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Body mass index of adults, pre-elderly and elderly in Indonesia (Indonesian Family Life Survey 2014)

Ratu Ayu Dewi Sartika & Eka Rosiyati

Department of Public Health Nutrition, Universitas Indonesia, Depok, Indonesia

ABSTRACT

Introduction: Nutritional status is an indicator of health status that can be determined using the Body Mass Index (BMI) (kg/m^2). This study aimed to determine factors affecting the nutritional status of adults, pre-elderly, and elderly. **Methods**: This cross-sectional study used secondary data from 13,655 respondents aged 36–66 years that were a part of the 2014 Indonesian Family Life Survey (IFLS). Food consumption patterns, physical activity, and socio-demographic data were used to assess nutritional status (BMI). **Results**: Consumption patterns of carbohydrates, protein, fat, vegetables, and fruits were significantly associated with mean BMI as an increase in consumption score led to an increase in mean BMI. Conversely, greater physical activity resulted in a decrease in mean BMI. Mean BMI among females was higher than that of males, irrespective of factors such as marital status, unemployment, presence of health insurance, or smoking. Sumatranese people had the highest mean BMI among the population, along with senior high school graduates and high-income earners. Both higher income and education levels led to higher mean BMI. **Conclusion**: Many factors were shown to affect nutritional status. The results imply that solving nutritional problems in order to improve quality of life will involve many factors, including socioeconomic variables, which are important for designing and evaluating health programmes.

Keywords: Nutritional status, adults, pre-elderly, elderly, factors

INTRODUCTION

Nutritional status is an indicator of health status that can be determined using the Body Mass Index (BMI). BMI is a metric currently used for defining anthropometric characteristics of weight and height in adults, pre-elderly, and elderly, and can be used to classify these populations into relevant groups. The Indonesian Ministry of Health (2013) has stratified BMI as thin (<18.0kg/m^2), normal (≥18.0 – <24.9kg/m^2), overweight (≥25.0 – <27.0kg/m^2), and obese (≥27.0kg/m^2). Numerous clinical consensus panels and public health organisations have recommended that persons with a BMI of ≥30kg/m^2 or those with risk factors of obesity and a BMI of ≥25kg/m^2 to achieve and maintain a lower weight. Additionally, a study by Hwang *et al.* (2009) found that BMI is a predictor of mortality in the elderly, with obesity (BMI >25kg/m^2) being a significant independent predictor for all-cause mortality and overweight (BMI >23kg/m^2) elevating the risk of mortality due to cancer, cardiovascular disease, and diabetes. Furthermore, the prevalence of all risk factors in adults, except for diabetes, decreases

*Corresponding author: Prof. Ratu Ayu Dewi Sartika
Department of Public Health Nutrition, Universitas Indonesia, Depok, Indonesia
Tel: (+62)7863501; Fax: (+62)7863501; E-mail: ratuayu.fkm.ui@gmail.com
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with a greater reduction in BMI among overweight and obese individuals (Gregg *et al.,* 2006).

The prevalence of obesity in Indonesia continues to increase in both adult men and women (>18 years old). In the last 6 years, the prevalence of obesity among adult women has increased 19.0% (13.9% in 2007 to 32.9% in 2013) and 5.8% among adult men (13.9 % in 2007 and 19.7% in 2013) (MOH Indonesia, 2013). BMI is an accepted index of obesity in individuals and is also a risk factor for the development of or assessing the prevalence of health concerns, apart from being used for determining public health policies (Nuttal, 2015). Diet, physical activity, and nutritional status are recognised as major determinants of health that are required to monitor direct or indirect changes associated with public health projects (Castetbon *et al.*, 2009).

This study aimed to determine factors affecting the nutritional status of the adult, pre-elderly, and elderly populations in Indonesia using secondary data from the Indonesian Family Life Survey (IFLS) 2014. Specifically, this study sought to answer the following: 1. Socio-demographic profile of the Indonesian people in terms of age, gender, marital status, ethnicity, education, working status, income status, health insurance, smoking status; 2. Nutritional status; 3. Physical activity level; 4. Food consumption patterns; 5. Relationship between socio-demographic and nutritional status; 6. Relationship between physical activity and nutritional status; and 7. Relationship between food consumption patterns and nutritional status.

