Aizawa, Toshiaki; Helble, Matthias

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Socioeconomic Inequity in Excessive Weight in Indonesia

Toshiaki Aizawa and
Matthias Helble

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Toshiaki Aizawa is a research associate at the Asian Development Bank Institute (ADBI). Matthias Helble is a research fellow at ADBI.

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Please contact the authors for information about this paper.

Email: Toshiaki Aizawa: taizawa@adbi.org

Matthias Helble: mhelble@adbi.org

Asian Development Bank Institute
Kasumigaseki Building 8F
3-2-5 Kasumigaseki, Chiyoda-ku
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500
Fax: +81-3-3593-5571
URL: www.adbi.org
E-mail: info@adbi.org

Abstract

Exploiting the Indonesian Family Life Survey, this paper studies the transition of socioeconomic related disparity of excess weight, including overweight and obesity, from 1993 to 2014. First, we show that the proportions of overweight and obese people in Indonesia increased rapidly during the time period and that poorer income groups exhibited the strongest growth of excess weight. Using the concentration index we find that prevalence of overweight and obesity affected increasingly poorer segments of Indonesian society. Third, decomposing the concentration index of excess weight in 2000 and 2014 for both sexes, our results suggest that most parts of the concentration index can be explained by the unequal distribution of living standards, sanitary conditions, the possession of vehicles, and home appliances. Finally, decomposing the change in the concentration index of excess weight from 2000 to 2014, we show that a large part of the change can be explained by the decrease in inequality in living standards, and improved sanitary conditions and better availability of home appliances in poorer households.

