

# Association Between Nutritional Knowledge, Dietary Regimen, and Excess Body Weight in Primary School Teachers

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**Introduction:** Peru is one of the developing countries with the highest prevalence of overweight and obesity in Latin America and Caribbean region. Primary school teachers are identified as a high-risk group for overweight and obesity. However, studies conducted in this population group are limited. This study evaluated the association between nutritional knowledge, dietary regimen, and excess body weight in primary school teachers.

**Methods:** This was a cross-sectional study that included 151 teachers from two state schools in the eastern region of Lima, Peru. The level of nutritional knowledge was assessed using a validated questionnaire. Dietary regimen was also determined. The body mass index (BMI) was determined through self-reported weight and height. Logistic regression analysis was used to assess the association between possible risk factors with excess body weight among teachers.

**Results:** Inadequate nutritional knowledge level (AOR = 5.21, 95% CI: 1.31–20.93), being male teachers (AOR = 2.25, 95% CI: 1.13–4.45), and being married (AOR = 2.49, 95% CI: 1.17–5.30) were the significant predictors of excess body weight. In contrast, vegetarian teachers were less likely to have excess body weight (AOR = 0.35, 95% CI: 0.47–0.97).

**Conclusion:** Future intervention programs should include improving nutritional knowledge with greater attention to male and married teachers to decrease the risk of excess body weight.

**Keywords:** body mass index, dietary regimen, nutrition knowledge, obesity, overweight, vegetarians

## Introduction

Excess body weight (overweight/obesity) represents one of the greatest challenges to public health and the economic and social development of countries.<sup>1,2</sup> The prevalence of excess body weight has doubled since 1980 in more than one third of the world's population,<sup>3</sup> and the number of people continues to increase steadily. In Peru, according to estimates by the Instituto Nacional de Salud, in 2019, the prevalence of overweight and obesity in people over 15 years of age was 37.8% and 22.3%, respectively,<sup>4</sup> this makes Peru one of the Latin American countries with the highest prevalence.

The etiology of excess body weight is multifactorial. On the one hand, among the most prominent causes are physiological factors, characterized by changes in the amount and distribution of body fat;<sup>5</sup> environmental factors, such as sedentary lifestyle<sup>6</sup> and an unhealthy diet characterized by a high energy density.<sup>7</sup> On the other hand, the lack of adequate nutritional knowledge about healthy eating may also be one of the main causes.<sup>8</sup> Therefore, an adequate level of knowledge about healthy food choices is an essential factor in staying healthy. In addition, a plant-based diet, dominated by the intake of minimally processed foods such as fruits, vegetables, nuts, and whole grains, as well as the Mediterranean diet with healthy foods such as fish and fermented or low-fat dairy products, can be beneficial in preventing excess body weight.<sup>9,10</sup>

Primary school teachers, as agents of socialization, are one of the most influential groups in improving public health. The ability to interact and communicate provides teachers an opportunity to bridge the gap between school and health facilities and they are able to transfer their food knowledge to their students.<sup>11</sup> In addition, the lifestyle of teachers can positively impact the health behaviors and overall health status of students.<sup>12</sup> In fact, some studies have shown that students' dietary habits are mainly affected by the nutritional knowledge and eating behaviors of teachers.<sup>13</sup> However, easy access to high-energy products in school cafeterias represents a challenge for the school community and is one of the factors that contribute negatively to nutritional status.<sup>14,15</sup> Therefore, to reduce the prevalence of excess body weight in the school community, it is important to promote healthy eating behaviors and programs to improve the levels of nutritional knowledge in this population group.

Healthy eating is one of the basic needs of a person; therefore, an adequate level of knowledge about healthy eating and nutrition and food hygiene should be considered as one of the health aspects within the curricula of school children. In this context, the Peruvian Ministry of Health, through a technical document, stresses the importance of creating and maintaining healthy environments in schools and universities.<sup>16</sup> They also emphasize the strengthening of nutrition-based health interventions in educational institutions, particularly in the school setting, to improve nutritional knowledge and reduce the incidence of communicable and non-communicable diseases in the school community.<sup>16</sup> However, it appears that primary school teachers lack effective methods to incorporate health elements focused on healthy eating and nutrition in their classrooms due to a lack of knowledge on the subject.<sup>17</sup> This study hypothesized that nutritional knowledge and dietary regimen are associated with excess body weight in primary school teachers.

Therefore, the purpose of this study was to investigate the relationship between the level of basic nutritional knowledge, dietary patterns, and excess body weight in primary school teachers. Understanding these determinants is important for establishing a baseline and implementing nutritional intervention strategies and policies in the school population, including teachers and students.

