin C-rich fruits, other fruits and vegetables, organ meat, and milk and milk products. Conversely, participants in vocational training had the highest mean intake of meat, poultry, and fish, eggs, as well as legumes, nuts, and seeds.

Employment status also indicated significant differences in the consumption of other fruits and vegetables (p = 0.030), with those who were employed having higher mean intake.

When considering smoking status, significant differences were noted in food consumption patterns. Starchy staples (p = 0.001), other vitamin C-rich fruits (p = 0.001), other fruits and vegetables (p = 0.001), organ meat (p = 0.001), and meat, poultry, and fish (p = 0.001) showed significant variations. Current smokers had a higher mean intake of starchy staples and organ meat compared to former smokers. Conversely, former smokers showed higher mean intake of other vitamin C-rich fruits, other fruits and vegetables, and meat, poultry, and fish.

Meanwhile, significant differences were observed in food consumption patterns based on drinking status (p = 0.001). Current drinkers exhibited higher mean intake of starchy staples, organ meat, meat, poultry, and fish, as well as legumes, nuts, and seeds. In contrast, no significant differences were noted in terms of dietary intake when the study participants were grouped according to physical activity (Table 4).

DISCUSSION

Socio-demographic Profile and Lifestyle Characteristics of Overweight/Obese Adults in the National Capital Region, Philippines

The present study showed that among overweight and obese adults in NCR, half were middle-aged adults, more females, were either married, in a common-law relationship, or living with a partner, and belonged to the richest quintile. About half had at least a high school education, and the majority were currently employed. In terms of lifestyle characteristics, a significant portion were lifetime abstainers from smoking, about half were current drinkers, and there was an almost equal proportion of physically active and inactive participants. These characteristics were consistent with findings from both foreign and local studies, which state that socio-demographic and lifestyle factors are associated with overweight and obesity.[13-15] This interplay between socio-demographic characteristics and lifestyle factors among overweight and obese adults underscores the multifaceted nature of body weight and health outcome disparities.

Micronutrient Intake and Diet Quality of Overweight/Obese Adults in the National Capital Region, Philippines

In this present study, overweight and obese participants showed inadequacies in vitamins A, C, thiamin, riboflavin, iron, and calcium. Similarly, various studies, which included non-overweight participants, also reported inadequacies in these micronutrients.[2,16,17] More than half of the participants were found to be inadequate in vitamins A, C, iron, and calcium. Calcium was identified as the most inadequate micronutrient across all mentioned studies. Conversely, the inadequacy of thiamin and riboflavin varied depending on geographical location, suggesting that nutrient intake may differ between locations.[18] In contrast to these inadequacies, the majority of participants in those various studies mentioned had adequate intake of niacin. Niacin is found in a variety of foods such as grains, cereals, meat, and fish, which are also the most consumed foods.[19] Therefore, the chance of inadequacy is limited.

Highlighting inadequacy in calcium intake, DOST-FNRI reported that dairy products, which are rich in calcium, were the least-consumed food among adults.[17] Additionally, it has been suggested that the major contributor to calcium intake comes from rice, which is not considered a primary calcium-rich food source. Another factor to consider is the affordability of calcium-rich foods like milk products. As of 2000, the average price of milk was as low as 13.70 PhP per liter, and as of 2024, the price of milk averaged 59.09 PhP per liter.[20,21] The increase of price of milk by about 10%, led to a reduction in dairy consumption for about 7.2%.[22] Poor food choices and increased prices of dairy products could partly explain the inadequacy of calcium intake among adults.