MATERIALS AND METHODS

A cross-sectional study design was determined to be the best method for analysing BMI and other factors among individuals for a certain time period. This study used secondary data collected during the IFLS, which is publicly accessible at the IFLS5 (2014) domain. Data for IFLS5 were collected between September 2014 and May 2015, and covered 13 selected provinces from IFLS or Sakerti (Indonesian Life Households Survey); specifically, four provinces in Sumatera (North Sumatera, West Sumatera, South Sumatera and Lampung), five provinces in Java (DKI Jakarta, West Java, Yogyakarta, East Java), and four other provinces, including a group of large islands (Bali, West Nusa Tenggara Barat, South Kalimantan, and South Sulawesi). Together, these provinces represented approximately 83.0% of the Indonesian population (Strauss *et al.*, 2009). The study population (N=13,655) comprised of adults (n=10829, 36–55 years), pre-elderly (n=1256, 55–59 years), and elderly (n=1570, 62–66 years). This research divided adults into two groups, young adults aged 36-45 years and late adults aged 46-55 years.

Data were collected from adults, pre-elderly and elderly in 2014, and were categorised based on gender. The independent variables for this study were socio-demographic characteristics, physical activity, and consumption patterns, while the dependent variable was nutritional status (BMI). Socio-demographic variables assessed included age, sex, marital status, ethnicity, education, employment status, income status, health insurance, and smoking status. Subjects were divided into three groups in terms of physical activity as: 1. Not performing regular physical activity (mild, moderate or heavy), 2. Performing physical activity (mild, moderate or heavy) for a period of <30 minutes per day, and 3. Performing regular physical activity (mild, moderate or heavy) for a period of ≥30 minutes per day. Consumption patterns were categorised

into five groups as: 1. Carbohydrate consumption, 2. Protein consumption, 3. Fat consumption, 4. Vegetable consumption, 5. Fruit consumption. Physical activity patterns based on a duration of <30 minutes or ≥30 minutes and dietary intake based on frequency (days per week) were determined using questionnaires (secondary data). Univariate and bivariate analyses were performed using the SPSS programme. Univariate analysis was performed as frequency distribution in mean and standard deviation, as well as size of frequency for categorical data, including age, sex, marital status, ethnicity, education, employment status, income status, health insurance, and smoking status. Bivariate analysis was performed using analysis of variance (ANOVA) and independent *t*-test, while Pearson correlation was used to determine the relationship between independent variables and BMI.

RESULTS

The respondents predominantly (47.1%) belonged to the age group of 36–45 years, while 32.2% were aged 46–55 years, 9.2% were aged 56–59 years, and 11.5% were aged 60–66 years (Table 1). The gender of respondents was evenly distributed as 51.1% were females and 48.9% were males. Most respondents were married (86.5%), were Javanese (62.8%), had graduated from senior high school (32.0%), were employed (82.0%), possessed health insurance (50.8%) and were non-smokers (59.7%). In terms of income, as shown in Table 1, only 4.7% of respondents were in percentile 2, which corresponds to an income of lesser than 1000,000 rupiahs per year, while many respondents were in percentiles 1, 4, and 5 (24.0% for all).

This study also aimed to obtain information on the consumption patterns, physical activity, and nutritional status of respondents. A consumption score was calculated for each type of nutrient, namely carbohydrate, protein, fat, vegetables, and fruits. These scores were then used to analyse consumption patterns. Table 2 shows that respondents often consumed carbohydrates (55.2%), proteins (52.3%), and fats (64.6%) in a week, but rarely consumed vegetables (52.9%) or fruits (51.5%). With respect to physical activity, most of the respondents reported engaging in physical activity for ≥30 minutes per day (69.8%), while the proportions of those who did not engage in any physical activity (16.4%) or those who did for <30 minutes (13.8%) were lower. Most of the respondents (53.3%) had good nutritional status, while the proportions of obese, overweight, and underweight respondents were 23.7%, 16.6%, and 6.4%, respectively.