## Materials and Methods

### Study Design and Participants

In the months of January and February 2022, a pre-structured online cross-sectional survey was conducted to assess nutritional knowledge, dietary regimen, and excess body weight among 158 teachers aged 23 to 58 years from two state schools located in the eastern region of Lima, Peru. Google Forms was used to administer the survey. It was a non-probabilistic convenience sample. Previously, the school authorities were contacted to request authorization.

The survey was then delivered to the teachers via e-mail for data collection. On the initial page of the survey, the purpose of data collection and the objective of the study were explained to the participants. In addition, before they began answering the questions, electronic informed consent was obtained from the participants by clicking on the "I wish to participate" option after reading the informed consent on the first page of the survey. Participation was completely voluntary; furthermore, participants did not receive any incentive for taking part in the study.

The research protocol was approved by the Research Ethics Committee of the Universidad Peruana Unión and was registered under the number 0011–2021/CE/CT/UPeU. The study was conducted according to the criteria established in the Declaration of Helsinki. We collected 158 data. However, we excluded 7 registries due to lack of data, as well as secondary level teachers from both schools. The final sample included in the analysis was 151.

### Data Collection Instruments

#### Nutritional Knowledge

The study used a questionnaire designed in a previous study<sup>18</sup> based on the criteria suggested by FAO in its Guide for Assessing Nutritional Knowledge, the questions of which are available at <http://www.fao.org/3/i3545e/i3545e00.htm>.<sup>19</sup> Reliability was determined through the Kuder-Richardson analysis. Cronbach's  $\alpha$  coefficient was  $> 0.7$ , indicating good internal consistency.<sup>18</sup> The questionnaire comprised 12 items that comprehensively assessed the basic nutritional knowledge of university teachers. The questions covered topics such as definition and characteristics of a healthy diet, adequate consumption of fruits and vegetables per day, foods that are sources of protein, among others. Each question was constructed

with true or false alternatives. Correct answers received 1 point while inadequate answers received a score of 0.<sup>20</sup> The discrimination value was taken as 60% of the correct answers, ie, if the participant answers  $\geq 60\%$  (out of 100%) to the knowledge questions, he/she has “adequate” knowledge; however, if the participant answers  $< 60\%$  (out of 100%) to the knowledge questions, he/she has “inadequate” knowledge.<sup>18</sup>

## Dietary Regimen

The participants’ dietary regimen was self-reported. In addition, they were classified as non-vegetarians (no specific dietary restrictions on the frequency of food consumption, such as meat, fish, dairy products, and derivatives) and vegetarians (lacto-ovo-vegetarians: consuming milk and derivatives, eggs and foods of vegetable origin and vegans: elimination of all animal products).<sup>8,21,22</sup>

## Excess Body Weight (Overweight/Obesity)

Participants’ weight and height were self-reported. Subsequently, BMI was calculated as  $\text{weight/height}^2$  ( $\text{kg/m}^2$ ). BMI was used to evaluate excess body weight according to the criteria established by the Peruvian Ministry of Health in the Technical Guide for the Anthropometric Nutritional Assessment of Adults.<sup>23</sup> Participants were classified into two groups as follows: BMI  $< 25$  and BMI  $\geq 25$ .<sup>24</sup> In Peru and according to the recommendations of the Ministry of Health and WHO, a BMI  $\geq 25$  is considered overweight.<sup>23</sup>

## Sociodemographic Data

Furthermore, data were collected on sex (male, female); age in years (23–39 and 40–58); place of origin (urban and rural); marital status (married and single); postgraduate study (yes: diploma, master’s, or doctorate. No: bachelor’s or licentiate degree).

## Statistical Analysis

The procedure of absolute frequency tables and percentages was used for statistical analysis of the data. To explore the distribution of sociodemographic variables according to the level of nutritional knowledge and dietary regimen, the Chi-square test was considered. In addition, logistic regression analysis was performed to analyze the association between nutritional knowledge and dietary regimen with excess body weight (overweight/obesity). Crude odds ratios (COR) and 95% confidence intervals (CI) were estimated using simple logistic regression analysis. Variables with a p-value of  $< 0.25$  in the simple logistic regression analysis were included in the final multiple logistic regression model. Multiple logistic regressions were controlled for sex, age, region of origin, marital status, and education level. Finally, the results were reported in adjusted odds ratio (AOR) with a 95% confidence interval. The significance level was set at 0.05. Data processing and analysis were performed with the SPSS statistical software package, version 25 (SPSS Inc., Chicago, IL, USA).