The overall observation of inadequacies in micronutrients were the result of poor quality of food intake.[2] Following Agdeppa et al study, it was found that rice, fats and oils, and pork were the top three most consumed foods among adults and known to be energy-dense foods.[2] Conversely, the least consumed foods were deep yellow and dark green vegetables, which are rich in various micronutrients. This nutrient-poor food pattern, combined with high energy-dense foods, increases the risk of overweight and obesity, leading to chronic diseases such as cardiovascular diseases.[2,23]

Differences in the Food Intake of Overweight/Obese Adults in the National Capital Region According to Socio-demographic and Lifestyle Characteristics

Upon examining the food groups typically consumed by overweight/obese participants shows significant differences when categorized by sociodemographic and lifestyle characteristics. In terms of age, individuals in early adulthood consumed more starchy staples, organ meat, meat, poultry, fish, eggs, legumes, nuts, and seeds. In contrast, those in middle adulthood consumed darker green leafy and yellow vegetables, as well as other fruits and vegetables. This

Table 4. Food Intake of Overweight and Obese Adults 20–59 Years Old in the National Capital Region

Socio-demographic Characteristics	Starchy Staples (EP g)		Dark green leafy and yellow vegetables (EP g)		Other vitamin C rich fruits (EP g)		Other fruit and vegetables (EP g)	
	Mean (SE)	*p*-value	Mean (SE)	*p*-value	Mean (SE)	*p*-value	Mean (SE)	*p*-value
Age group (years)		0.018[b*]		0.001[b*]		0.027[b*]		0.009[b*]
20–39	628.3 (12.7)		64.1 (3.4)		26.9 (2.9)		58.4 (3.3)	
40–59	578.0 (10.0)		73.2 (3.5)		35.7 (3.3)		64.7 (3.3)	
Sex		0.001[b*]		0.018[a*]		0.011[b*]	62.4 (4.3)	0.526[a]
Male	728.2 (14.8)		74.1 (4.3)		28.9 (4.1)			
Female	526.8 (8.2)		65.6 (2.9)		32.9 (2.6)		61.2 (2.8)	
Civil Status		0.001[b*]		0.001[b*]		0.024[b*]		0.039[b*]
Single	629.1 (20.3)		55.4 (5.3)		25.4 (5.0)		55.6 (5.7)	
Married etc.[c]	604.1 (9.3)		71.9 (2.9)		32.8 (2.6)		62.7 (2.7)	
Widow etc.[d]	507 (20.6)		69.3 (8.1)		32 (6.8)		65.8 (8.8)	
Wealth Quintile		0.859[b]		0.001[b*]		0.001[b*]		0.001[b*]
Poor	594.2 (19.2)		48.1 (3.7)		26.5 (6.8)		40.1 (4)	
Middle	588.3 (18.4)		42.7 (3.7)		21.9 (5)		38.9 (4)	
Rich	588.9 (12.4)		56.5 (3.3)		22.7 (2.7)		51.3 (3.5)	
Richest	608.5 (11.2)		79 (3.5)		35.4 (3)		71.1 (3.4)	
Educational Level		0.001[a*]		0.932[a]		0.001[b*]		0.026[b*]
Elementary level	610.2 (31.3)		66.5 (5.2)		36.9 (11)		48.6 (8.4)	
High School level	618.3 (11.7)		70.6 (3.8)		23.9 (2.3)		58.4 (3.1)	
College level	577.2 (13.3)		66.4 (4.2)		42.1 (4.4)		70.4 (4.4)	
Others	599.6 (22.1)		70.7 (8.0)		26.5 (5.4)		62.1 (7.7)	
Employment Status		0.903[a]		0.194[a]		0.244[b]		0.030[b*]
Unemployed	609.8 (24.2)		58.8 (6.0)		24.6 (4.3)		55.5 (6.1)	
Employed	601.4 (8.6)		70.1 (2.6)		32.3 (2.4)		62.5 (2.5)	
Smoking Status		0.001[b*]		0.098[b]		0.001[b*]		0.001[b*]
Lifetime Abstainer	564.4 (8.7)		69.9 (3.0)		33.3 (2.6)		62.2 (2.7)	
Current Smoker	693.6 (22.1)		65.6 (5.1)		14.5 (2.6)		50 (4.5)	
Former Smoker	663.1 (23.8)		67.8 (7.0)		46.5 (9.5)		75.8 (9.1)	
Drinking Status		0.001[b*]		0.339[b]		0.062[b]		0.429[b]
Lifetime Abstainer	553.7 (15.1)		68.2 (5.0)		36.3 (4.7)		63.2 (5.0)	
Current Drinker	637.8 (11.4)		70.2 (3.2)		28.8 (2.8)		61 (3.0)	
Former Drinker	569.3 (14.7)		65.1 (5.2)		31.7 (5.1)		61.1 (5.1)	
Physical Activity		0.987[a]		0.406[a]		0.356[b]		0.333[a]
Physically Inactive	603.2 (11.8)		65.8 (3.4)		30.6 (2.9)		75.6 (3.7)	
Physically Active	601.5 (11.1)		71.7 (3.5)		32.2 (3.4)		72.2 (3.3)	