JEL Classification: I14, I15, I18, I24

Contents

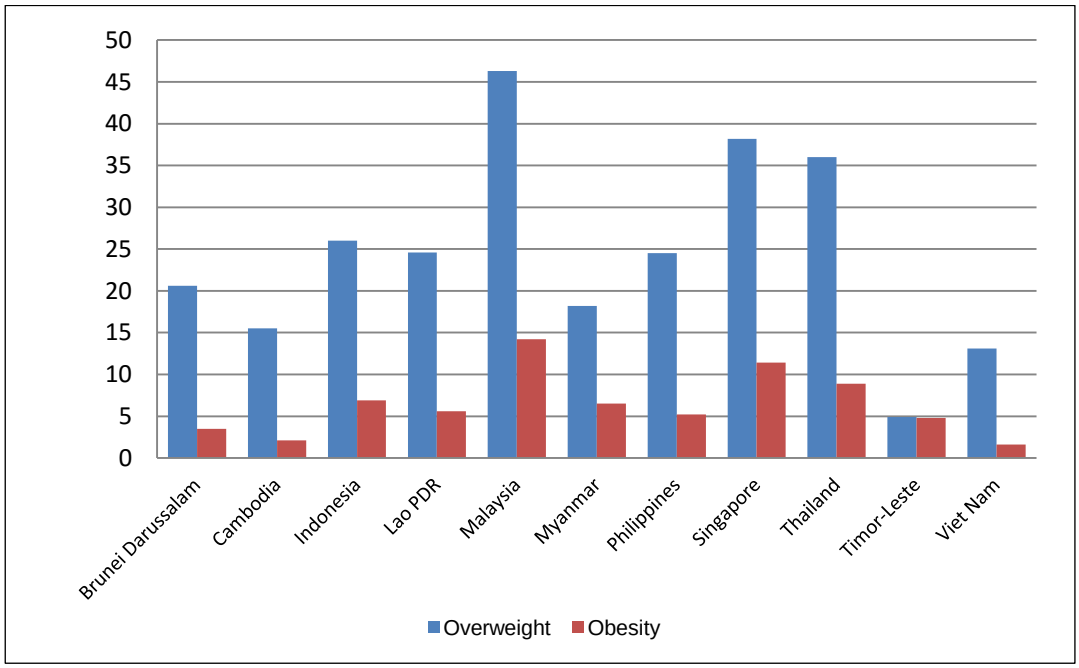
1. INTRODUCTION

Obesity and overweight are increasing worldwide with particularly high growth rates in developing countries. According to the World Health Organization (WHO) (2015) estimates, in 2014 more than 1.9 billion adults aged over 18 were overweight and 600 million adults were obese. In percentage terms, 39% of the adult populations in the world were overweight and around 13% obese. The population of overweight and obese adults increased between 1980 and 2013 from 30% to 38% in women, and 29% to 37% in men (Ng et al. 2014). The worldwide prevalence of obesity more than doubled between 1980 and 2014 (WHO 2015). The problem of overweight is no longer a public health challenge in the developed world. The most rapid increase was recorded in developing countries. Today, 62% of overweight people reside in a developing country (Ng et al. 2014).

In Southeast Asia, the prevalence of overweight ranged from 4.9% in Timor-Leste to 46.3% in Malaysia; and for obesity from 1.6% in Viet Nam to 14.2% in Malaysia (Figure 1). An estimated 300,000 people die of overweight or obesity every year in the region (WHO 2011).

Figure 1: Prevalence of Overweight and Obesity in Southeast Asia, 2013

(%)



Lao PDR = Lao People's Democratic Republic.

Source: Institute for Health Metrics and Evaluation (2013).

Overweight and obesity are leading risk factors for noncommunicable diseases, such as cancer, heart disease, stroke, diabetes, and musculoskeletal disorders. In 2010, obesity and overweight were estimated to have caused 3.4 million deaths, mainly through a number of cardiovascular diseases (Ng et al. 2014). According to Jung (1997), a 20% rise in weight in males leads to an 86% increase in the risk of coronary heart disease, while the same rise in women leads to a 3.6-fold increase in risk.

Overweight and obesity are also regarded as important risk factors for endometrial, breast, and colon cancers. Moreover, overweight people face also a higher risk of gout, sleep apnea, and obstetric and surgical complications (Jung 1997). Having a high body mass index (BMI) ranked as the third-largest risk factor for developing noncommunicable diseases in 2013, following high blood pressure and smoking (GBD 2013 Risk Factors Collaborators 2015: 15, Figure 7). As noncommunicable diseases often require lifetime treatment, the

increase of overweight and obesity are strong drivers for the surge in medical costs in many countries. Importantly, different from many diseases, overweight and obesity are preventable by changing diets and lifestyles. However, inducing such changes is not an easy undertaking. Prevention of overweight and obesity requires a holistic policy approach that includes improved education, cooperation with the food industry, and possibly the introduction of tax incentives. The difficulty in treating excessive weight is manifest in the fact that no country has successfully reduced obesity rates in 33 years (Ng et al. 2014). Addressing overweight and obesity has thus become a major public health challenge for countries around the world.

Overweight and obesity are the outcomes of a continuous energy surplus in the balance between calories consumed and calories used. As an economy develops, people typically shift from the agricultural sector to manufacturing and eventually services industries. As a result, the work becomes more sedentary with less physical activities involved. Hand-in-hand with economic development comes more income that can be spent on food and better food availability. With development, people also shift toward the intake of energy-dense foods with high fat content (Popkin and Du 2003). Urbanization has also been found to be contributing to the acceleration of the change in lifestyles and subsequently to health conditions (Popkin 2001; Van de Poel, O'Donnell, and van Doorslaer 2007; Van de Poel, O'Donnell, and van Doorslaer 2009; Van de Poel, O'Donnell, and van Doorslaer 2012).

In the best case, economic development improves the living conditions of all income groups. However, low-income groups still remain in poverty and face the challenge of buying sufficient and adequate food. Several low- and middle-income countries are thus confronted with a "double burden" of disease (WHO 2015). While they still struggle to curb the spread of infectious disease and to fight hunger, they are now experiencing a rapid increase in obesity and overweight, particularly in urban settings.