Table 3 using bivariate analysis revealed a significant relationship between mean BMI and various socio-demographic characteristics, consumption patterns, and level of physical activity ($p<0.05$). The mean BMI in adults (24.3kg/m^2) was higher than that of both the pre-elderly (23.9kg/m^2) and the elderly (23.2kg/m^2). Gender of the respondents was also significantly related to mean BMI ($p<0.05$) as mean BMI in females (25.0kg/m^2) was higher than that of males (23.2kg/m^2). Marital status had a significant relationship with mean BMI ($p<0.05$), whereby married respondents had a higher BMI (24.2kg/m^2) than respondents who were not married (23.7kg/m^2). Sumatranese were found to have the highest mean BMI (24.4kg/m^2), implying that ethnicity may affect mean BMI ($p<0.05$).

The mean BMI of respondents was significantly related to their education level as a higher education was correlated with a higher mean BMI, and the highest mean BMI (24.7kg/m^2) was recorded among respondents who had graduated from senior high school. Mean

Table 1. Socio-demographic profile of respondents (*N*=13,655)

Variables	*n*	*%*
Age (years)		
36–45	6428	47.1
46–55	4401	32.2
56–59	1256	9.2
60–66	1570	11.5
Gender		
Female	6973	51.1
Male	6682	48.9
Marital status		
Married	11816	86.5
Not married	1839	13.5
Ethnicity		
Sumatera	1861	13.6
Jawa	8578	62.8
Other	3216	23.6
Level of education		
Not graduated in Primary School	4014	29.4
Graduated from Primary School	3413	25.0
Graduated from Junior High School	1862	13.6
Graduated from Senior High School	4366	32.0
Working status		
Unemployed	2457	18.0
Employed	11198	82.0
Health insurance		
Do not have	6721	49.2
Have	6934	50.8
Income status (per year)		
Percentile 1 (Rp 0)	3276	24.0
Percentile 2 (<Rp 1,000,000)	635	4.7
Percentile 3 (≥Rp 1,000,000 – <Rp 10,000,000)	3192	23.4
Percentile 4 (≥Rp 10,000,000 – <Rp 20,000,000)	3271	24.0
Percentile 5 (≥ Rp 20,000,000)	3281	24.0
Smoking status		
No smoking	8149	59.7
Smoking	5506	40.3

BMI increased with increasing income, whereby respondents with the highest income (>20 million rupiahs) had the highest mean BMI (24.7kg/m^2).

A significant negative relationship was observed between mean BMI with employment status and having medical insurance (p<0.05 for both). The mean BMI of unemployed respondents (24.9kg/m^2) was higher than that of employed respondents (23.9kg/m^2). Furthermore, respondents possessing health insurance had a higher mean BMI (24.3kg/m^2) than those without health insurance (23.9kg/m^2). The higher mean BMI of those who were unemployed may have been caused by the lack of physical activity in this population. Non-smokers had a greater BMI (24.9kg/m^2) than smokers (22.9kg/m^2). The mean BMI of respondents was significantly related to physical activity. Respondents who did not have any physical activity (24.3kg/m^2) or were engaged in <30 minutes per day of physical activity (24.4kg/m^2) had greater mean BMI than respondents

Table 2. Consumption patterns, physical activity and nutritional status of respondents (*N*=13,655)

Variables	*n*	*%*
Consumption of carbohydrates		
Seldom (<3 days/week)	6117	44.8
Often (≥3 days/week)	7538	55.2
Consumption of proteins		
Seldom (<2 days/week)	6507	47.7
Often (≥2 days/week)	7148	52.3
Consumption of fats		
Seldom (<1 days/week)	4838	35.4
Often (≥1 days/week)	8817	64.6
Consumption of vegetables		
Seldom (<3 days/week)	7220	52.9
Often (≥3 days/week)	6435	47.1
Consumption of fruits		
Seldom (<1 days/week)	7037	51.5
Often (≥1 days/week)	6618	48.5
Physical activity		
No physical activity	2245	16.4
Physical activity <30 min	1882	13.8
Physical activity ≥30 min	9528	69.8
Nutritional status		
Underweight (BMI <18.5kg/m^2)	875	6.4
Normal (BMI ≥18.5 - <24.9kg/m^2)	7280	53.3
Overweight (BMI ≥24.9 - <27.0kg/m^2)	2266	16.6
Obese (BMI ≥27.0kg/m^2)	3234	23.7

