

# Nutritional Status among Filipino Elderly: Prevalence and Correlates

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## ABSTRACT

**Objective:** The dual burden of undernutrition and overnutrition has received attention around the world, especially in the Philippines, where malnutrition is an issue that the country is continuously facing. Malnutrition have been prevalent and alarming concerns among the Filipino elderly through the years. Several studies support the claim that the prevalence of malnutrition is associated with factors, such as socioeconomic status, biochemical, clinical, dietary intake, and food security. This study aimed to determine the factors associated with the nutritional status of the Filipino elderly.

**Materials and Methods:** The study utilized the 2013 National Nutrition Survey. Data of the 1,807 sampled Filipino elderly who had no physical defects were considered. The Rao-Scott test and a multiple correspondence analysis were conducted to assess the association of the nutritional status of the Filipino elderly with the socio-demographics, health/clinical conditions, and nutrient intake factors.

**Results:** Majority (54.97%) of the Filipino elderly had a normal nutritional status. However, both the prevalence of underweight and overweight are still alarming with a 20.19% and 24.83% rate, respectively. The socio-demographic characteristics found that are associated with the nutritional status of the Filipino elderly include age, sex, occupation, and education. Health conditions and behavioral risk factors such as smoking and drinking alcohol beverages were also found to have significant association with the elderly's nutritional status. Lastly, a significant association between the nutritional status and the intake of nutrients such as iron, Vitamin A, niacin, and thiamine was observed.

**Conclusion:** With both underweight and overweight/obesity still rampant among the Filipino elderly, their lifestyle and food intake should be given much attention. Further studies about the nutritional status of the Filipino elderly should be conducted to have a sufficient basis on how society can help the elderly maintain and improve their nutritional conditions.

**Keywords:** Correspondence analysis, elderly, nutritional status, Rao-Scott

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## INTRODUCTION

Malnutrition signifies a deficiency, excess, or imbalance in the energy and nutrient intake of an individual [1]. It includes both undernutrition and overnutrition, where the former is due to inadequate food intake, dietary imbalance, and

nutrient deficiencies, while the latter is due to excess food consumption [2]. Undernutrition includes being underweight for age, stunted, wasted, and micronutrient deficient, while overweight and obesity are results of overnutrition [3]. Both

underweight and overweight are related to the increased risk of excess mortality, poor cognition, chronic diseases, and poor health-related quality of life [4]. The dual burden of undernutrition and overnutrition has received attention around the world, especially in the Philippines, where malnutrition is an issue that the country is continuously facing.

Growth in the number and proportion of the elderly in the population is experienced by every country worldwide [5]. Countries around the world will face a rapid increase in the over-65 and especially the over-80 populations [6]. It was also found that the Philippines is moving towards the aging [7]. However, a majority of the study incorporating older Filipinos emphasized their perceptions of aging, quality of life, and workforce involvement [8]. In a study conducted by Jenkins et al., results showed that 29.9% of the Filipino elderly experienced undernutrition, while 12.2% experienced overnutrition. These results imply that both undernutrition and overnutrition are prevalent among the elderly age group, which prompts the need for attention equal to what malnutrition among children is getting [9].

Donini et al. stated that malnutrition among the elderly (both under and overnutrition) may trigger a vicious cycle where malnutrition and its determinants worsen both the nutritional status and its causes. For instance, obesity can cause a decline in physical activity, which, in return, leads to a further increase in obesity. Moreover, undernutrition causes respiratory illness, which also leads to the worsening the malnutrition. Thus, malnutrition worsens health conditions and the nutritional status itself if the factors associated with undernutrition and overnutrition are not addressed [10].

The elderly are the usual major users of health care services; therefore, they contribute to the problem of limited health care resources in the Philippines. Malnutrition among the older adult (>60) age group is related to various negative consequences, such as higher prevalence of infections, hospitalization, and increased morbidity and mortality [11]. Hence, a high prevalence of undernutrition and overnutrition will demand an increase in healthcare services and spending, which at the aggregate level, may affect the country's economy due to higher mortality rates among the elderly and increased budget in health.

Several studies support the claim that the prevalence of malnutrition is associated with different factors such as socioeconomic status, biochemical, clinical, dietary intake, and food security [9-10, 12-17]. However, these factors vary across countries due to several reasons, including the state of a country's economy, culture, and lifestyle among others.

Aging is accompanied by numerous physiological changes, and in effect, it negatively impacts the nutritional status of an individual and their daily activities, dietary intake, health, and food access. Hence, there is a need to determine the factors affecting the nutritional status of elderly people. Determining these factors could help the national and local government in identifying programs and nutritional policies that can be implemented to lessen the prevalence of malnutrition among elderly people in the country. With the aim of assessing the nutritional status of the Filipino elderly aged 60 and above, this study intended to describe the socio-demographic profiles, health conditions, and nutrient intake status of the Filipino elderly. This study determined the factors associated with the nutritional status of the elderly and identified determinants of the nutritional status of the elderly using multinomial logistic regression.

