RESEARCH STUDY
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Factors Related to Overnutrition among High School Teachers in Bogor City

Faktor-Faktor yang Berhubungan dengan Masalah Gizi Lebih pada Guru Sekolah Menengah Atas di Kota Bogor

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ABSTRACT

Background: Teachers play a vital role in education and must maintain productivity. However, some teachers face overnutrition due to spending most of their working hours on low-physical-activity tasks. Previous research in vocational high schools (SMK) in Bogor City reported that 37.3% of teachers were classified as having level I obesity, while 10.7% had level II obesity.

Objectives: This study aims to examine factors associated with overnutrition among senior high school (SMA) teachers in Bogor City and to analyze differences in overnutrition risk factors between public and private schools.

Methods: A cross-sectional design with a total sampling method was employed, involving 121 teachers, comprising 60 from public schools and 61 from private schools. Data collection included questionnaires and anthropometric measurements, analyzed using Chi-Square and Mann-Whitney tests.

Results: The analysis revealed significant associations between overnutrition and factors such as age (p-value<0.05), family income (p-value<0.05), physical activity (p-value<0.05), energy intake (p-value<0.001), protein intake (p-value<0.001), fat intake (p-value<0.001), carbohydrate intake (p-value<0.001), and nutritional knowledge (p-value<0.001). Gender, vegetable and fruit consumption, and stress (p-value>0.05) showed no association. Significant differences were found in physical activity (p-value<0.05), stress (p-value<0.05), protein intake (p-value<0.05), fat intake (p-value<0.05), carbohydrate intake (p-value<0.05), and vegetable (p-value<0.001) and fruit (p-value<0.001) consumption between public and private school teachers.

Conclusions: Factors associated with overnutrition among high school teachers in Bogor City include age, physical activity, dietary intake (energy, protein, fat, and carbohydrates), nutritional knowledge, and family income, with significant differences between public and private schools.

INTRODUCTION

One of the central elements in the education system is the teacher. Teachers are required to maintain their productivity due to their importance to the education system[1]. Overnutrition is common among teachers, largely because their working hours are dominated by seated activities with minimal intensive physical movement. Activities such as teaching in class, preparing lesson materials, and completing administrative tasks are generally done at a desk or workspace that does not support adequate physical mobility[2].

Overnutrition is defined as an imbalance between daily energy expenditure and food intake, which can increase the risk of health problems and excess body weight[3]. The results of the Basic Health Research 2018 (Riskesdas) show that the prevalence of obesity in adults (>18 years) continues to increase, reaching 21.8%[4]. In particular, West Java Province recorded a prevalence of overweight of 13.66% and obesity of 23%[4]. Overnutrition in teachers has significant short- and long-term impacts on their health and work performance. Short-term impacts include lack of mobility, decreased immune system, and increased absenteeism, while long-term impacts include decreased productivity, negative stigma, unemployment, and risk of non-communicable diseases such as hypertension and diabetes[5–7].

Several factors contribute to the prevalence of overnutrition among teachers, including age and gender. As individuals get older, there tends to be an increase in overall body fat, especially in the abdominal area. Additionally, aging is associated with a decrease in muscle mass and certain hormonal changes that promote fat accumulation in the central part of the body[8]. In line

Amerta Nutrition

e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
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with previous studies which state that age and obesity in female teachers have a significant relationship[9]. In terms of gender, it is often found that women have higher rates of obesity than men. This is influenced by differences in metabolic rate, where women's basal metabolic rate at rest is about 10% lower than that of men, so women tend to convert food into fat rather than muscle[10]. Previous research also reported that gender was associated with overweight/obesity (p-value<0.05) in teachers in Brazil[11].

Sedentary behavior by teachers can also lead to overnutrition. Previous research suggests that most teachers spend their working time in a sitting position[12]. Globally, 55% of people (23% male and 32% female), aged >18 years have a low level of physical activity[13]. A positive association between physical activity and obesity in school teachers (p-value<0.001) was also found in a previous study[9]. High stress levels in teachers are also a factor in the incidence of overnutrition. When stressed, many people tend to seek comfort in unhealthy foods as a form of coping. These food choices, which are often calorie-rich, can result in increased body weight and obesity risk[14]. In addition, ghrelin production tends to increase in response to stress, which can increase appetite as well as the desire to consume foods high in fat and carbohydrates[15]. This theory is in line with previous research which explained that there is a positive correlation between stress levels and obesity (p-value=0.005) in high school teachers in Kendari City[16].