who were engaged in physical activity for ≥30 minutes per day (24.0kg/m^2). A significant positive relationship was seen between consumption patterns and mean BMI (p<0.05). Table 3 shows that respondents who frequently consumed carbohydrates, proteins, fats, vegetables, and fruits in a week had greater mean BMI than those who did not, implying that when various nutritional needs are met, the individual's nutritional status remains adequate.

DISCUSSION

In this study, BMI in adults was higher than that of both the pre-elderly and elderly. Meeuwsen, Horgan & Elia (2010) have stated that differences in age, BMI distribution, and possible loss of muscle may be compensated by an increase in other body components, and that it may be due to age-related decrease in the extracellular fluid relative to intracellular water (an indicator of body cell mass), especially in the elderly. Another explanation is survival bias. Obese persons are more likely to die earlier at a younger age, so those who survived into old age are selectively healthier. This commensurates with the recent observation of a population sub-group of obese people who were 'metabolically healthy' and therefore confounded due to prior disease-associated unintentional weight loss (Ng *et al.*, 2017).

Gender was significantly related to BMI, whereby females had a higher BMI than males. This difference can be attributed to body composition differences between males and females, as females generally have a higher percentage of body fat than males. Data from the study by Blaak (2001) also

Table 3. Relationship between socio-demographics, consumption patterns and physical activity with mean BMI of respondents (*N*=13,655)

Variables	*BMI (kg/m²) Mean (SD)*	*p-value*	*95% CI*
Age (years)			
36-45	24.3 (3.9)	<0.001***	-1.35 – -0.76
46-55	24.3 (3.9)	<0.001***	-1.35 – -0.74
56-59	23.9 (4.0)	<0.001***	-1.03 – -0.24
60-66	23.2 (3.9)		
Gender			
Female	25.0 (4.0)	<0.001***	1.73 – 1.99
Male	23.2 (3.6)		
Marital status			
Not Married	23.7 (3.9)	<0.001***	-0.71 – -0.32
Married	24.2 (3.9)		
Ethnicity			
Sumatera	24.4 (3.9)		
Jawa	24.2 (3.9)	0.049*	0.00 – 0.48
Lainnya	23.9 (3.9)	<0.001***	0.28 – 0.84
Education			
Not graduated in Primary School	23.6 (4.0)		
Graduated in Primary School	23.9 (3.9)	0.005**	-0.54 – -0.07
Graduated in Junior High School	24.3 (3.9)	<0.001***	-1.06 – -0.48
Graduated in Senior High School	24.7 (3.8)	<0.001***	-1.41 – -0.96
Working status			
Unemployed	24.9 (4.0)	<0.001***	0.79 – 1.15
Employed	23.9 (3.9)		
Income			
Percentile 1 (Rp 0)	24.6 (4.1)	<0.001***	-1.53 – -0.58
Percentile 2 (< Rp 1,000,000)	23.5 (4.0)		
Percentile 3 (≥ Rp 1,000,000- < Rp 10,000,000)	23.6 (3.9)	1.000	-0.58 – 0.37
Percentile 4 (≥ Rp 10,000,000- < Rp 20,000,000)	23.7 (3.8)	1.000	-0.63 – 0.32
Percentile 5 (≥ Rp 20,000,000)	24.7 (3.8)	<0.001***	-1.67 – -0.71
Health insurance			
Don't have	23.9 (3.9)	<0.001***	-0.41 – -1.46)
Have	24.3 (3.9)		
Smoking status			
No smoking	24.9 (3.9)	<0.001***	1.80 – 2.07
Smoking	22.9 (3.7)		
Physical activity			
No physical activity	24.3 (4.0)	0.01*	-0.54 – -0.05
Physical activity <30 min	24.4 (3.9)	<0.001***	-0.65 – -0.17
Physical activity ≥30 min	24.0 (3.9)		
Consumption of carbohydrates			
Seldom (<3 days/week)	24.0 (3.9)	0.002**	-0.34 – -0.08
Often (≥ 3 days/week)	24.2 (3.9)		
Consumption of protein			
Seldom (<2 days/week)	23.9 (3.9)	<0.001***	-0.58 – -0.31
Often (≥2 days/week)	24.4 (3.9)		
Consumption of Fat			
Seldom (<1 days/week)	23.9 (3.9)	<0.001***	-0.54 – -0.26
Often (≥1 days/week)	24.3 (3.9)		
Consumption of vegetables			
Seldom (<3 days/week)	24.0 (3.9)	0.049*	-0.27– -0.00
Often (≥ 3 days/week)	24.2 (3.9)		
Consumption of fruits			
Seldom (<1 days/week)	23.9 (3.9)	<0.001***	-0.68 – -0.41
Often (≥ 1 days/week)	24.4 (3.9)		