## **MATERIALS and METHOD**

### **Data Source**

This study used the data from the 8th National Nutrition Survey (NNS) in 2013 conducted by the Food and Nutrition Research Institute – Department of Science and Technology (FNRI-DOST). The survey adopted the 2003 Master Sample designed by the Philippine Statistics Authority [18]. A stratified three-stage sampling design was utilized where the first stage involved the selection of Primary Sampling Units (PSUs), consisting of one barangay or a combination of contiguous barangays with at least 500 households each. Enumeration areas (EAs) with 150 to 200 households were then identified from these PSUs. The third and final stage was the random selection of the households, which was the ultimate sampling unit [19]. In addition, four replicates of the Master Sample were employed in obtaining the national, regional, and provincial estimates for measurements of anthropometry, blood pressure, and schedule-based interview

information for all of the components. Meanwhile, only one replicate was used to generate the biochemical and dietary components' national and regional estimates [20].

The 8th NNS has several components, namely anthropometry, biochemical, clinical and health, dietary, socioeconomic, food security, government program participation, maternal health and nutrition, infant and young child feeding, and household awareness and usage of iodized salt, nutrition label, and nutritional facts. The anthropometry component's purpose was used to assess the nutritional status of the Filipino population in all ages. Meanwhile, the biochemical component provided information on biochemical indicators used to detect iron deficiency anemia (IDA), thalassemia, iodine deficiency disorder (IDD), vitamin A deficiency (VAD), and zinc, folate, and vitamin B6 deficiencies. On the other hand, deficiencies of nutrients such as vitamin A, iron, and iodine and epidemiology of lifestyle-related diseases such as obesity, hypertension, diabetes, and dyslipidemia were found in the clinical and health component. Moreover, the data provided on the dietary component were used to measure food and nutrient intakes at the household and individual levels. Moreover, demographic information was collected from the socioeconomic component. The food security component was used to assess food security of Filipino households in terms of food access, dietary diversity, and food frequency. Another component is the government program participation, which was used to assess the participation of households and members of selected government nutrition and related programs. Furthermore, the maternal health and nutrition component provided data on the maternal and child health practices such as prenatal care, nutrition counseling, pregnancy complications, micronutrient supplementation, and postnatal care. Additionally, updates in the information on the feeding practices of Filipino children were included in the infant and young child feeding component. Finally, the household awareness and usage of iodized salt, nutrition label, and nutrition facts component delivered information on the awareness, frequency, usage, and source of iodized salt of households and their utilization of product labels and nutrition facts [20].

Prior to data collection, an informed consent form was given to the sampled respondents. The said form

contained a detailed explanation of the purpose of the survey, the manner of data collection, involved risks in the data collection, benefits of participation, data confidentiality assurance, choice to withdraw without consequences, and respondent's written consent [21].

The data gathered for the different components of the survey were taken from all the members of the randomly selected households who affirmed their voluntary involvement in the survey. However, for the anthropometric component, there were cases during the collection of data where some respondents refused to be measured or had body defects (e.g. polio, hunchback), which resulted to an incomplete record [21].

In this study, the data of 1,807 sampled Filipino elderlies without physical defects and have a complete measurement for the anthropometry, clinical and health, dietary, and socioeconomic components were considered. The body mass index was calculated as the anthropometric indicator for the nutritional status of the Filipino elderly [21]. The explanatory variables include socio-demographic factors, health conditions, behavioral risk factors, and nutrient intake.

### Data Analyses

The weighted and unweighted frequency and percentage distributions of the Filipino elderly, based on some factors, were generated in the study. However, only the weighted distribution was discussed in the paper as this gives unbiased estimates. Unweighted distribution was just computed for additional information in describing the distribution of the sampled elderly.

To determine whether the nutritional status of the Filipino elderly is significantly associated with variables such as socioeconomic status, dietary intake, behavioral risk factors, and health conditions, the Rao-Scott test statistic was used. The aforementioned test was considered to take the complexity of the survey design into account. The degree of association between the nutritional status of the Filipino elderly and each of the considered variables was assessed using the Cramer's V coefficient. This coefficient ranges from 0 to 1, which indicates a very weak association if the computed V is less than 0.10, weak association if V is within 0.10 and 0.19, moderate association if V is within 0.20 and 0.29, and strong association if V is greater than 0.30 [22].