*Note: Values are expressed as mean (Standard error), [a] = ANOVA, [b] = Kruskal-Wallis Test, [c] = married, common-law, live-in, [d] = widow, widower, separated, divorced, annulled * = Statistically significant result,*

consumption pattern aligns with the findings of Nour et al., which indicates that early adults have a lower vegetable intake compared to middle-aged adults.[24] Aging appears to increase awareness of good dietary practices.[25]

In terms of sex, males consumed more starchy staples, dark green leafy and yellow vegetables, organ meat, meat, poultry, and fish, while females consumed more vitamin C-rich fruits. This dietary pattern is consistent with findings from Brauchla et al., which show that men consume more meat products and women consume more fruits.[26] This pattern is attributed to the perception that fruits are less filling compared to meat products.[27]

The study revealed a relationship between civil status and dietary choices. Singles tended to consume more starchy staples, organ meats, various meats, and animal proteins (poultry, fish, and eggs).[28] This pattern may be due to the convenience and satiety these foods provide, fitting a lifestyle that may involve less structured meal planning and preparation.[29] In contrast, individuals who were married or partnered consumed more dark green leafy and yellow vegetables, likely reflecting shared meals and a greater focus on balanced nutrition within family settings. Widowed or separated individuals prioritized fruits rich in vitamin C, along with other fruits and vegetables, which could be attributed to increased health awareness and the need for nutrient-dense foods that support overall well-being in the absence of a partner.[30]

In terms of wealth status, the consumption of almost all food groups was higher among individuals in the richest wealth quintile, with the notable exception of starchy staples. Since rice is a staple food in the Philippines, there were no significant disparities in rice consumption across different wealth quintiles. This uniformity reflects the cultural and dietary importance of rice, making it a common component of meals regardless of socioeconomic status.[31] However,