Dietary intake can also be a trigger for overnutrition. Individuals who consistently consume more calories than needed for daily activities tend to store these excess calories as fat[17]. The type of food consumed also plays an important role, as foods high in fat, sugar, or salt tend to have a high energy density, so they can contain many calories in a small portion. Excessive consumption of these types of foods can lead to the accumulation of body fat[18]. In addition, irregular eating habits and consumption of high-calorie foods at night can increase the likelihood of obesity[19]. The study explained that macronutrient intake, namely energy, protein, fat, and carbohydrates, has a correlation with the incidence of obesity in high school teachers in Tomohon[20]. Fruit and vegetable consumption, which is rich in fiber, vitamins, minerals, and antioxidants, is also correlated with reduced prevalence of obesity, as high fiber helps slow digestion and reduces the risk of overeating[21,22]. Research shows a good correlation between fruit and vegetable consumption and obesity among health and non-health workers[23].

The relationship between nutrition knowledge and obesity suggests that an understanding of healthy eating plays an important role in the weight management process. Individuals with a good understanding of nutrition tend to choose more nutritious and healthy foods, plan calorie, macronutrient and micronutrient consumption in a more balanced manner[24,25]. Conversely, a lack of nutrition knowledge can lead to unhealthy eating decisions and increase the risk of obesity. Research has also found a significant association between nutrition knowledge and obesity. In addition, income also has an effect on overnutrition[26]. Families with higher incomes tend to have a higher prevalence of obesity[9]. High-income families often prefer fast food, which contributes to the increased risk of obesity[27,28]. This teory is in line with previous studies which explain that nutritional knowledge has an association with obesity (p-value=0.03)[11].

This study focuses on high school teachers in Bogor City. Previous research conducted on teachers in one of the Junior High Schools (SMP) in Bogor City showed that there were 51.4% cases of obesity and on teachers in one of the Vocational High Schools (SMK) in Bogor City as many as 37.3% obesity level I and 10.7% obesity level II[29,30]. The high incidence of obesity in school teachers in Bogor City area and the lack of research on the nutritional status of high school teachers in Bogor City is a strong driver of this research. Based on the background description, the purpose of this writing is to identify "Factors Associated with Overnutrition Problems in High School Teachers in Bogor City."

METHODS
Design, Location, and Time
This research design is a cross-sectional study. The population in this study were all teachers who were actively teaching at SMAN 8 Bogor, SMA Mardi Yuana Bogor, and SMA Regina Pacis Bogor. The number of teachers who actively teach at SMAN 8 Bogor was 60 teachers, the number of teachers who actively teach at SMA Mardi Yuana Bogor was 40 teachers, the number of teachers who actively teach at SMA Regina Pacis Bogor was 21 teachers, so that the total population of this study was 121 people. This research was conducted in March 2024-June 2024. This research had received ethical approval from the Research Ethics Committee of the National Development University "Veteran" Jakarta with letter number 310/VI/2024/KEP which was set on June 27, 2024.

Sample
The number of samples was calculated using the hypothesis test formula, with the minimum sample size of 110 respondents. The number of samples was added by 10% to anticipate potential dropouts, so that the total research sample reached 121 respondents. This study used the total sampling method, taking into account the following inclusion and exclusion criteria: permanent high school teachers who are actively teaching, aged 20-60 years, physically and mentally healthy, not on a special diet, not pregnant, and not suffering from chronic diseases that affect the problem of overnutrition such as diabetes mellitus, hypertension, heart disease, and infectious diseases. The total sample size was 121 respondents, consisting of 60 respondents who taught in public schools and 61 respondents who taught in private schools.

Data Collection Method
This study used primary and secondary data. Primary data came from filling out questionnaires consisting of characteristic data, nutritional knowledge questionnaire, SQ-FFQ food consumption survey, GPAQ V2 physical activity level measurement, DASS-14 stress level measurement, and anthropometric measurements for nutritional status data. Secondary data was sourced

from each school related to the profile data of teachers who were actively teaching.