The growth of the overweight and obesity prevalence can be widely observed throughout the world, but the distribution across income groups varies by country. Over the past 5 decades, a considerable number of studies have been made on the relationship and nature of overweight and obesity and there seems to be a consensus. An exhaustive and seminal review by Sobal and Stunkard (1989) describes 144 published studies on the relationship between socioeconomic status and obesity, both in developed and developing countries. They observe a consistent, inverse association in developed countries particularly for women. That is, the poor are more probable to be obese. In developing countries, on the other hand, a strong direct relationship was revealed among men, women, and children. In other words, people of a more privileged socioeconomic status are more likely to become overweight and obese. McLaren (2007) updates their review with research on 333 published studies. Their results are more or less consistent with the findings by Sobal and Stunkard (1989) and argue that as a country moves from a low- and middle-income status to a high-income status, the relationship between socioeconomic status and obesity is reversed. In other words, in more advanced economies, the less wealthy are more likely to be exposed to the risk of obesity than people with a higher socioeconomic status. Other studies on this relation show largely similar results (e.g., Reynolds et al. [2007] and Monteiro et al. [2004]). As an example of a developing country, Monteiro et al. (2000) and Monteiro, Conde, and Popkin (2001) examine the case for Brazil and show that as the country advanced, obesity grew faster among the group with a lower socioeconomic status.

The growing number of overweight and obesity is one of the most pressing public health issues, particularly in developing countries, where almost two-thirds of the obese people in the world live. In addition to the large obese population, study of the case of developing countries is important because while the increase in obesity in developed countries accelerated from 1992 to 2002, it has slowed since 2006, but is expected to continue to increase in developing countries (Ng et al. 2014). As we have briefly discussed, a great deal of effort has been made in the literature on the inequity in health including overweight and obesity, but what is lacking, to our best knowledge, is study on the change over time using a

panel dataset of a household survey. The purpose of this paper is to fill the gap in the literature by exploring the change in the trend of overweight and obesity. We employ the inequality index and measure the disparity of excessive weight from 1993 to 2014. We then trace the change in these disparities between 2000 and 2014, when the large reduction of the concentration index was observed, and attempt to explain the change by decomposing the change in the inequity into several potential contributing factors. The case of a Southeast Asian developing country is intriguing not only from a public health perspective, but also from an economic viewpoint. Indonesia has shown high economic growth in recent years and has the largest population in Southeast Asia. Indonesia thus represents an excellent case study among the emerging economies of Southeast Asia. Better understanding of the transition during the period in Indonesia can provide important guidance for the design of appropriate policies to tackle the problem of overweight and obesity in Indonesia and beyond. To the best of our knowledge, this study is the first attempt to explain factors that contribute to the change in the disparity of overweight and obesity in Indonesia.

The structure of this paper is as follows. The next section introduces the data used in this research, gives definitions of overweight, obesity, and excess weight, and discusses descriptive statistics. In Section 3 we explain the econometric methods used to measure the inequity in health. Section 4 gives the results of the analysis and provides the interpretation. Finally, in Section 5, we discuss the policy implications and conclude our findings.

2. DATA

The Indonesian Family Life Survey (IFLS) is an ongoing, multipurpose household longitudinal survey that was launched in 1993/94. The IFLS currently has five waves (as of 2016) and the latest one was completed in 2014. Each wave covers around 30,000 individuals living in 13 of the 27 provinces in the country. We use all five waves in this paper. From measurements of the heights and weights of the respondents, we calculate the body mass index (BMI), defined as an individual's weight divided by the square of their height and expressed internationally in units of kg/m^2. We use the BMI to assess the overweight and obesity status. The threshold points for overweight and obesity are 25 kg/m^2 and 30 kg/m^2, respectively, and corresponding to WHO definitions of overweight and obesity. A person is classified as overweight if his/her BMI is greater than or equal to 25 and less than 30. A person is assessed to be obese if his/her BMI is greater than or equal to 30. We do not include children and adolescents in the samples due to difficulty in judging overweight conditions for these groups under the same criteria as that applied for adults. Therefore, our sample is composed of people aged over 20. Furthermore, in this paper, excess weight is defined as the difference between a respondent's weight minus his/her optimal weight.[1] Excess weight is nonnegative and set to be equal to 0 if a respondent's weight is below his/her optimal weight.

