Regional differences in obesity prevalence and associated factors among adults: Indonesia Basic Health Research 2007 and 2013

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ABSTRACT

Background: Obesity prevalence has increased worldwide. Based on the Indonesia Basic Health Research (BHR), the prevalence of obesity among adults rose from 10.3% in 2007 to 15.4% in 2013. This study is aimed at examining selected obesity-related factors among adults aged 15 years and above from different regions of Indonesia. **Methods:** The BHR data comprising of 664,196 adults from 258,366 households in 440 districts in 2007, and 722,329 adults from 294,959 households 497 districts were included in this analysis. Frequency intake of fatty, sweet and salty foods, and status of physical activity were assessed using a validated questionnaire developed for IBHR. Mental health status was assessed using WHO Self Reporting Questionnaire. Logistic regression was performed to assess the risk factors of obesity. **Results:** Overall, obesity prevalence was 9.2% in 2007 and 14.2% in 2013. Obesity prevalence was comparatively higher in all regions in 2013, ranging from 14.1% to 15.5% in the western and eastern regions respectively. In 2007, the most likely risk factor contributing to obesity in the western and middle regions was frequent consumption of fatty food (OR=1.26 and OR=1.38, respectively), while physical inactivity (OR=1.27) was the highest odds for obesity risk in the eastern region. In 2013, frequent fatty food consumption showed the highest influence on obesity risk in all the regions. **Conclusion:** Risk factors for obesity in adults varied in different regions in Indonesia. Future research and interventions on obesity are recommended to focus on unhealthy dietary intake and lifestyles indifferent regions of Indonesia.

Keywords: Obesity, lifestyle trend, BMI, food consumption, physical activity

INTRODUCTION

According to WHO (2015), the prevalence of overweight and obesity globally have doubled since 1980, and it has reached epidemic levels. In United States, the prevalence of obesity increased dramatically from 22.6% (1996) to 40.2% (2014) and occurred dominantly in women (Ogden *et al.*, 2015). High BMI is associated with chronic diseases namely, cardiovascular diseases cancers, and chronic respiratory diseases. Besides, obesity also contributes to diabetes mellitus type 2. Roughly 50% of diabetic patients are obese (Abdelaal *et al.*, 2017). It is estimated that about 2.8 million mortality among adults occurs annually and is associated with overweight or

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obesity (Arojo & Osungbade, 2013).

Indonesia as a developing country also faces the obesity burden and this trend has been increasing annually. Based on the national survey of the Basic Health Research (BHR), the prevalence of obesity among Indonesian adults rose significantly from 10.3% in 2007 to 15.4% in 2013. Moreover, an increase on obesity prevalence significantly occurred in female adults, from 9.67% in 1993 to 19.64% in 2007 (Roemling & Qaim, 2012). The increase in obesity trend has resulted in high risk for morbidity and mortality among Indonesian adults. There has been a shift in the type of diseases that causes death among Indonesian adults, namely from infectious diseases to non-communicable diseases. Based on the five leading causes of mortality, four of five main causes of death are due to stroke, cancer, and diabetes mellitus (Moelok, 2017).

Fundamentally, obesity occurs due to an imbalance between intake and expenditure of calories. Excessive energy intake results in weight gain in the form of fat (Nestle & Nesheim, 2012). It is triggered by unhealthy behaviour, such as sedentary activity and unbalanced diet. The changes of lifestyle especially for people who live in urban areas are considered as an impact of westernisation in which people are encouraged to have unhealthy behaviours (Harrell *et al.*, 2015). Indeed, these behaviours might rise including in rural areas because the occurrence of inevitable nutrition transition (Khan & Talukder, 2013; Popkin, 2010).

Indonesia has three major regions with several provinces and hundreds of districts. There are main regions are the western, middle, and eastern part of Indonesia. The western part is mostly well developed because the capital city (Jakarta) is located in this region. While the middle part has been partially developed and others are growing, the eastern part is still largely left behind the other regions in terms of infrastructure and economic development. Because of its vastness, it leads to regional differences in characteristics (in terms of social, cultural and economic factors) which might result in different lifestyle patterns. It is hypothesised that obesity might be affected by the varying regional characteristics. This study aims to examine the differences of obesity prevalence and associated risk factors which might be varying among regions from 2007 to 2013.