## Results

A total of 151 teachers gave informed consent to participate in the study; of which, 50.33% ( $n=76$ ) were males. Table 1 shows the association between sociodemographic and anthropometric characteristics with the level of nutritional knowledge of the respondents. It was observed that the highest proportion of participants reporting an adequate nutritional knowledge level was females compared to males (54.5% vs 45.5%,  $p = 0.021$ ). On the other hand, 71% of married teachers reported an inadequate level of knowledge ( $p = 0.025$ ). The proportion of teachers who studied a postgraduate degree (diploma, master’s, and doctorate) and those who were not overweight reported an adequate level of knowledge at 62.2%,  $p = 0.043$  and 61%,  $p = 0.024$ , respectively. In addition, we found that those who were vegetarians had a postgraduate degree (55.7%,  $p = 0.003$ ) and did not have excess body weight (58.4%,  $p = 0.012$ ).

Table 2 reports the level of nutritional knowledge, dietary regimen, sociodemographic characteristics associated with excess body weight. Teachers who had an inadequate level of nutritional knowledge were 5.21 (AOR = 5.21, 95% CI: 1.31–20.93,  $p = 0.05$ ) times more likely to have excess body weight compared to their counterparts. Vegetarians were less likely to have excess body weight (AOR = 0.35, 95% CI: 0.47–0.97,  $p = 0.05$ ). Excess body weight was 2.25 times (AOR

**Table 1** Analysis of the Sociodemographic and Anthropometric Characteristics of the Participants According to the Level of Nutritional Knowledge and Dietary Regimen

Variable	Nutritional Knowledge					Dietary Regimen				
	Adequate		Inadequate		P-value	Vegetarian		No-Vegetarian		P-value
	n	%	n	%		n	%	n	%	
Nutritional knowledge										0.466
Adequate	-	-	-	-	0.021*	42	53.2	34	47.2	0.675
Inadequate	-	-	-	-		37	46.8	38	52.8	
Sex										
Males	35	45.5	41	55.4		39	49.4	37	52.8	
Females	42	54.5	33	44.6		40	50.6	35	47.2	
Age (years)					0.483					0.552
23–39	59	76.6	53	71.6		57	72.2	55	76.4	
40–58	18	23.4	21	28.4		22	27.8	17	23.6	
Place of origin					0.310					0.264
Urban	30	39	23	31.1		31	39.2	22	30.6	
Rural	47	61	51	68.9		48	60.8	50	69.4	
Marital status					0.025*					0.149
Single	31	40.3	21	28.4		56	70.9	43	59.7	
Married	46	59.7	53	71.6		23	29.1	29	40.3	
Postgraduate studies					0.043*					0.003*
No	39	50.6	28	37.8		35	44.3	49	68.1	
Yes	46	62.2	38	49.4		44	55.7	23	31.9	
Excess body weight					0.024*					0.012*
No (BMI <25)	47	61	30	40.5		45	58.4	28	39.1	
Yes (BMI ≥25)	30	39	44	59.5		32	41.6	42	57.8	

Note: \*p &lt;0.05.

Abbreviation: BMI, body mass index.

**Table 2** Logistic Regression of Participants' Excess Body Weight

Variable	Crude OR	95% CI	Adjusted OR‡	95% CI	P-value
<b>Nutritional knowledge</b>					0.043*
Adequate	1.00	Reference	1.00	Reference	0.010*
Inadequate	1.08	(0.57–2.05)	5.21	(1.31–20.93)	
<b>Dietary regimen</b>					0.020*
Vegetarian	0.78	(0.41–1.48)	0.35	(0.47–0.97)	0.964
No-vegetarian	1.00	Reference	1.00	Reference	
<b>Sex</b>					0.673
Males	2.29	(1.19–4.41)	2.25	(1.13–4.45)	0.017*
Females	1.00	Reference	1.00	Reference	
<b>Age (years)</b>					0.374
40–58	0.98	(0.47–2.04)	1.01	(0.47–2.20)	0.374
23–39	1.00	Reference	1.00	Reference	
<b>Place of origin</b>					
Urban	1.00	(0.51–1.95)	1.16	(0.56–2.40)	0.017*
Rural	1.00	Reference	1.00	Reference	
<b>Marital status</b>					
Married	2.46	(1.22–4.93)	2.49	(1.17–5.30)	0.374
Single	1.00	Reference	1.00	Reference	
<b>Postgraduate studies</b>					
Yes	0.98	(0.51–1.86)	0.71	(0.34–1.49)	0.374
No	1.00	Reference	1.00	Reference	

Notes: \*p &lt;0.05. ‡Adjusted for diet, sex, age, place of origin, marital status, and postgraduate studies.