Organ meat (EP g)		Meat, poultry, and fish		Eggs		Legumes, nuts, and seeds		Milk and milk products	
Mean (SE)	*p*-value	Mean (SE)	*p*-value	Mean (SE)	*p*-value	Mean (SE)	*p*-value	Mean (SE)	*p*-value
	0.001[b*]		0.001[b*]		0.003[b*]		0.001[b*]		0.860[b]
88.8 (4.1)		256.3 (7.8)		18.7 (1.2)		11.6 (1.6)		15.3 (2.5)	
59.8 (2.7)		215.2 (5.5)		15 (1.0)		7.9 (1.2)		15.4 (2.1)	
	0.001[b*]		0.001[b*]		0.060[b]		0.274[b]		0.536[b]
96.4 (5.0)		298.9 (8.9)		19.5 (1.5)		11.7 (2.0)		18.3 (3.4)	
60.3 (2.4)		196.8 (5.0)		15.2 (0.9)		8.5 (1.1)		13.6 (1.6)	
	0.001[b*]		0.003[b*]		0.001[b*]		0.816[b]		0.734[b]
89.9 (5.9)		274.3 (13.8)		24.3 (2.2)		12.5 (2.7)		16 (3.7)	
70.9 (2.8)		227.5 (5.2)		15.7 (0.9)		9.2 (1.2)		15.8 (1.9)	
64.6 (8.9)		215.5 (14.2)		8.3 (1.3)		7.4 (1.6)		8.5 (2.0)	
	0.001[b*]		0.001[b*]		0.069[b]		0.100[b]		0.001[b*]
60.1 (5.5)		202.8 (7.9)		16.9 (1.8)		5.4 (0.8)		11.9 (2.4)	
65.8 (5.8)		216.4 (10.4)		16.8 (1.8)		9.3 (1.9)		12.5 (7.3)	
66 (4.4)		214.7 (8.1)		17.2 (1.5)		8.6 (1.4)		12.1 (3.5)	
79.3 (3.4)		248.3 (6.8)		16.7 (1.1)		10.9 (1.5)		17.1 (2.1)	
	0.001[b*]		0.001[b*]		0.010[b*]		0.012[b*]		0.001[b*]
58.1 (6.0)		218.8 (18.3)		15.3 (2.4)		7.4 (2.1)		8.9 (2.7)	
68.4 (3.3)		222.5 (6.4)		15 (1.1)		9.7 (1.8)		10.0 (1.7)	
85.4 (4.7)		251.1 (8.8)		18.3 (1.3)		10.1 (1.3)		26.3 (3.9)	
79 (9.6)		263.2 (14.5)		22.7 (3.4)		11.1 (2.4)		11.2 (5.0)	
	0.126[b]		0.804[a]		0.186[a]		0.149[b]		0.355[b]
80.1 (6.6)		229.6 (12.2)		17.1 (2.0)		12.8 (3.9)		15.8 (4.9)	
73 (2.7)		235.8 (5.2)		16.7 (0.8)		9.3 (1.0)		15.3 (1.7)	
	0.001[b*]		0.001[b*]		0.286[b]		0.519[b]		0.067[b]
65.6 (2.7)		215.8 (5.1)		15.1 (0.9)		8.4 (1.0)		16.5 (1.9)	
91.2 (7.1)		274.3 (13.7)		18.9 (2.1)		11.1 (2.3)		6.6 (1.4)	
90.5 (7.0)		276.6 (13.7)		22.3 (2.6)		14.2 (4.5)		21.9 (6.7)	
	0.001[b*]		0.001[b*]		0.109[b]		0.005[b*]		0.191[b]
62.5 (4.2)		209.2 (7.6)		15.6 (1.4)		9.1 (2.1)		15.8 (3.0)	
84 (3.7)		255.7 (7.1)		18.1 (1.2)		10.1 (1.4)		14.7 (2.2)	
59.9 (4.3)		211.6 (9.3)		14.4 (1.3)		9.1 (1.6)		16.7 (3.9)	
	0.451[a]		0.178[a]		0.926[b]		0.912[b]		0.612[a]
239.1 (6.6)		15.7 (1.1)		11.2 (1.8)		11.2 (1.8)		15.8 (2.1)	
231.2 (6.9)		17.8 (1.1)		8.3 (1.0)		8.3 (1.0)		14.9 (2.4)	

disparities were evident in the consumption of other food groups. Wealthier individuals had greater access to and consumption of a variety of nutrient-rich foods, including fruits, vegetables, meat, poultry, fish, and dairy products. This difference can be attributed to the higher purchasing power and better access to diverse food options among the wealthy. Conversely, those in lower wealth quintiles may have limited access to these foods.[32]

Regarding educational attainment, those with at least a high school education level consumed more starchy staples. In contrast, individuals with at least a college education consumed more vitamin C-rich fruits, other fruits and vegetables, organ meat, meat, poultry, fish, and milk and milk products. This pattern suggests that higher educational attainment is associated with a more diverse and nutrient-rich diet. The increased consumption of starchy staples among those with a high school education could be attributed to economic constraints that make starchy staples a more accessible and affordable dietary option.[31] On the other hand, individuals with a college education are likely to have greater nutritional awareness and financial resources, enabling them to make healthier food choices and afford a wider variety of nutrient-dense foods.[33]

Regarding employment status, the study found that only the consumption of other fruits and vegetables showed significant differences. Employed or self-employed individuals consumed more of these food groups compared to their unemployed counterparts. Employed individuals generally have higher disposable incomes, allowing them to purchase a wider variety of fruits and vegetables. Employment can influence dietary habits through structured meal times and routines that may encourage healthier eating patterns.[34]