MATERIALS AND METHODS

This study was a further analysis of Indonesia Basic Health Research (BHR) survey conducted in 2007 and 2013. Basic Health Research is a survey spearheaded by the Ministry of Health to describe and monitor the health condition of population in Indonesia. This survey included nutritional status component, a result of which is used in national policy-making.

The two datasets were obtained from the Research and Development of Health Agency, Ministry of Health. The samples of this study were individuals aged ≥15 years. The total number of samples in 2007 was 664,196 individuals from 258,366 households in 440 districts/cities. In 2013, a higher number of samples were shown, 722,329 individuals from 294,959 households spread over 497 districts. Data analysis was conducted from September 2016 to January 2017.

The characteristics of the respondent are presented by age, sex, education, occupation status, body mass index (BMI) value, waist circumference (WC), and smoking status. Education was divided into two categories, low (below secondary school) and high (secondary school and above). Occupation status was classified by employment and

unemployment (including student and housewife). Smoking status was categorised as smoking and not smoking. The dependent variable was obesity based on body mass index. According to Indonesian Ministry of Health, BMI ≥27 kg/m² was categorised as obese, while <27 kg/m² was normal weight (Hastuti *et al.*, 2017).

Weight, height, and WC measurements were collected with an anthropometric measurement kit from the Indonesian Ministry of Health. Independent variables including frequency consumption of fatty, sweet, and salty food, physical activity and mental health status were determined using the validated instrument of the BHR, 2013. Similar categories for these variables were also used in 2007, except for physical activity (PA) categorisation. For 2007, PA was categorised <150 minutes/day as low, ≥150 mins as high, while for 2013, PA was classified as low for sedentary activity of ≥five hours/day and as high PA for sedentary activity <five hours/day. The questions used to assess mental health status was translated from the Self-Reporting Questionnaire developed by WHO (Beusenberg *et al.*, 1994).

The two data sets were analysed separately. Univariate analyses were conducted to describe the participants' characteristics. Chi square test was used to determine the association between participants' characteristics and obesity status. Conditional logistic regression analysis was performed to examine the effect of single risk factor on obesity. Analysis is presented according to three regions of Indonesia namely, western (18 provinces), middle (11 provinces), and eastern (4 provinces). Data analysis was performed using SPSS software version 18 (IBM Corp., USA).

RESULTS

The characteristics of the respondents in 2007 and 2013 surveys are shown in Table 1. The mean of age of the respondents ranged between 38 to 39 years, with more than 51% females. A high proportion of the respondents in both years was from low socioeconomic status as characterised by occupational status (farmers 25.7% in 2007; 22.2% in 2013), unemployed (11.8%; 30.6%), and poor education level (27.8%; 29.0%). The percentage of unemployed was higher in 2013 (30.6%) compared to that in 2007 (11.8%).

Based on nutritional status, the mean BMI of the respondents were 22.00±3.69 kg/m² in 2007 and 22.77±4.18 kg/m² in 2013. However, their mean waist circumference was below normal at 76.42±11.28 cm in 2007 and 77.62±10.97 kg in 2013. The prevalence of obesity was higher in 2013 at 14.2% compared to 9.2% in 2007. Obesity prevalence was higher among the females and the unemployed respondents.

Figure 1 shows that in 2007, there were more areas/regions with prevalence of obesity considered as low namely, <9% and 10-19%. However, in 2013, there were less regions with obesity prevalence below 9%, while more regions were found with obesity prevalence >10-19%. The highest prevalence of obesity of 15.5% was in the eastern region namely, North Sulawesi and West Kalimantan. Overall, prevalence of adult obesity in all regions of Indonesia was higher in 2013 compared to that 2007.

The risk factors of obesity among Indonesian adults examined were (i) occupational status, (ii) consumption of fatty foods, salty food, and sweet food, (iii) physical activity, and (iv) mental health. Table 2 shows the results of the conditional logistic regression for

Table 1. Characteristics of respondents, 2003 and 2007

Variable	2007 (N=664,196)		2013 (N=722,329)	
	Mean±SD	%	Mean±SD	%
Age (years)	38.26±16.21		39.92±16.20	
Weight (kg)	53.88±10.15		55.91±11.23	
Height (cm)	156.39±8.07		156.69±8.47	
Body mass index (kg/m^2)	22.00±3.69		22.77±4.18	
Waist circumference (cm)	76.42±11.28		77.62±10.97	
National prevalence of obesity		9.2		14.2
Sex, female		51.9		51.8
Obesity by gender[*]				
Female		12.3		18.8
Male		5.9		9.2
Occupation, farmer		25.7		22.2
Occupation, unemployment		11.8		30.6
Obesity by occupation[*]				
Unemployment		10.3		15.1
Employment		8.5		13.5
Education, elementary school		27.8		29.0
Obesity by education[*]				
Low		8.3		12.7
High		11.7		17.3