Abbreviations: OR, odd ratio; CI, confidence interval.

= 2.25, 95% CI: 1.13–4.45,  $p = 0.05$ ) more likely in men compared to women. Finally, married teachers were 2.49 times (AOR = 2.49, 95% CI: 1.17–5.30,  $p = 0.05$ ) more likely to have excess body weight compared to single teachers.

## Discussion

This study evaluated the association between the level of nutritional knowledge, dietary regimen, and excess body weight among primary school teachers. The main results of the study were the following: (a) teachers who reported inadequate nutritional knowledge were more likely to have excess body weight, (b) being vegetarian was a protective factor against excess body weight, (c) excess body weight was more likely in men, (d) Finally, married teachers were more likely to have excess body weight compared to single teachers.

In the logistic regression analysis, we found that teachers who reported inadequate nutritional knowledge were more likely to have excess body weight. These results could be due, albeit partially, to the fact that 59.5% of the teachers who reported inadequate nutritional knowledge were overweight. Evidence regarding the association between food and nutrition knowledge has been demonstrated in other similar studies that evaluated the general adult population. In fact, a study that analyzed the association between the variables under study demonstrated the significant impact of the level of nutritional knowledge on anthropometric status, concluding that respondents who scored lower on the knowledge questionnaire had worse results in BMI, waist circumference (WC), and waist-hip ratio.<sup>25</sup> Similarly, in a study conducted in adults aged 18 to 64 years, it was found that a higher nutrition knowledge score was associated with a better anthropometric profile, including a reduction in BMI, WC, and body fat mass.<sup>26</sup> A possible justification for these results could be the fact that people with a high level of knowledge about healthy eating and nutrition tend to adopt healthy weight loss behaviors that include, for example, a healthy diet characterized by the consumption of fruits, vegetables, nuts, whole grains, among other healthy foods, which, in turn, could influence anthropometric nutritional status (lower risk of excess body weight).<sup>27</sup> In our study, more than half of the teachers who reported an adequate level of knowledge opted for a vegetarian diet.

However, the results of a study conducted among kindergarten teachers disagree with our findings, showing that the respondents who reported a higher level of knowledge were those who were overweight.<sup>20</sup> This implies that, although teachers reported an adequate level of nutritional knowledge, it was not sufficient to maintain a healthy weight. Therefore, nutritional knowledge alone should not constitute the exclusive focus of weight control interventions among teachers, but should be considered as a complement to broader strategies aimed at improving lifestyle and overall health.

Plant-based diets are considered one of the healthiest dietary regimen options.<sup>22</sup> The popularity of these diets is closely related to their nutritional components and health benefits.<sup>28,29</sup> In fact, vegetarian diets are a predictor of a better anthropometric profile, including a healthy weight.<sup>10,28</sup> In the current study, we found that being vegetarian constituted a protective factor against excess body weight. These findings are similar to the results found in previous studies in the Peruvian population, which found that vegetarians had a lower BMI than non-vegetarians.<sup>8,10</sup> Several studies conducted in other contexts have shown that the BMI of vegetarians is significantly lower than that of non-vegetarians.<sup>30,31</sup> In fact, two recent studies reported that vegetarians reported an ideal BMI,<sup>30</sup> while non-vegetarians had a greater tendency to have an elevated BMI.<sup>31</sup> It is suggested that diets characterized by the abundant consumption of vegetables are essentially anti-obesogenic compared to diets that include the regular consumption of meat and derived products.<sup>8,10</sup> Possible justifications behind these results could be the fact that vegetarian diets are characterized by a lower energy density, due to the presence of foods rich in dietary fiber, water, and bioactive elements (phytochemicals).<sup>32</sup> This study adds to the literature that not only adequate nutritional knowledge can positively impact body weight, but also dietary regimen can play an important role.

Recent evidence regarding the association between sex and excess body weight has been two-sided, and it is even suggested that the probability of being overweight or obese is approximately the same between men and women.<sup>33</sup> In our study, we found that excess body weight was more likely in male teachers. These results are consistent with the findings of a previous study where male teachers have been found to have higher excess body weight.<sup>34</sup> Epidemiological data available in Western countries show an increasing trend of excess body weight among men than women.<sup>35</sup> One possible explanation for these results is the fact that men, in many cases, show little interest in their physical appearance and body

weight compared to women; in addition, they have little basic knowledge about healthy eating and nutrition.<sup>36</sup> In the current study, we found that women reported a higher level of nutritional knowledge than men. However, there arises the fact that, in most countries, there are more women with excess body weight than men.<sup>37</sup> In fact, a cross-sectional survey that evaluated teachers and other population groups reported that obesity was more prevalent in female teachers; moreover, they were 2 times more likely to be overweight or obese than men.<sup>38</sup> In any case, regardless of these inconsistencies between excess body weight (overweight/obesity) and sex, the truth is that obesity continues to be one of the greatest public health problems in the world. Therefore, decreasing the prevalence of obesity in both groups is an essential step in preventive medicine to ensure optimal health in teachers, which, in turn, will benefit students.<sup>10</sup>