Age characteristics data were categorized into non-risk age (20-35 years) and risk age (36-60 years)[31]. Family income characteristics were also classified according to the Regency/City Minimum Wage of Bogor (UMK) 2024, namely low (<Rp 4,813,988) and high (>Rp 4,813,988). Nutritional knowledge was taken using a questionnaire that had been modified from previous research and had gone through a re-validation test[32]. The types of questions on the questionnaire consisted of individual nutritional intake and needs, the content of the General Guidelines for Balanced Nutrition (PUGS), and the incidence of obesity. Knowledge scores were divided into poor (<60), fair (60-80), and good (>80)[33]. Data on dietary intake of energy, protein, fat, and carbohydrate were taken by SQ-FFQ within the last 1 month and compared with the value of the Nutritional Adequacy Rate (WNPG, 2014) with the classification of sufficient (80-110%) and more (>110%)[20]. Vegetable and fruit consumption levels were also taken by SQ-FFQ within the last one month and then classified as less (<150 g/day) and sufficient (≥150 g/day) for fruit and less (<250 g/day) and sufficient (≥250 g/day) for vegetables[21]. Physical activity was assessed based on the validated GPAQ V2 questionnaire and categorized into less (<600 METs) and sufficient (≥600 METs) physical activity levels[34]. Stress level assessment was scored from the validated DASS-14 questionnaire and categorized into normal (score 0-10), mild (11-20), moderate (21-30), and severe (>30) stress levels. Anthropometric measurements were carried out during the day by trained staff. The data collected included body weight measured using a digital scale with an accuracy of 0.1 kg, and height measured using a microtoise. The measurement results were classified into the groups of not overnutrition (≤25.0 kg/cm^2) and overnutrition (≥25.1 kg/cm^2)[4].

RESULTS AND DISCUSSIONS
Characteristic Respondents

Based on Table 1, it was found that out of 121 respondents, 85 respondents (70.2%) had ages in the range of 36-60 years or in the risk category with a median of 45 years. According to the Statistics Indonesia (BPS), productive age includes the age range of 15-64 years[35].

This age group is considered capable of becoming a potential workforce, business actors, and consumers who play a very important role in accelerating development. However, this study limits the age group of respondents to 60 years old, in accordance with the rules for dismissing teachers by age limit in Indonesian Law Number 14 of 2005[36]. The respondents were also dominated by women with 77 respondents (63.6%). Gender is often associated with the incidence of overnutrition. Basal metabolism in women is about 10% lower compared to men, which suggests that women tend to burn fewer calories while at rest[10]. This theory implies that women have a tendency to convert the food they consume into body fat rather than men who tend to convert their food into muscle[37].

Most respondents were also married (81%). After marriage, family responsibilities increase, so the time available for physical activity becomes more limited. In addition, eating patterns tend to change, and weight control efforts become less consistent than before marriage[38]. These behavioral changes can be a driver of weight gain or overnutrition in adults[38]. Work experience was also found to be highest among respondents who worked for >20 years, namely 54 respondents (44.6%). Teachers are considered to have served long enough in their duties when they have worked at least more than 10 years[39]. Good teacher performance is often found in those who have been in the profession for 21 to 30 years[40]. This length of service can affect teachers' experience, confidence, and dedication to their profession[39].

Furthermore, in the family income group, 65 respondents (53.7%) had a high level of family income. In this study, family income was considered high if it was more than the Bogor Regency/City Minimum Wage (UMK) of IDR 4,813,988. A family's economic level affects their capacity to meet their needs, make food choices, and adjust the lifestyle of family members[27]. Income can also be a trigger for overnutrition. Families with a stable income show a higher prevalence of obesity[9]. However, the incidence of obesity can also occur in families with low income due to the inability to choose and buy diverse and quality foods such as foods that are high in calories and fat.

Table 1. Frequency distribution of teacher characteristics of public and private senior high schools in Bogor City

Variables	n	%
Age		
20-35 years (not at risk)	36	29.8
36-60 years (at risk)	85	70.2
Gender		
Male	44	36.4
Female	77	63.6
Marriage Status		
Married	98	81
Unmarried	23	19

Variables	n	%
Length of Service		
1-10 years	45	37.2
11-20 years	22	18.2
>20 years	54	44.6
Family Income		
Low	56	46.3
High	65	53.7
Nutrition Status		
Not overnutrition	52	43
Overnutrition	69	57
Physical Activity		
Less	84	69.4
Adequate	37	30.6
Stress Level		
Not stressed	60	49.6
Stress	61	50.4
Energy Intake		
Adequate	66	54.5
Over	55	45.5
Protein Intake		
Adequate	55	45.5
Over	66	54.5
Fat Intake		
Adequate	61	50.4
Over	60	49.6
Carbohydrate Intake		
Adequate	40	33.1
Over	81	66.9
Vegetable Consumption		
Less	120	99.2
Adequate	1	0.8
Fruit Consumption		
Less	84	69.4
Adequate	37	30.6
Nutrition Knowledge		
Less	81	66.9
Good	40	33.1

Overview of Nutritional Status

Referring to Table 1, the respondents were dominated by the level of nutritional status, specifically 69 respondents (57%). The nutritional status in teachers who teach in urban areas tends to be obese[41]. Teachers often experience overnutrition problems because most of their working time is spent in activities that are carried out at a desk or workspace and do not support physical activity or in a sitting position, such as teaching in class, preparing lessons, and administrative work[2]. In addition

to physical activity, the problem of overnutrition in teachers is also due to teachers' inappropriate dietary habits because of their tendency to buy snacks such as fried foods and sweet foods during lunch hours[30]. The long-term impact of overnutrition on teachers is reduced productivity, negative stigma, unemployment, and non-communicable diseases such as hypertension and diabetes[6,7].