2.1 Data Description

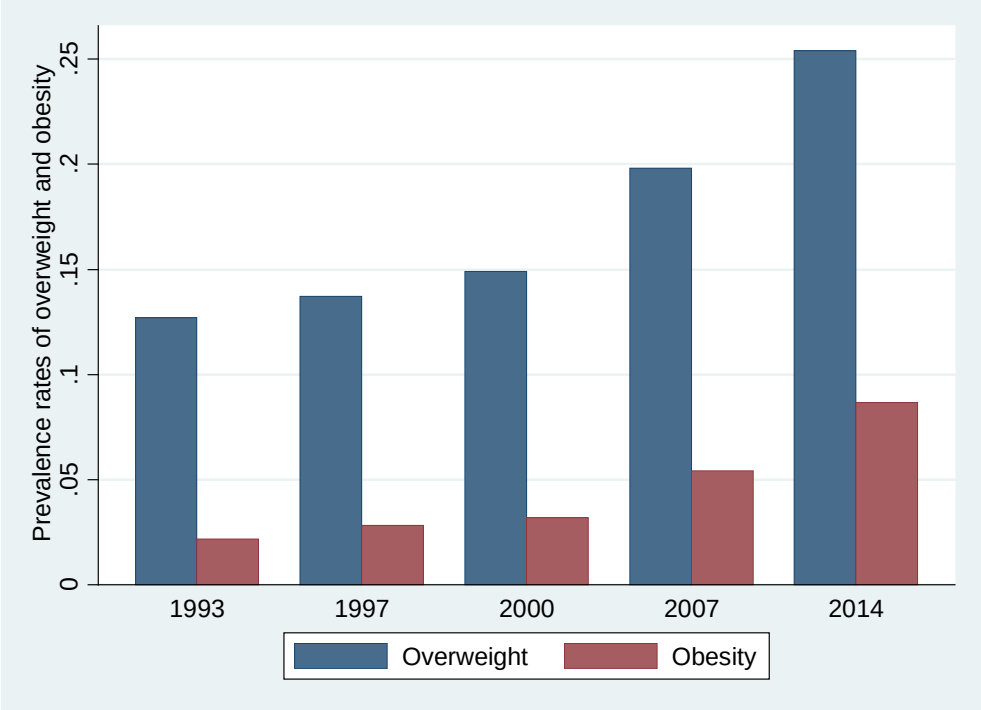
Figure 2 shows the prevalence rate of overweight and obesity in the four waves of our sample. The figure illustrates that the number of overweight and obese people grew during the period. In 1993, approximately 13% of the people were overweight or obese, but in 2014 the number reached 25%. As well as the continuing increase in the prevalence rate of overweight and obesity, we find that the average BMI of Indonesian people became larger during the period. Figure 3 and Figure 4 illustrate the cumulative distribution functions of BMI for men and women. We find a relatively large increase after 2000 for both men and women.

[1] $Optimal\ weight = 22 * \{(height/100)^2\}$

Overall, our BMI numbers are consistent with another study (Witoelar, Strauss, and Sikoki 2009) on overweight in Indonesia.