*p<0.05
**p<0.01
***p<0.001

showed that basal oxidation (adjusted for fat-free mass) is lower in females compared to males, thereby contributing to higher fat storage in women.

Marital status had a significant relationship with BMI, in which married respondents had a higher BMI than those who were not married. These results are in line with a study by Lipowicz, Gronkiewicz & Malina (2002) in Poland, which reported that married individuals had a higher BMI than those who were never married, in all age and educational groups analysed. Cobb *et al.* (2016) found that women gained more weight than men, and there was a stronger association between changes in the husband's BMI and that of the wife's, suggesting that marriage may lead to a wife's weight-related behaviours being influenced by their husbands, rather than vice-versa.

The result of BMI being related to education level is consistent with that reported by Zhoua *et al.* (2017), which stated that greater BMI was observed among those with elementary or higher education level compared to those who were less educated. Importantly, higher levels of education are associated with better socioeconomic status that is supported by greater incomes. Higher income therefore grants greater purchasing power to buy nutritious foods.

Non-smokers had a greater BMI than smokers. This is in agreement with results published by Jitnatrin *et al.* (2014) showing that BMI among male and female smokers were lower than male and female non-smokers, respectively. This may be due to the elevation in metabolic rate and/or reduced appetite caused by nicotine in smokers.

The benefits of optimum physical activity are apparent when BMI among respondents engaging in <30 minutes and ≥30 minutes per day of physical activity were compared as BMI decreased when duration of activity increased. Sun, Norman & While (2013) have reported that regular physical activity can lead to significant health improvements at all ages and that it can prolong the active years of independent living, apart from enhancing the quality of life for the elderly. Nelson *et al.* (2007) have recommended that the aim of physical activity for the elderly should be to increase the volume of aerobic physical activity to prevent unhealthy weight gain. There is evidence that an increase in physical activity is related to the prevention of weight gain, but a clear dose-response effect has yet to be established. The recommended goal includes moderate aerobic physical activity performed for 30–60 minutes per day. Interestingly, the fat-free mass accounts for 19.0% of weight gain due to decreasing physical activity while it represents 33.0% of weight loss in people who experience a decrease in weight (Hughes *et al.*, 2002). These observations imply that the duration of physical activity is related to body weight.

The strength of this study was that it represented the majority of the population in Indonesia which is spread across various provinces including urban and rural areas. The limitations of this study were its cross-sectional design and its use of bivariate, not multivariate analysis, to determine factors influencing BMI. Consequently, confounders could be adjusted for in this study. There were also limited information about portion of foods, variety of fruits and vegetables, duration of physical activity in this study.

CONCLUSION

Using BMI as an index, we showed that many factors affected nutritional status, such as age, gender, marital status, ethnicity, education, employment status, income status, health insurance,

smoking status, physical activity, and consumption patterns. These results strongly advocate the importance of nutrition improvement programmes that will help improve the quality of life among adults and elderly.

Authors' contributions

RADS, conceptualised and designed the study and reviewed the manuscript; ER, conducted the study, data collection, data analysis and drafting of the manuscript.

Conflict of interest

There is no conflict of interest

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