Overview of Physical Activity

Based on Table 1, there were 84 respondents who showed low physical activity levels (69.4%). Several other studies explained that the picture of physical activity in school teachers tends to be low because most teachers spend more of their working time in a sitting position and when at home they do not have time to exercise or do physical activity, so their bodies become inactive[12,41]. This can lead to low overall physical activity, which in turn increases the risk of obesity.

Overview of Stress Level

Referring to Table 1, the most respondents were found in individuals who experienced stress as many as 61 respondents (50.4%). Based on the results of measuring stress levels, it can be said that a teacher who experiences stress was someone who tends to feel restless, irritable, and difficult to relax. Emotions that arise include excessive worry, feelings of inability to cope with pressure, or ongoing feelings of tension. High levels of stress experienced by teachers were often caused by limited time to fulfill responsibilities, a large number of tasks to be completed, intense work rhythms, high workloads, excessive administrative demands, and lack of time for personal interests[42]. This could have an impact on their diet, with a tendency to consume unhealthy foods, such as foods containing high levels of fat and sugar as a form of coping, which can lead to weight gain and increase the risk of obesity among teachers[14,43].

Overview of Macronutrient Intake

Table 1 illustrates that out of 121 respondents, 66 respondents (54.5%) had an adequate level of energy intake, 66 respondents (54.5%) had an excessive level of protein intake, and 61 respondents (50.4%) had an adequate level of fat intake, and in carbohydrate intake most respondents had an excessive level of intake (66.9%). The picture of food intake consumed by teachers was sometimes inaccurate due to the habit of teachers who often bought snacks during lunch breaks, most of which are fried and sweet foods[30]. In addition, teachers' daily food intake patterns show that in the morning they tend to consume more carbohydrates, during the day they consume more protein, and at night they consume more fat and carbohydrates[41]. In addition, an unbalanced diet can lead to overnutrition. A person's weight can increase if they regularly consume more calories than their body needs because the extra calories are stored as fat[17].

Overview of Vegetable and Fruit Consumption

Referring to Table 1, it was found that the majority of respondents showed insufficient consumption levels respectively for vegetable consumption (99.2%) and fruit consumption (69.4%). The level of fiber intake obtained from vegetables and fruits is in the category of less in educators[44]. Vegetable and fruit consumption is often associated with the incidence of obesity. Water soluble fibers, such as pectin found in vegetables, fruits, and nuts, play an important role in controlling body weight and reducing the incidence of obesity[45]. Foods with high levels of fiber take longer to dissolve in digestion and this can increase food volume, helping to prevent the risk of overeating[22].

Overview of Nutrition Knowledge

Referring to Table 1, 81 respondents had a poor level of nutritional knowledge (66.9%) with a median nutritional knowledge score of 65. It is also presented in previous studies that the health and nutrition knowledge of school teachers before receiving training interventions on health and nutrition was poor with an average score of 57.62[46]. This study also explained that the lack of nutritional knowledge in teachers was often found in the questions regarding the content of balanced nutrition guidelines, macro and micro nutritional needs in a day, and the role of nutrients in the body. This lack of nutritional knowledge is due to various reasons, such as not being able to understand the information well or forgetting the various nutritional information that has been given. The relationship between nutritional knowledge and obesity emphasizes the importance of understanding a healthy diet to maintain optimal body weight. Lack of nutrition knowledge can lead to unhealthy food choices, which in turn increases the risk of obesity[25].

Relationship between Age and Overnutrition

Table 2 shows that age has a significant association with overnutrition (p-value<0.05). The data indicates that the at-risk age group (35-60 years old) has a higher proportion of overnutrition, at 63.5%, compared to the non-risk age group (41.7%). This finding confirms that age is one of the important factors affecting the incidence of overnutrition.