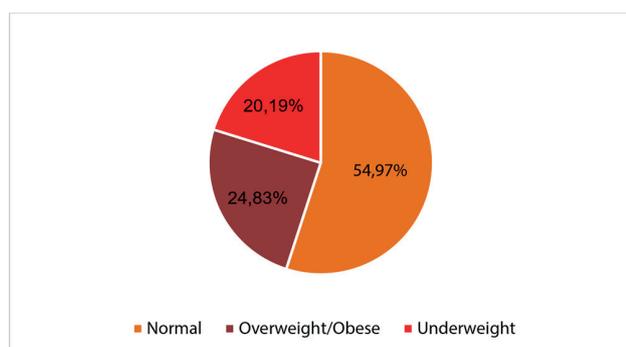
Multiple correspondence analysis was further employed to assess the degree of association between the nutritional status of the Filipino elderly and the significantly associated variables. Correspondence analysis is a statistical technique used to determine the similarity of row categories, the similarity between the column categories, and the association between the row and column variables. Row and column coordinates and the origin of the plot are the basis of this technique. All analyses were done using STATA.

## RESULTS

### Nutritional Status

Based on the 2013 NNS, as shown in Figure 1, underweight and overweight/obesity among the Filipino elderly are still prevalent despite more than half (54.97%) of them having a normal nutritional status. Particularly, 20.19% of the Filipino elderly were underweight, while 24.83% of them were obese/overweight.

Looking into details, it can be observed that the prevalence of underweight and overweight/obese elderly aged 60 to 70 years were 13.6% and 30.0%, respectively. On the other hand, for the age group 70 and above, 23.5% were underweight, and 20.2% were overweight/obese. Majority of the elderly aged 60 to 69 years and 70 years and above had normal nutritional status, with a prevalence rate of 56.4% and 56.3%, respectively (Figure 2). The estimated prevalence of underweight and overweight/obesity among Filipino elderly for the years 2008, 2011, and 2013 are shown in Figures 3 and 4, respectively. The highest prevalence of underweight Filipino elderly was observed during 2008 and was noticeably decreasing through

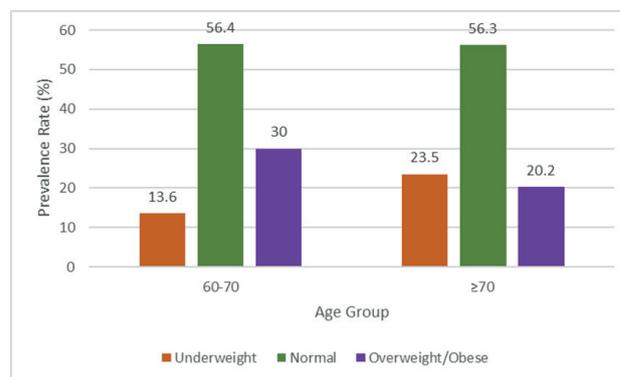


**Figure 1.** Nutritional status of Filipino elderly based on 2013 NNS

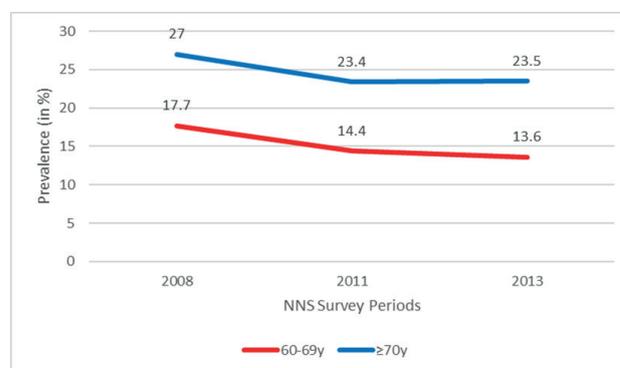
the years. In contrast, the highest prevalence of overweight/obese elderly was observed in 2013. It was also found that the prevalence of overweight/obesity increased through the years.

### Socio-demographic Profile

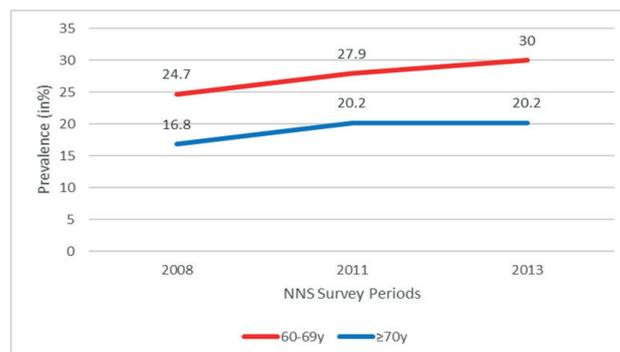
The majority of the Filipino elderly respondents were aged 60 to 70 years, comprising 61.08% of the estimated population of the Filipino elderly. There were very few respondents aged 80 years old and above, covering only 8.25% of the elderly population. Female outnumbered male elderly with