In terms of smoking status, the study revealed distinct dietary patterns among current smokers, former smokers, and

non-smokers. Current smokers were found to consume more starchy staples and organ meat. This trend could be influenced by the tendency of smokers to prefer foods that are high in energy and protein, possibly as a compensatory behavior for the appetite-suppressing effects of nicotine.[35]

On the other hand, former smokers showed different dietary patterns. They consumed more vitamin C-rich fruits, other fruits and vegetables, meat, poultry, fish, eggs, legumes, nuts and seeds, and milk and milk products. This shift towards a more varied and nutrient-dense diet among former smokers could be a result of increased health awareness and efforts to improve overall health following smoking cessation.[36] Quitting smoking often coincides with a broader adoption of healthier lifestyle practices, including better dietary choices aimed at mitigating the long-term health risks associated with smoking.[36]

Lastly, in terms of alcohol consumption status, the study found significant differences in dietary patterns between current alcohol drinkers and former drinkers. Current alcohol drinkers were observed to consume more starchy staples, organ meat, meat, poultry, fish, eggs, legumes, nuts, and seeds. Alcohol can stimulate appetite and lead to increased consumption of energy-dense foods.[37] These dietary choices might also be linked to the tendency of drinkers to consume foods that can mitigate the effects of alcohol or complement their drinking habits. On the other hand, former drinkers showed a different dietary profile, consuming more milk and milk products. This shift could reflect a deliberate effort to adopt healthier dietary habits after quitting alcohol, aiming to improve overall nutritional intake and support bodily recovery.[38]

Limitation of the Study

This study explored the nutrient intake and diet quality of overweight/obese Filipino adults residing in NCR. It relied on secondary data analysis, a cost-effective approach but with inherent limitations. Because this study used secondary data, there are many factors not included that may potentially affect food intake, such as cultural beliefs and practices, health status, and knowledge about diet. The researchers had minimal control over data collection methods, which could introduce inconsistencies or inaccuracies. Additionally, recall bias may occur, as participants might not accurately remember or report their food intake, leading to over- or underestimation of consumption.

The cross-sectional nature of the research design limits the ability to establish causal relationships between nutrient intake, diet quality, and overweight/obesity. It could only assess associations at a single point in time. Unmeasured factors, such as genetics and medical conditions, could also have influenced the results. Furthermore, temporal factors like seasonal variations in diet or evolving obesity rates weren't considered. Developments since the data collection in 2021, such as the COVID-19 pandemic, might further limit the generalizability of the findings.

Despite these limitations, the study offers valuable insights into the dietary patterns of overweight/obese adults in an urban setting. These findings can inform future research and relevant stakeholders.

CONCLUSION AND RECOMMENDATION

Majority of overweight and obese participants were female, married or partnered, belonging to the wealthiest quintile, employed, lifetime abstainers from smoking, and current drinkers. In addition, apart from being overweight or obese, micronutrient inadequacies, particularly in vitamin A, C, thiamin, riboflavin, iron, and calcium, were observed among them. In connection, males tended to consume more starchy staples and animal proteins, while females consumed vitamin C-rich fruits. Singles consumed more starchy staples and meats, whereas married individuals consumed more dark green and yellow vegetables. Wealthier quintiles showed higher consumption across food groups. Education level influences food consumption, with higher education linked to increased consumption of fruits and meats. Employment status had minimal impact on diet, except for increased fruit and vegetable intake among the employed. Current smokers consumed more starchy staples, while former smokers consumed fruits and proteins. Alcohol drinkers showed similar dietary patterns, with current drinkers consuming more staples and proteins, and former drinkers opting for dairy products.

Hence, it is essential to encourage a wider variety of nutrient-rich foods among individuals with adequate overall calorie intake but lacking with micronutrient intake. Healthcare professionals such as doctors, nurses, and nutritionist-dietitians can play a vital role in this process by providing personalized dietary counseling that promotes the inclusion of micronutrient-rich food choices. Community and support groups can also contribute by developing culturally appropriate meal plans that address the specific needs of overweight/obese individuals and by organizing workshops and recipe sharing sessions to promote healthy eating habits.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

The authors have stated that no conflicts of interest are known, and the institution has no financial involvement or ownership in the study's findings.

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