The results of this study support several previous studies which say that there is a correlation between age and obesity[9,47–49]. Age is one of the dominant risk factors after gender[49]. Although obesity can be experienced by individuals in various age groups, ranging from children to the elderly, the highest prevalence of obesity is found in the 35-60 years age group. This suggests that individuals in this age range face a greater risk of obesity compared to other age groups. Statistics show that the risk of obesity increases by 1.02 times higher in individuals who are in the older age group[10].

Various other factors may support the theory of a relationship between age and the incidence of obesity. There is a significant trend that physical activity levels in various aspects of life begin to decline in adulthood. One of the most prominent aspects is the decline in physical fitness[50]. This decline occurs for several reasons, including the natural physiological changes that occur with age, such as a decrease in muscle mass or sarcopenia which is ultimately associated with the incidence of obesity[51]. In addition, as we age, the body tends to store more fat, meaning the amount of fat in the body

increases as muscle tissue decreases[8,49].

Table 2. Analysis of factors associated with overnutrition among high school teachers in Bogor City

Variables	Not Overnutrtion		Overnutrition		p-value (CI 95%)
	n	%	n	%	
Age					
Not at risk	21	58.3	15	41.7	0.043*
At risk	31	36.5	54	63.5	
Gender					
Male	14	31.8	30	68.2	0.092
Female	38	49.4	39	50.6	
Family Income					
Low	33	58.9	23	41.1	0.002*
High	19	29.2	46	70.8	
Physical Activity					
Less	30	35.7	54	64.3	0.026*
Adequate	22	59.5	15	40.5	
Stress Level					
Not stressed	22	36.7	38	63.3	0.228
Stress	30	49.2	31	50.8	
Energy Intake					
Adequate	52	78.8	14	21.2	<0.001*
Over	0	0	55	100	
Protein Intake					
Adequate	48	87.3	7	12.7	<0.001*
Over	4	6.1	62	93.9	
Fat Intake					
Adequate	50	82	11	18	<0.001*
Over	2	3.3	58	96.7	
Carbohydrate Intake					
Adequate	37	92.5	3	7.5	<0.001*
Over	15	18.5	66	81.5	
Vegetable Consumption					
Less	52	43.3	68	56.7	1.000
Adequate	0	0	1	100	
Fruit Consumption					
Less	33	39.3	51	60.7	0.300
Adequate	19	51.4	18	48.6	
Nutrition Knowledge					
Less	24	29.6	57	70.4	<0.001*
Good	28	70	12	30	

*) There is a significant relationship.

Amerta Nutrition

e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
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Relationship between Gender and Overnutrition

As presented in Table 2, the results showed that gender had no association with overnutrition (p-value>0.05). However, this analysis found that the percentage of female respondents who were overnutrition was lower (50.6%) compared to male respondents (68.2%). This indicates that there is a tendency for the distribution of overnutrition to differ by gender, although it is not statistically significant.

The results of this study are in line with previous studies, where researchers described no correlation between gender and obesity[52,53]. These findings suggest that there is no association between gender characteristics and overnutrition because the majority of participants were female and gender is not the sole factor influencing overnutrition[53]. Although this study did not find an association between gender and overnutrition, there is still a trend that obesity is more common among women than men. Women have twice the risk of being overweight or obese, and tend to be more susceptible to obesity-related comorbidities[54].

The basal metabolic rate in women is approximately 10% lower than in men, resulting in a reduced caloric expenditure at rest and a higher propensity for converting food into fat[10]. Furthermore, women typically possess less muscle mass than men. Since muscle tissue is more metabolically active and burns more fat than other types of cells, women are less efficient at burning body fat[37]. These physiological differences contribute to variations in energy metabolism and fat storage between men and women.

Relationship between Family Income and Overnutrition

Referring to Table 2, it was found that 23 respondents (41.1%) with low income experienced overnutrition, while 46 respondents (70.8%) with high income experienced the same problem. The Chi Square test revealed a significant relationship between family income and overnutrition (p-value<0.05). This indicates that overnutrition is more common in families with higher incomes, especially in urban areas. Based on the results of this study, family income may be a factor influencing the prevalence of overnutrition.

This study supports previous research that describes the correlation between family income and the incidence of obesity[9,11,55]. Family income is a factor that affects a person's nutritional status, especially in the incidence of obesity, although the effect is indirect. The family's ability to meet basic needs, such as the selection of the type and amount of food and lifestyle changes, is strongly influenced by the level of family income. Therefore, family income has an important role in determining the quality and quantity of food that can be accessed by each family member[27].