**Figure 2.** Prevalence of underweight, overweight/obesity, and normal nutritional status among elderly for 60 to 69 years and 70 year and above age group



**Figure 3.** Prevalence of underweight Filipino elderly in 2008, 2011, 2013 based on NNS



**Figure 4.** Prevalence of overweight/obese Filipino elderly in 2008, 2011, and 2013 based on NNS

a percentage points difference of 9.68. More than half (56.93%) of the elderly were married, around 32.42% were already a widow or widower, and 2.17% of them were separated. The largest portion (41.02%) of the elderly were reported to be elementary graduates. This is followed by elders with no grade completed, which was posted at 33.31%. It was also estimated that about 10 out of 100 of the elders were able to earn a college degree. As for their economic status, a large portion of the elderly were still active in the labor force. About 41.06% of them had jobs or businesses. As expected, a number of the respondents were no longer economically active, where 27.03% of the elders had no occupation. (Table 1).

**Clinical/Health Condition**

The different health conditions such as anemia, hypertension, dyslipidemia, and diabetes and the behavioral risk factors such as smoking and alcohol status were considered. Among the Filipino elderly, 19.55%, 6.72%, and 14.90% had anemia, dyslipidemia and anemia, respectively.

Alternatively, almost 44% of the elderly were estimated to have hypertension – relatively higher than other health conditions considered in the study. It can also be noted that 21.82% of the elderly still smoked during the conduct of the survey, while around 23% already stopped smoking. In addition, a considerably large portion of the elderly were alcohol drinkers, with the 33.95% recorded drinking on a regular basis and 18.05% drinking occasionally (Table 2).

**Nutrient Intake**

To describe the elderly’s intake, some statistics were presented in Table 3. The mean ± standard deviation daily intake of iron, vitamin A, vitamin C, energy, protein, riboflavin, niacin, and thiamine of the Filipino elderly were 7.13 ± 3.57 mg, 305.40 ± 533.47 mgRE, 33.01 ± 39.77 mg, 1361.20 ± 548.41 kcal, 45.43 ± 20.66 mg, 0.59 ± 0.39 mg, 15.12 ± 7.23 mgNE, and 0.69 ± 2.20 mg, respectively. Higher variability relative to the mean can be noticed in the intake of the elderly, especially for thiamine, vitamin A, and vitamin C, as revealed by their coefficients

**Table 1.** Weighted and unweighted distribution of Filipino elderly by the socio-demographic characteristics

Factors	Weighted			Unweighted		
	Frequency	%	Standard Error	Frequency	%	Standard Error
<b>Age Group</b>						
60-70	441,623	61.08	0.0006	1070	59.21	0.0116
70-80	221,721	30.67	0.0005	590	32.65	0.0117
>80	59,629	8.25	0.0003	147	8.14	0.0064
<b>Sex</b>						
Male	326,510	45.16	0.0006	806	44.60	0.0117
Female	396,463	54.84	0.0006	1001	55.40	0.0117
<b>Civil Status</b>						
Single	34,760	4.81	0.0003	79	4.37	0.0048
Married	441,572	56.93	0.0005	1047	57.94	0.0116
Live-in	26,539	3.67	0.0002	57	3.15	0.0041
Widow/Widower	234,402	32.42	0.0006	590	32.65	0.011
Separated	15,700	2.17	0.0002	34	1.88	0.0032
<b>Highest Educational Attainment</b>						
No Grade Completed	240,801	33.31	0.0006	650	35.97	0.0113
Elementary	296,578	41.02	0.0006	735	60.68	0.0116
High School	110,957	15.35	0.0004	255	14.11	0.0082
At least college graduate	74,637	10.32	0.0004	167	9.24	0.0068
<b>Occupation</b>						
No Occupation	195,392	27.03	0.0005	471	26.07	0.0103
House Keeper	138,873	19.21	0.0005	359	19.87	0.0094
Pensioner	91,849	12.70	0.0004	205	11.34	0.0074
With job or business	296,859	41.06	0.0006	772	42.72	0.0116