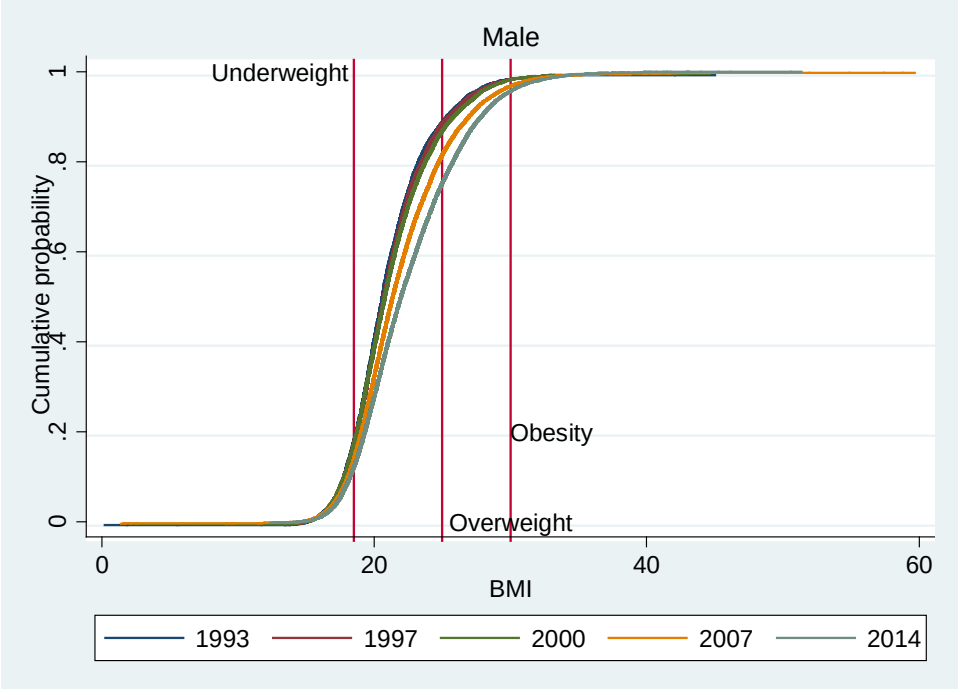
Figure 2: Prevalence Rate of Overweight and Obesity, 1993–2014

(%)



Source: Authors' calculation.

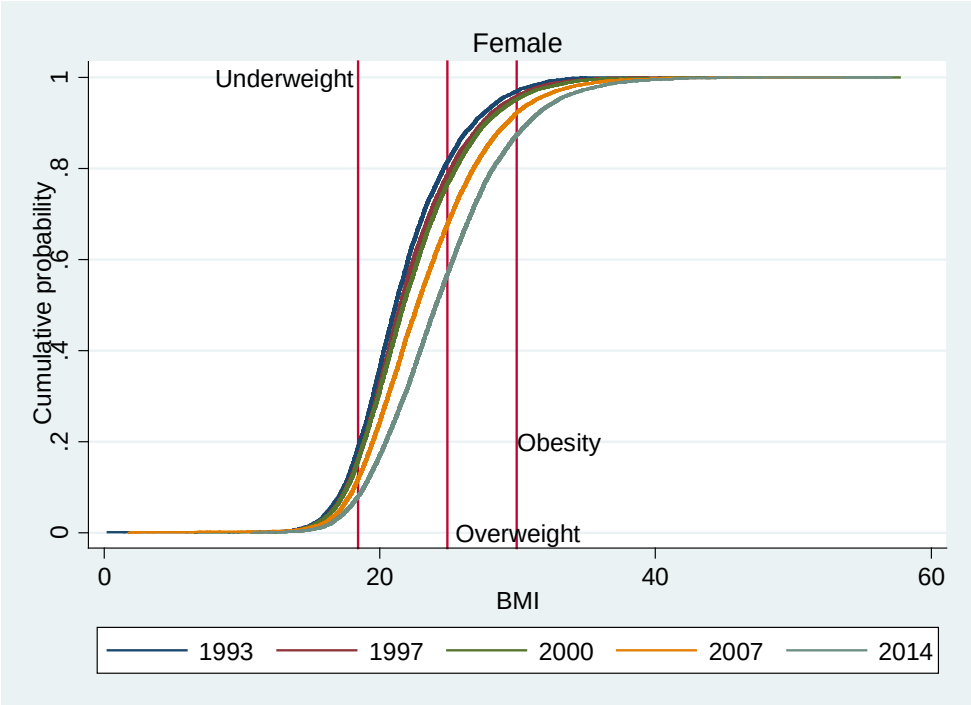
Figure 3: Empirical Cumulative Distribution Function of BMI for Men



BMI = body mass index.