Higher income levels generally provide families with increased resources, enabling them to afford a more diverse and nutritionally balanced diet[27]. However, families with high income levels may be more likely to opt for convenient but less healthy fast food, which may be a contributing factor to the incidence of obesity[28]. Those with higher family income are 4.1 times more likely to be obese than those with lower income[55]. The prevalence of obesity tends to be higher in families that have a high or stable income[56]. People who live in urban areas tend to have higher opportunities to buy and consume meat, snacks, ready meals, and soft drinks[57]. Besides food choices, lifestyle also plays an important role in the increasing prevalence of obesity among urban residents. Individuals with higher incomes generally have jobs that involve less physical activity, tend to require long periods of sitting and little movement, leading to lower energy expenditure[58].

Relationship between Physical Activity and Overnutrition

Based on the results of the study presented in Table 2, it was found that 54 respondents (64.3%) with overnutrition status had insufficient physical activity levels, while 14 respondents (20.4%) had sufficient physical activity levels. Chi-square test showed an association between physical activity and overnutrition (p-value<0.05). This finding shows that the majority of respondents lack adequate physical activity to maintain optimal health. According to some respondents, work demands, fatigue, the habit of carrying personal transportation, and sedentary habits such as watching television or playing cellphones during leisure time are the main reasons why they rarely do physical activity.

The results of this study support several previous studies which state that there is a correlation between physical activity and overnutrition[41,59–61]. One of the variables that influence nutritional status is physical activity[62]. Respondents who do not have a job or have a low level of physical activity have a 1.1 times greater risk of obesity[61]. Physical activity can account for 20-50% of energy expenditure, therefore, someone who rarely does physical activity can make the food consumed not burn completely and there is a buildup of fat in the body[63]. There are various reasons why teachers have low physical activity, such as only 10 minutes of physical activity in 5 days, work demands, fatigue, and other household chores that are assisted by other people[41].

Physical activity is an important factor in both physical and mental health. Physical activity does not always have to be a regularly scheduled exercise. Various activities that encourage a person to stay active can be an effective effort to increase endurance[61]. Physical activity can also increase muscle mass and accelerate the burning of energy in the body[60]. Moderate intensity physical activity can reduce or overcome complaints experienced during menopause[64]. In addition, physical activity can help prevent stress, control mood, and improve sleep quality[65].

Relationship between Stress Level and Overnutrition

As outlined in Table 2, it was found that the level of stress had no association with the problem of overnutrition (p- value>0.05). The results showed that more respondents who were not stressed were overnutrition (58%) compared to respondents who felt stressed (53.8%). This shows that the majority of respondents with overnutrition are able to manage stress well. They do not respond to stress by eating foods that are high in energy and fat as a coping mechanism.

These findings are consistent with previous studies that did not find a positive relationship between

stress levels and overnutrition[59,66,67]. Based on the univariate analysis in this study, it was found that there was no significant difference between the non-stressed and stressed respondent groups, which is why the stress level factor did not significantly affect the incidence of overnutrition. However, the findings of this study contradict previous research which revealed that there was a correlation between stress levels and obesity (p-value=0.005) in high school teachers[16]. When experiencing stress, many people tend to seek comfort through foods that are high in calories as a form of coping, resulting in weight gain and increasing the risk of obesity[14].

Based on Table 2, it was found that more of the non-stressed group were overnutrition, and vice versa. Stress is often associated with overnutrition, but stress is not the only factor that affects weight gain[68]. The case of respondents who are stressed but not overnutrition is due to acute and chronic stress conditions that can affect appetite due to the work of noradrenaline and Corticotropin-Releasing Hormone (CRH) hormones which can ultimately cause a person to lose appetite[66]. High stress levels in high school teachers can also lead to reduced physical activity as well as reduced diet and consumption of foods that are high in carbohydrates[16].

Relationship between Food Intake and Overnutrition

Referring to Table 2, it was found that there was a significant association (p-value<0.001) between energy intake, protein intake, fat intake, and carbohydrate intake with overnutrition, but the level of vegetable and fruit intake was found to have no association with overnutrition (p-value>0.05). However, there is a trend that individuals with low vegetable and fruit intake are more at risk of overnutrition. Dietary intake includes all types of food and beverages consumed by the body every day. In general, dietary intake analysis is conducted to relate it to the level of nutritional status of individuals or populations in an area[69].

This finding is in line with other studies that identified an association between energy intake and the incidence of overnutrition[41,70,71]. Weight gain is strongly influenced by total energy intake. The main elements of energy balance include energy intake, expenditure and storage[59]. Energy that comes in more than the body needs will be stored as fat or other tissues. If this situation continues, it can lead to obesity and even complications[62].