**Table 2.** Weighted and unweighted distribution of Filipino elderly by risk factors and health condition

Factors	Weighted			Unweighted		
	Frequency	%	Standard Error	Frequency	%	Standard Error
<b>Anemia</b>						
With Anemia	141,350	19.55	0.0005	364	20.14	0.0094
Without	581,623	80.45	0.0005	1443	79.85	0.0094
<b>Hypertension</b>						
With Hypertension	316,322	43.75	0.0006	797	44.11	0.0117
Without Hypertension	406,651	56.25	0.0006	1010	55.89	0.0117
<b>Dyslipidemia</b>						
With Dyslipidemia	48,558	6.72	0.0003	119	6.56	0.0056
Without Dyslipidemia	674,415	93.28	0.0003	1688	93.41	0.0056
<b>Diabetes</b>						
With Diabetes	107,720	14.90	0.0004	259	14.33	0.0082
Without Diabetes	615,253	85.10	0.0004	1548	85.67	0.0082
<b>Smoking Status</b>						
Never	382,055	55.45	0.0006	978	55.15	0.0120
Current	150,355	21.82	0.0005	413	22.34	0.0100
Former	156,592	22.73	0.0005	416	22.51	0.0101
<b>Alcohol Status</b>						
No	330,700	48.00	0.0006	867	48.69	0.0121
Yes	233,914	33.95	0.0005	605	33.51	0.0114
Occasional	124,388	18.05	0.0005	335	17.80	0.0092

of variation of 318.84, 174.68, and 120.48 percent, respectively. With high variability among these vitamins and nutrient intake, the median could be more useful to describe the central tendency of the data. It can be said that at least half of the Filipino elderly had at most 6.55 mg, 185.73 mgRE, 22.77 mg, 1308.42 kcal, 42.86 mg, 0.49 mg, 14.29 mgNE, and 0.56 mg daily intake of iron, vitamin A, vitamin C, energy, protein, riboflavin, niacin, and thiamine, respectively. Lower average intake among the elderly in these nutrients can be observed based on the median compared to the average intake based on the mean.

To better assess the vitamins and nutrient intake of the Filipino elderly, the adequacy of their intake was determined based on the cut-off points provided by FNRI-DOST [23]. It was found that the majority of the Filipino elderly had adequate nutrient and vitamin intake except niacin, in which a great portion (53.60%) of the elderly had an inadequate intake (Table 4).

### Correlation and Degree of Association

Among the factors considered in the study, age, sex, occupation, and highest educational attainment of the elderly were found to be significantly

**Table 3.** Summary statistics of the data on the daily nutrient intake among Filipino elderly

Nutrient	Mean	Median	Standard Deviation	Coefficient of variation (%)
Iron(mg)	7.13	6.55	3.57	50.07
Vitamin A (mgRE)	305.40	185.73	533.47	174.68
Vitamin C (mg)	33.01	22.77	39.77	120.48
Energy (kcal)	1361.20	1308.42	548.41	40.29
Protein (mg)	45.43	42.86	20.66	45.48
Riboflavin (mg)	0.59	0.49	0.39	66.10
Niacin (mgNE)	15.12	14.29	7.23	47.82
Thiamine (mg)	0.69	0.56	2.20	318.84

**Table 4.** Weighted and unweighted distribution of Filipino elderly by nutrient intake status

Nutrient Status	Weighted			Unweighted		
	Frequency	%	Standard Error	Frequency	%	Standard Error
<b>Iron</b>						
Inadequate	99,034	13.70	0.0004	218	12.06	0.0077
Adequate	623,939	86.30	0.0004	1589	87.94	0.0077
<b>Vitamin A</b>						
Inadequate	16,627	2.30	0.0002	45	2.49	0.0037
Adequate	396,053	54.78	0.0005	994	55.01	0.0117
Overadequate	310,293	42.92	0.0006	768	42.50	0.0116
<b>Vitamin C</b>						
Inadequate	99,735	13.80	0.0004	260	14.39	0.0083
Adequate	623,238	86.20	0.0004	1547	85.62	0.0083
<b>Energy</b>						
Inadequate	131,420	18.18	0.0005	315	17.43	0.0089
Adequate	591,553	81.82	0.0005	1492	82.57	0.0089
<b>Protein</b>						
Inadequate	102,599	14.19	0.0004	224	12.40	0.0078
Adequate	620,374	85.81	0.0004	1583	87.60	0.0078
<b>Riboflavin</b>						
Inadequate	47,347	6.55	0.0003	94	5.20	0.0052
Adequate	675,626	93.45	0.0003	1713	94.80	0.0052
<b>Niacin</b>						
Inadequate	387,761	53.63	0.0006	997	55.17	0.0117
Adequate	321,155	44.42	0.0006	776	42.94	0.0116
Overadequate	14,057	1.94	0.0002	34	1.88	0.0032
<b>Thiamine</b>						
Inadequate	60,538	8.37	0.0003	137	7.58	0.0062
Adequate	662,435	91.63	0.0003	1670	92.42	0.0062