Another important finding of the current study is that married teachers were more likely to have excess body weight than single teachers. Recent literature regarding the association between marriage and excess body weight (overweight/obesity) can be viewed from two perspectives.

First, related to our findings, a recent Chinese study reported that married people had a higher risk of being overweight or obese than people who were never married.<sup>39</sup> This supports findings from other similar studies indicating that being married is an important predictor of excess body weight.<sup>40</sup> There are several possible justifications for these results. Being in a couple represents a possible risk factor for the adoption of unhealthy behaviors, such as sedentary lifestyles.<sup>41</sup> It is possible that married people are less physically active and spend more time watching television.<sup>41</sup> In addition, in many cases, married people no longer care about their body image, resulting in increased consumption of energy-dense foods,<sup>42</sup> which can lead to an unhealthy anthropometric nutritional status.

Second, however, it is suggested that entering into a strong marriage—where there is mutual support from the couple—has some health benefits because it encourages healthy behavior and promotes longevity.<sup>43</sup> In fact, studies have consistently shown that happily married people have a lower risk of coronary heart disease compared with divorced, single, or separated people.<sup>44</sup> In any case, it is important that interventions (nutritional counseling and physical activity plans) aimed at maintaining a healthy anthropometric nutritional status should not only target married people but also those who are divorced/widowed, considering that the risk of overweight/obesity is not significantly reduced when leaving marriage.<sup>39</sup>

## Limitations

The results of this study should be interpreted considering several limitations. First, this is a cross-sectional study; therefore, determining a possible causal relationship between caporal excess weight (overweight/obesity) will require prospective cohort studies. Second, the information collected regarding the dietary regimen was self-reported; it is possible that the definitions of “vegetarian” and “non-vegetarian” are not precise; we have not based on the analysis of dietary intake to determine the dietary regimen. Third, we do not have exact knowledge of the proportion of vegetarian subgroups (lacto-ovo-vegetarians and vegans) present in the study. This missing information from our study may represent a bias, therefore, studies focusing on primary school teachers are suggested to explore the behavior of various vegetarian subgroups. Fourth, the sample size represents one of the most worrisome limitations of the study; consequently, further analysis of the impact of the level of nutritional knowledge and dietary regimen on excess body weight with larger samples is suggested. Fifth, this small sample was limited to teachers from two state schools located in a specific region of Lima, Peru; therefore, the results cannot be generalized. It is suggested that future studies consider providing evidence that can be generalized to teachers in other countries. Finally, the weight and height of the participants were self-reported, this could represent a bias in the study, increasing the probability of certain errors in the BMI results. In addition, people often underestimate weight and overestimate height.<sup>45</sup> On the other hand, we consider that the fact of not considering other anthropometric measurements apart from BMI represents a limitation, due to the fact that BMI is not a perfect measure that provides a specific and direct view on body composition, body fat distribution, and muscle mass of the surveyed participants.<sup>46</sup> Therefore, future research should use alternative anthropometric measures to BMI to identify body composition more accurately.



## Public Health Implications

Despite these limitations, we believe that the results of this study have relevance for implementing intervention and prevention programs for excess body weight (overweight/obesity) in primary school teachers. This is particularly important considering that teachers' eating behaviors can have a large effect on students' lifestyles and overall health. In addition, students' dietary patterns may be affected primarily by teachers' nutritional knowledge. Therefore, interventions should not only include preventive aspects regarding the reduction of excess body weight, but also training in topics related to nutrition and healthy eating to improve teachers' knowledge by providing them with greater capacity to attend to students' queries and thus create a healthy environment for the benefit of the entire school population (teachers, students, and administrative staff).

## Conclusion

The results of the present study have provided evidence that teachers inadequate nutritional knowledge level is associated with excess body weight excess body weight, while being a vegetarian represents a lower probability for excess body weight. In addition, excess body weight was more likely in male teachers and those who were married. Therefore, future intervention programs should include improving nutritional knowledge by paying more attention to male and married teachers to decrease the risk of excess body weight.

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## Disclosure

The authors declare that they have no potential conflicts of interest in relation to this work.

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