Source: Authors' calculation.

Figure 4: Empirical Cumulative Distribution Function of BMI for Women



BMI = body mass index.

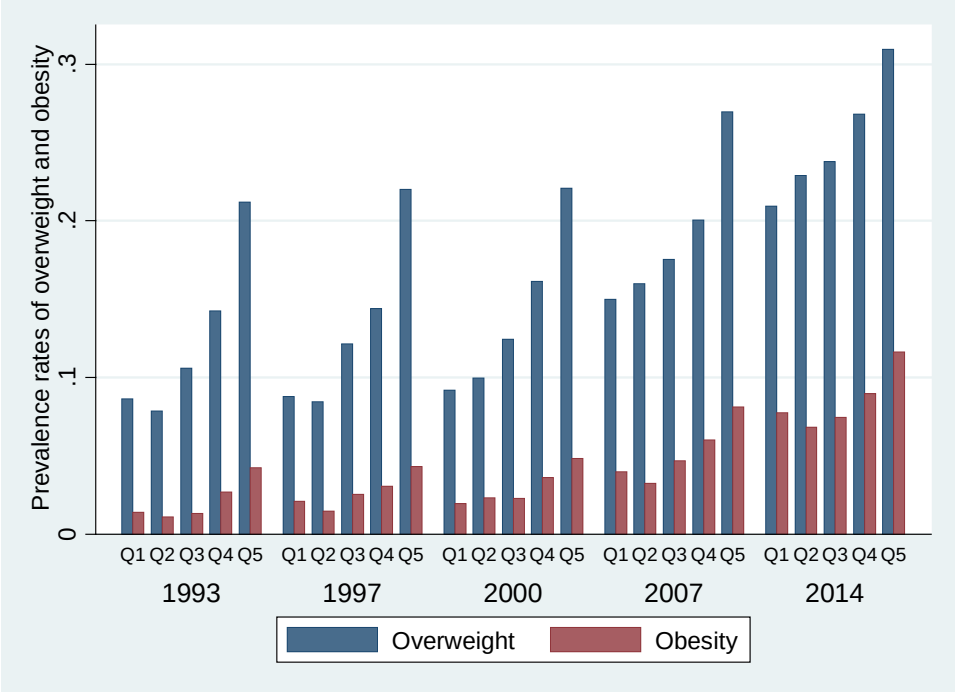
Source: Authors' calculation.

Next we look into the relationship between socioeconomic status and overweight/obesity. As a measure of socioeconomic status, various studies use different measurements, such as income, expenditure, education level, and wealth. One can use one or several of these variables to rank people from low to high socioeconomic status, but different indicators generally give different results and the choice depends fundamentally on researchers' interests (Fleurbaey and Schokkaert 2012). In this paper we use family-size adjusted household wealth.[2] Using wealth has advantages over other options at it includes the monetary values of various items commonly found in household. The reason we do not use income for socioeconomic status is that we may not be able to correctly observe employment income if households make their living from family-owned business, such as farm administration. Furthermore, it would be difficult to rank retired people as they typically have very little or no employment income. We also consider educational levels not to be suitable for this study because of the difficulty in capturing a respondent's educational qualifications or achievement as a continuous number, which would be needed to rank people.