This finding is also in line with previous research which explains that protein intake has a relationship with overnutrition[20,72]. Protein intake also affects a person's nutritional status[73]. Protein intake that is often consumed by respondents is chicken meat, chicken eggs, beef, tofu, and tempeh, which are often processed by frying or with stews and chili sauce. These foods often also contain high cholesterol and saturated fatty acids, which can have a negative impact on health. The combination of protein and saturated fat consumption can trigger insulin resistance, which is associated with obesity[67].

The results of the analysis of fat intake in this study are also in line with previous studies that show a significant correlation between fat intake and obesity problems[20,73]. High fat intake in respondents is due to the

habit of eating fried foods or using a lot of coconut milk such as fried chicken, foods with curry or rendang spices, and also fried foods such as cassava, tempeh, or fried tofu. Fatty foods have high energy or calories so that excessive fat intake can improve a person's nutritional status, which can also be a risk factor for obesity[59,74].

Findings from previous studies that suggest a strong correlation between carbohydrate intake and obesity also support the results of the analysis of carbohydrate intake and overnutrition in this study[20,73]. High carbohydrate consumption is due to respondents who often consume rice as the main carbohydrate, noodles, especially instant noodles, packaged bread, and fried cassava. Sources of non-complex carbohydrates are also obtained from the consumption of sugar in tea, coffee, and packaged milk. The body uses carbohydrates as one of its main sources of energy. Frequent and excessive consumption of carbohydrates can increase the body's energy reserves and can cause obesity due to fat accumulation[62,73].

This analysis of vegetable and fruit consumption is consistent with previous research which states that vegetable and fruit consumption has no relationship with the problem of overnutrition[75,76]. The results of this study showed that respondents' vegetable and fruit intake was more at the underconsumption level, making the comparison between underconsumption and adequate consumption levels of vegetables and fruits look very contrasting, which in turn did not find an association between the level of vegetable and fruit consumption and the incidence of overnutrition Respondents prioritized macronutrient intake from 3 large meals over vegetable and fruit intake, which explains why consumption of these foods is low. Vegetable and fruit consumption is not a factor that plays a major role in the incidence of obesity[49]. The dominant factors that lead to obesity are macronutrient intake and physical activity level[59].

Relationship between Nutrition Knowledge and Overnutrition

The results in Table 2 show that 57 respondents (70.4%) with poor nutritional knowledge were overnutrition while 12 respondents with good nutritional knowledge were overnutrition. Based on the Chi Square test, the nutritional knowledge factor was found to have a significant correlation with overnutrition (p-value<0.001). This indicates that people with poor nutritional knowledge are more at risk of overnutrition than those with good nutritional knowledge.

The findings of this study are in line with previous studies which state that there is a significant relationship between nutritional knowledge and the incidence of obesity[24,77,78]. Nutritional knowledge is the foundation for a person to make healthier food choices. Individuals who understand nutrition and food can more effectively assess and determine foods that suit their needs, therefore nutritional knowledge also affects a person's consumption patterns[24,79]. When people lack an understanding of the importance of balanced nutrition, they tend to make less healthy food choices[25]. For example, they may more often consume foods high in calories, sugar, saturated fat and sodium which can

increase the risk of body fat accumulation[80].

Nutritional knowledge is an in-depth understanding of the concepts and principles of nutrition science, which includes various information about nutrition, types of food, and their effects on overall body health[81]. One of the factors that influence a person's obesity is nutritional knowledge, as evidenced by the correlation between nutritional knowledge and nutritional status (p-value=0.007)[82]. Nutritional knowledge involves a complex cognitive process, in which individuals integrate nutritional information with their eating behavior. Understanding nutrition is not only limited to knowing nutritional facts, but also involves the ability to apply this knowledge in daily eating habits[83].

Analysis of Variable Differences between Public and Private School Groups

This study has gone through the Mann-Whitney test or the difference test between two different groups to see if there are differences between variables in public and private school groups. Referring to Table 3, it was found that there were significant differences in the variables of physical activity, stress level, protein intake, fat intake, carbohydrate intake, and vegetable and fruit consumption in public schools and private schools (p-value<α), while the other four variables did not have significant differences. Based on the results of the study, vegetable and fruit consumption are factors that have a very significant difference compared to other factors.

A significant difference was seen in the level of physical activity. When viewed from the results of the study, it was found that a sufficient level of physical activity occurred among respondents working in private schools. Based on observation, more respondents in public schools use private vehicles compared to respondents in private schools. There are various reasons why teachers have low levels of physical activity, including only doing physical activity for about 10 minutes in five days, busy work demands, fatigue, and household chores that are often assisted by the services of others[41]. Some respondents who teach in private schools often use public transportation to get to and from work, so they still have to walk around 10-30 minutes to find their usual transportation.