[*]Chi-square test, significant at $p<0.001$

the odds ratios of these risk factors. Overall, unemployed status, compared to employed as a referent, showed the highest odds of adult obesity (OR=1.226 in 2007 vs OR=1.215 in 2013), followed by high frequency intake ("always"), compared to "seldom intake" of fatty foods (OR=1.21 in 2007 vs OR=1.141 in 2013,) and low physical activity (OR=1.197 in 2007 vs OR=1.126 in 2013).

Regional differences were found for adult obesity risks. In 2007, unemployment status ranked the highest risk for obesity in the western region (Sumatra & western Java) and middle region (central and eastern parts of Java including Bali). In 2013, unemployment remained the highest risk factor only in the western region. High frequency intake of fatty foods ranked among the higher risk factors in all the regions for both years. Low physical activity was also shown to be a high-risk factor of adult obesity in all regions especially in 2013.

Intake of salty and sweet foods were not shown to be risk factors of adult obesity in nationally and by regions in 2007 and 2013. Mental status (low versus normal) was also not found to contribute to adult obesity in Indonesia based on the BHR studied.

DISCUSSION

In general, the mean BMI and waist circumference of Indonesian adults remained within the normal range in 2007 and 2013. While the overall prevalence of adult obesity can be considered as relatively low compared to other countries, the level was higher in

Table 2. Conditional logistic regression analyses of obesity risk factors in 2007 and 2013

Variable (Referent variable)	Western Indonesia		Middle Indonesia		Eastern Indonesia		Nation	
	2007	*2013*	*2007*	*2013*	*2007*	*2013*	*2007*	*2013*
Occupation								
Unemployed (Employed)	1.237 (1.212 – 1.262)	1.245 (1.244 – 1.246)	1.281 (1.240 – 1.323)	1.133 (1.131 – 1.136)	1.129 (1.046 – 1.219)	0.856 (0.851 – 0.860)	1.226 (1.197 – 1.255)	1.215 (1.214 – 1.216)
Fatty food intake								
Always (Seldom)	1.210 (1.185 – 1.235)	1.104 (1.103 – 1.105)	1.250 (1.205 – 1.297)	1.290 (1.288 – 1.293)	1.126 (1.035 – 1.226)	1.382 (1.375 – 1.389)	1.217 (1.196 – 1.239)	1.141 (1.140 – 1.142)
Salty food intake								
Always (Seldom)	0.889 (0.872 – 0.907)	0.861 (0.861 – 0.862)	0.851 (0.822 – 0.881)	0.943 (0.940 – 0.945)	0.975 (0.899 – 1.059)§	1.002 (0.996 – 1.008)§	0.886 (0.872 – 0.901)	0.879 (0.878 – 0.880)
Sweet food intake								
Always (Seldom)	0.871 (0.850 – 0.892)	0.886 (0.865 – 0.867)	1.139 (1.095 – 1.184)	1.129 (1.126 – 1.132)	1.126 (1.015 – 1.248)	1.057 (1.051 – 1.063)	0.950 (0.931 – 0.969)	0.911 (0.910 – 0.912)
Physical activity†								
Low (High)	1.231 (1.196 – 1.267)	1.114 (1.112 – 1.115)	1.196 (1.142 – 1.252)	1.213 (1.210 – 1.216)	1.298 (1.166 – 1.445)	1.064 (1.058 – 1.071)	1.197 (1.169 – 1.225)	1.126 (1.125 – 1.127)
Mental health‡								
Low (Normal)	1.112 (1.078 – 1.146)	1.032 (1.030 – 1.034)	0.898 (0.853 – 0.945)	0.772 (0.768 – 0.776)	0.883 (0.772 – 1.009)§	0.877 (0.866 – 0.889)	1.040 (1.014 – 1.067)	0.984 (0.982 – 0.986)