associated with nutritional status ( $p=0.005$ ,  $p=0.0074$ ,  $p<0.0001$ ,  $p<0.0001$ , respectively) (Table 5). Of these socio-demographic variables, occupation and age group showed a moderate association, while sex and highest educational attainment showed weak and strong association, respectively. Meanwhile, anemia, hypertension, diabetes, and dyslipidemia showed significant association with nutritional status ( $p<0.0001$  for all variables). All the health conditions showed a moderate association with the nutritional status of the Filipino elderly. On the other hand, behavioral risk factors such as smoking and alcohol consumption showed weak association ( $p<0.0001$ ,  $p=0.02$ , respectively). In addition, for dietary intake, only vitamin A, iron, thiamine, and niacin showed significant association with nutritional status ( $p<0.0001$ ,  $p=0.0037$ ,  $p=0.0312$ ,  $p<0.0001$ , respectively). Particularly, vitamin A and niacin exhibited moderate association, while

weak association was found for iron and thiamine (Table 5).

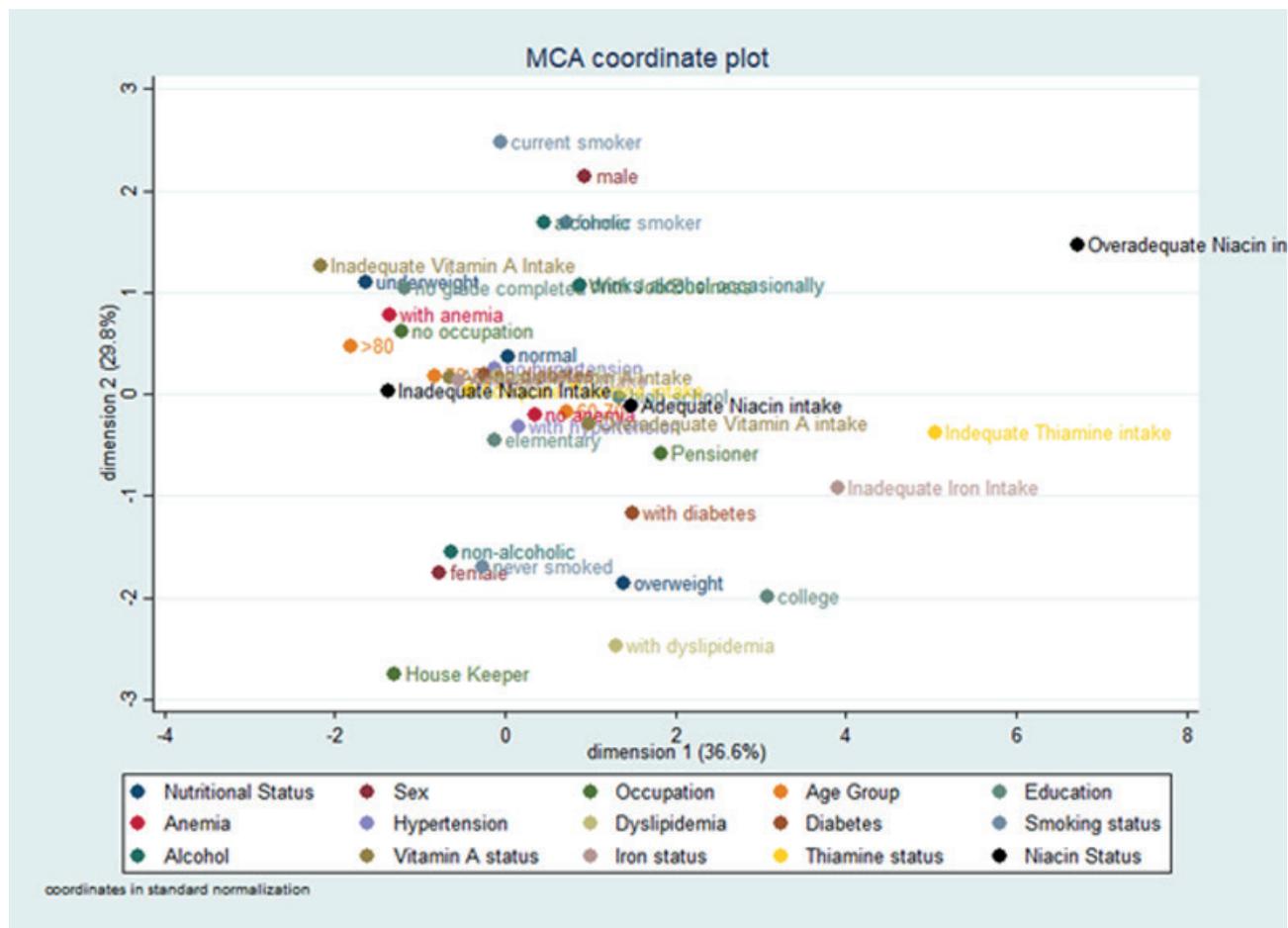
The results of the multiple correspondence analysis showed that respondents who were underweight, had no grade completed, had no occupation, belonged to the age groups 70 to 80 and above 80 years, had anemia, and had inadequate vitamin A intake tended to form a cluster (Figure 5). That is, a Filipino elderly is more likely to be underweight if one has the following characteristics: aged 70 years old and above, uneducated, unemployed, anemic, and with inadequate vitamin A intake. On the other hand, clustering of those who were obese/overweight, diabetic, with dyslipidemia, female, college, non-alcoholic, and non-smokers can be observed (Figure 5). This implies that a female Filipino elderly who are diabetic, has dyslipidemia, is at least a college graduate, non-smoker, and non-alcoholic is more likely to be obese/overweight.