The highest level of stress was also found among respondents working in public schools. The work demands on the respondents were fairly similar, but when the data collection took place, public schools were conducting activities and preparing for further activities

including preparing religious events for students, teachers, and educators in the past week so that the workload was denser than when collecting data in private schools. One of the stressors that plays a major role in the stress level of high school teachers is the increased workload, where they have to provide more performance compared to the previous days[84]. However, this is also not entirely a factor in the difference in stress levels in public and private schools because the measurement of stress is quite personal so that each person's assessment of the stressors received will be different every time.

In addition, in the food intake variable, significant differences were found in the intake of protein, fat, and carbohydrates. The results of protein intake did not have significant differences in the type of food but were seen in differences in food portions only. Then for fat intake, it was found that the highest fat intake was seen in the public school group. This is probably because when data collection occurred, the school was holding many events to prepare for the end of the semester and also religious events so that they often get high-fat foods such as fried or coconut milk side dishes during the event. Then the highest carbohydrate intake was also found in the public school group. This is because respondents in the public school group still often have breakfast, either in large or small portions compared to the private school group. In addition, the habit of consuming noodles is also quite high in the public school group compared to the private school group.

Furthermore, there were also differences in vegetable and fruit consumption. The highest vegetable consumption was found in the private school group, while the highest fruit consumption was found in the public school group. During data collection through the SQ-FFQ questionnaire, it was seen that respondents in the private group consumed vegetables more often than fruit. The researcher assumed that the level of personal preference and fondness for eating vegetables is the reason why the level of vegetable consumption has a significant difference. According to observations, in public schools, fruit baskets are often provided in each room and respondents are also free to take the fruit they want compared to workplaces in private schools. The close proximity between the fruit shop and the public school makes it easier for the school to supply fruits in each room. In addition, respondents also admitted that they often ate fruit at home, especially bananas, papayas, oranges and watermelons that they bought from the fruit shop near the school.

Table 3. T-tests on risk factor variables between public and private high school teacher groups

Variables	Group		p-value
	Public School (n=60) Mean Rank	Private School (n=61) Mean Rank	
Physical Activity	50.50	71.33	0.001*
Stress Level	67.69	54.42	0.036*
Energy Intake	61.83	60.18	0.795
Protein Intake	70.36	51.80	0.004*

Fat Intake	68.75	53.38	0.016*
Carbohydrate Intake	68.90	53.23	0.014*
Vegetable Consumption	46.76	75.01	<0.001*
Fruit Consumption	77.34	44.93	<0.001*
Nutrition Knowledge	61.26	60,75	0.935
Family Income	55.73	66.19	0.057
Nutrition Status	59.83	62.15	0.717

*) There is a significant difference in each risk factor in two different groups.

Pros and Cons of Research

This study presents current and up-to-date data on factors associated with overnutrition among high school teachers in Bogor City, as well as differences between risk factors among teachers teaching in public and private schools. However, this study has several limitations in its implementation and interpretation. The measurement of food intake over the past 1 month relied on respondents' memory, which could potentially result in inaccurate answers due to the limited memory of the respondents, which could lead to respondents overestimating or underestimating their answers. This study also did not fully consider other variables that may contribute to the problem of overnutrition in high school teachers, such as genetic factors, consumption of risky foods, and work environment. In addition, in collecting data on food intake, researchers did not further explore the types of food commonly served at each school, which could provide additional information in analyzing differences in variables between groups.

CONCLUSIONS

Factors significantly associated with overnutrition were age, family income, physical activity, energy intake, protein intake, fat intake, carbohydrate intake, and nutritional knowledge. In addition, there were significant differences in the risk factors of physical activity, stress level, protein intake, fat intake, carbohydrate intake, and vegetable and fruit consumption between public and private schools. Respondents are advised to increase their attention to their personal health and implement healthy lifestyles such as increasing physical activity or exercise, choosing and buying healthy and quality food, maintaining a daily diet, and increasing knowledge and understanding of health, nutrition and food to prevent overnutrition problems.

ACKNOWLEDGEMENT

CONFLICT OF INTEREST AND FUNDING DISCLOSURE

AUTHOR CONTRIBUTIONS

LMRL: conceptualization, investigation, methodology, analysis, supervision, writing-original draft and editing; UW: methodology, supervision, writing-review editing; AQM: supervision, writing-review and editing.

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