†Cut-off: ≤150 minutes
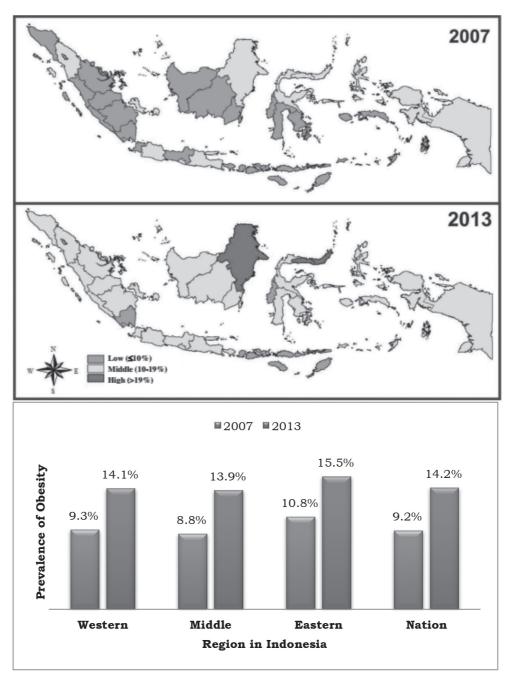‡Score cut-off: ≤6
§Not significant ($p>0.05$)

Figure 1. The trend of obesity prevalence of Indonesian adults from 2007 to 2013

2013 at 14.2%, compared to 9.2% in 2007. It is thus important to have an insight into the risk factors contributing to obesity among adults in Indonesia and according to the various regions.

Obesity prevalence in the western and middle regions was higher in 2013 compared to 2007, while that of the

eastern region remained at somewhat the same level. This might be due to the increasing number of towns and cities in the western and middle regions. The environment in city areas is described as obesogenic in exerting unhealthy influences leading to obesity (Lake & Townshend, 2006). Moreover, obesity risk was found to be high among the unemployed. The obesogenic environment tends to affect more the low income as they are not able to afford healthy choices e.g. in purchasing vegetables and fruits (Żukiewicz-Sobczak *et al.*, 2014).

Low physical activity was a leading risk factor of obesity in Indonesia with the middle region showing the highest risk in 2013. Physical activity levels could change within a few years with urbanisation (Downs *et al.*, 2012). Another important risk factor of obesity found is high frequency intake of fatty foods. A similar finding was reported previously in Bali and East Kalimantan Provinces (MoH, 2015).

Regional differences in adult obesity prevalence occur in other countries including United States (Myers *et al.*, 2015). Several attributing factors have been implicated, such as socio-economic, political, and cultural factors (Żukiewicz-Sobczak *et al.*, 2014, beside sedentary behaviour and excessive consumption of sugar-sweetened beverages (Chan *et al.,* 2014; Ottevaere *et al.*, 2011; Haning *et al.*, 2016). Dietary and physical activity changes are part of the nutrition transition that developing countries undergo (Kac & Perez-Escamilla, 2013).

While some studies reported that obesity and mental health are related (Kivimaki *et al.*, 2009; Taylor *et al.*, 2013). A study in Japan showed that high prevalence of adult obesity occurred particularly in those with mental health problems, leading to eating disorders, in both under- and over-consumption (Kivimaki *et al.*, 2009; Saiga *et al.*, 2013).

This study did not find a conclusive association between adult obesity and mental health status.

Limitations
This study did not take into consideration the "weight variable" as reported in the Indonesian Basic Health Research, hence the findings here may be somewhat different from the national BHR report. We are not able to quantify the differences in terms of "increases' or "decreases" in significant terms for the prevalence of the obesity risk factors between 2007 and 2013, as statistical comparison was not undertaken between the BHR datasets.

CONCLUSION
This study revealed regional differences in the factors associated with obesity among Indonesian adults. It is recommended that more comprehensive studies be undertaken to investigate the contribution of socio-economic status and lifestyles, especially dietary intake and physical activity, to adult obesity in the different regions in Indonesia.

Authors' contributions
Andi Imam Arundhana, did the study conception, performed data analysis and interpretation, wrote the manuscript, and provided revision for final version of the manuscript; Asry Dwi Muqni, drafted the manuscript and contributed to the final version; Aisya Putri Utama, contributed to the data preparation and analysis of the result; Maria Theresa Talavera, wrote the manuscript in consultation with Andi Imam Arundhana, performed results interpretation.

Conflict of interest
All authors declared no conflict of interest for this study.

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