**Table 5.** Factors significantly associated with the nutritional status of the Filipino elderly.

Factors	Rao-Scott Test Statistic	p-value*	Cramer's V†
<b>Socio-demographic</b>			
Sex	11.8237	0.0074	0.0808
Occupation	44.1766	<0.0001	0.1564
Age Group	34.3517	0.0005	0.1379
Highest Educational Attainment	101.3833	<0.0001	0.2369
<b>Health Condition</b>			
Anemia	50.0802	<0.0001	0.1685
Hypertension	33.9041	<0.0001	0.137
Hypertension	24.9307	<0.0001	0.1177
Dyslipidemia	40.8466	<0.0001	0.1506
Diabetes	55.5592	<0.0001	0.08
Smoke status	11.2827	0.02	0.0811
Alcohol Status	50.0802	<0.0001	0.1685
<b>Dietary Intake</b>			
Vitamin A	48.0201	<0.0001	0.165
Iron	16.4464	0.0037	0.0954
Thiamine	8.6668	0.0312	0.0693
Niacin	50.9494	<0.0001	0.1679

\*significant at p<0.05

† <0.10 is very weak, 0.10-0.19 is weak, 0.20-0.29 is moderate, >0.3 is strong



**Figure 5.** Multiple correspondence analysis plot of nutritional status of Filipino elderly and significantly associated explanatory variables

**Table 6.** Dimensions, percentages and inertia values of the constructed MCA plot

Dimension	Principal Inertia	Percentage	Cumulative Percentage
dim 1	0.0084	36.57	36.57
dim 2	0.0068	29.81	66.38
dim 3	0.0013	5.46	71.84
dim 4	0.0008	3.62	75.46
dim 5	0.0001	0.8	76.26
dim 6	0.00005	0.23	76.49
dim 7	0.00004	0.18	76.67
dim 8	0.00001	0.07	76.75
dim 9	0.000007	0.03	76.77

Some statistics that indicate the results of performing the multiple correspondence analysis are presented in Table 6. The table shows that within the principal inertia of all the total number of explanatory variables, change amounts corresponding to each dimension are far from each other except for dimensions 1, 2, 3, and 4, which are relatively closer to each other. The total inertia explained by the nine dimensions is 0.0229. Of the total inertia, the first dimension explains the greatest amount of variance with 36.57% of the inertia, while 29.81% of the total inertia is explained by the second dimension. With the addition of a third component, the cumulative percentage increases to 71.84%.

## DISCUSSION

Results showed that Filipinos aged 70 years and older had a considerably higher prevalence of underweight since 2008 compared to those aged 60 to 69 years ( $p=0.0248$ ). Although there was a decreasing trend in the prevalence of underweight Filipino elderly through the years, the magnitude and severity of underweight among the Filipino elderly can still be considered high [24]. In contrast, it can be observed that through the years, the elderly aged 60 to 69 years had a higher prevalence of overnourished compared to those aged 70 years and older ( $p=0.0248$ ). Additionally, the prevalence of obese/overweight continuously increased among the elderly [21]. These data may imply that the elderly population are exposed to malnutrition.

In this study, the socio-demographic factors significantly associated with the nutritional status of the Filipino elderly were sex, occupation, age group, and highest educational attainment. Particularly,

a Filipino elderly aged 70 years old and above, uneducated, and unemployed was more likely to be underweight. Meanwhile, a female elderly and an elderly who were at least college graduates were more likely to be obese/overweight. Similar to the study of Leslie & Hankey in Canada, it was found that age is significantly associated with the nutritional status for body composition changes. The loss of muscle mass (sarcopenia) begins at around 50 years old and becomes more accelerated after the age of 60 [15]. This explains why being underweight is associated with the 70 to 80 and above 80 years old age group. Existing literature also reported that poorer nutritional status is observed among older age groups compared to younger age groups [25, 26]. Furthermore, Albiadi et al. obtained the same results in their study where nutritional status was associated with education. A higher level of education was associated with higher income and a better lifestyle, thus meeting and even exceeding the necessary food intake [13]. In Iran, Donini et al. found that nutritional status was associated with the occupational profile of the elderly. It was mentioned that poverty was strongly associated with low occupational profiles, hence leading to difficulties in achieving the nutritional needs [10]. The study of Boulos et al. also found a significant positive association between being a female and nutritional status [27]. According to Maru et al. the changes in the hormones caused by menopausal stage might contribute to an elder's weight gain around the abdomen compared to the thigh or hips, thus increasing the body mass index, which leads to being overweight or even obese [28].

Health conditions such as anemia, hypertension, dyslipidemia, and diabetes were found to have a significant association with the nutritional status of the elderly. Results of the multiple

correspondence analysis showed that an elderly individual with dyslipidemia and diabetes was more likely to be obese/overweight. However, an anemic elder was more likely to be underweight. Imae et al. found similar results where anemic elderly tended to have a lower body mass index or tended to be underweight. This is attributed to nutrient deficiency, such as hemoglobin and iron count [29]. The study of Lu et al. also showed similar results, where an elderly patient who was hypertensive, insulin resistant, and had lower high-density lipoprotein cholesterol level tended to have a higher BMI [16]. Serum insulin levels have high association with serum leptin levels, coherent with insulin resistance having an association with obesity [30]. Furthermore, a larger consumption of lipids in the form of saturated fatty acids and cholesterol, which further results to a higher post-prandial lipid concentration, are observed in obese individuals [31].

In terms of the association between the behavioural risk factors considered and the nutritional status of the elderly, Fares et al. showed that their association was weak. It was further mentioned that controversy in the association between these factors was due to the difference in the criteria regarding smoking and alcohol consumption used in different studies [32]. Similar results were revealed in this study where the smoking and alcohol status of the Filipino elderly was weakly associated with their nutritional status. However, looking into detail, results of the multiple correspondence analysis showed that a non-alcoholic and non-smoker elderly tended to be overweight. Opposite findings were presented by Alcacera et al., where intake of alcohol were shown to stimulate higher body fat percentage and overweight in older adults [33]. Furthermore, the study of John et al. reported that body weight was observed highest in ex-smokers, medium in never smokers, and lowest in current smokers [34].

The intake and utilization of nutrients have an effect on the individuals' nutritional status [35]. As reported in this study, there was an association between the nutritional status of the Filipino elderly and the intake of vitamin A, niacin, iron, and thiamine. In addition, it was stated that a Filipino elderly was more likely to be underweight if he/she had an inadequate intake of vitamin A. However, it was reported that excessive intake of vitamin A by elderly individuals results to low bone mineral

content and mineral density [36]. Furthermore, lower bone mineral density was associated with lower body mass index [37]. Hence, it can be implied that excessive intake of vitamin A leads to an underweight elderly, contradicting the results of this study.

## CONCLUSION

With the continuing problem in the malnutrition among Filipino elderly, this study aimed to determine the factors associated with the nutritional status of the Filipino elderly using the 2013 National Nutrition Survey. The socio-demographic factors significantly associated with the nutritional status of the Filipino elderly were sex, occupation, age group, and highest educational attainment. All of the health conditions as well as the dietary intakes considered in this study had significant associations with the nutritional status of the elderly. For the behavioral risk factors, the smoking status and alcohol consumption of the elderly showed a significant but weak association with the nutritional status.

Furthermore, elderly in the age groups 70-80 and above 80 years old, uneducated, unemployed, anemic, and the intake of vitamin was inadequate tend to become underweight. On the other hand, females, at least a college graduate, diabetics, has dyslipidemia, non-alcoholics, and non-smokers were more likely to be overweight/obese.

Based on the results, it is recommended that the families or the caregivers of the elderly, especially those with no grade completed, no occupation, and aged at least 70 years old, become more aware of these elders' lifestyles and must properly give the right nutrition as the elders are more likely to be underweight. An underweight elderly might experience a decrease in immune function and have a higher risk for complications [38]. The members of the family or the elderly himself/herself must observe the quality and quantity of the elder's food intake. Moreover, the elderly should adopt healthy lifestyle practices to avoid malnutrition and to maintain good health.

With the constant prevalence rate of underweight and overweight/obesity among Filipino elderly, it is also recommended to conduct further studies about the nutritional status of the Filipino elderly

to have sufficient basis on how society can help the elderly maintain and improve their nutritional condition.

## CONFLICT of INTEREST STATEMENT

The authors declared no conflict of interest.

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