[2] Wealth is defined as the aggregated total value of the following assets. The value is divided by the number of family members.
1. House and land occupied by a household
2. Other house/building (including land)
3. Land (not used for farm)
4. Poultry
5. Livestock/fishpond
6. Hard stem plant not used for farm or non-farm business
7. Vehicles (cars, boats, bicycles, motorbikes)
8. Household appliances (radio, tape recorder, television, fridge, sewing or washing machine, video and CD player, cell phone, etc.)
9. Savings/certificates of deposits/stocks
10. Receivables
11. Jewelry
12. Household furniture and utensils
13. Others

Figure 5 shows the prevalence rate of overweight and obesity over time and conveys a few important points. Firstly, wealthy people tend to be overweight and obese in every period of time, and in this regard, the prevalence of overweight and obesity in Indonesia corresponds to the case typically found in low- and middle-income countries (Sobal and Stunkard 1989; McLaren 2007). Second, the prevalence rates of the first (the least wealthy group) and second (the second least wealthy groups) quintile groups show a large increase between the years 2000 and 2014, resulting in the smaller gap between the lowest and top quintile groups in 2014, compared with other years in the survey. More detailed analysis will be conducted in Section 4, where we will quantify the degree of disparity of overweight, obesity, and excess weight across the population.

Figure 5: Prevalence Rate of Overweight and Obesity across Different Wealth Groups in 1993, 1997, 2000, 2007, and 2014



Q1 = quintile 1, Q2 = quintile 2, Q3 = quintile 3, Q4 = quintile 4, Q5 = quintile 5.

Source: Authors' calculation.

3. METHODOLOGY

3.1 The Concentration Curve and the Concentration Index

The measurement of disparity of the distribution of overweight/obesity and excess weight in this paper is based on the concentration curve.[3] The concentration curve plots the cumulative percentage of the health variable against the cumulative percentage of the population ranked from poorest to richest (Kakwani 1977; Kakwani, Wagstaff, and van Doolslaer 1997).

The concentration index corresponds to twice the area between the concentration curve and the perfect equality 45-degree line (Kakwani, Wagstaff and van Doorslaer 1997). Differences between the Lorenz curve and the concentration curve, and between the Gini coefficient and the concentration index are succinctly explained by Carr-Hill and Chalmers-Dixon (2005).

[3] The concentration curve is also known as a generalized Lorenz curve and its main difference from the Lorenz curve is that people are ranked by their socioeconomic status, not by their health status.

While the Gini coefficient ranges from 0 to 1 (0 means perfect equality and 1 represents perfect inequality), the concentration index, on the other hand, ranges from –1 to 1. If health is equally distributed, the concentration curve coincides with the 45-degree line and the index becomes 0. If the index for overweight is positive, for instance, then it means overweight is more concentrated among the rich, and vice versa.

The concentration index can be calculated simply by the following equation:

$$CI = \frac{2}{N\mu}\sum_{i=1}^{n} h_i r_i - 1 - \frac{1}{N} \quad (1)$$

where h_i is the health outcome index of individual *i* and μ is its mean. $r_i = {}^{i}/_{N}$ is the fractional rank of individual *i* in the economic status based on household wealth.

The concentration index can be alternatively obtained from the coefficient of the regression of equation (2):[4]

$$2\sigma_r^2 \left(\frac{h_i}{\mu}\right) = \alpha + CIr_i + \varepsilon_i \quad (2)$$

where σ_r^2 is the variance of the fractional rank. The coefficient of the rank is an estimate of the concentration index, which is numerically equivalent to the value from equation (1) (for more details, see O'Donnell et al. [2008]).

When the health outcome is a binary variable, the minimum and maximum possible values of the concentration index become μ – 1 and 1 – μ and therefore the feasible range of values the index can take shrinks as the mean of the outcome value increases (Wagstaff 2005). Following the normalization method suggested by Wagstaff (2005), we provide both the original concentration index and the normalized concentration index in this paper. The normalization index, introduced by Wagstaff (2005), is simply calculated as:

$$\widetilde{CI} = \frac{1}{1-\mu} CI \quad (3)$$

3.2 The Achievement Index

Wagstaff (2002) proposed a measurement of the average level of health taking into account equity aspects. His measurement gauges the average health level ("achievement") taking into account the different health conditions and income levels within the sample. It is defined as a weighted average of the health conditions of all persons in the sample, and imposes higher weights on persons with lower incomes. Wagstaff (2002) introduces equation (4) to calculate the achievement index, *AI*. If the health variable measures excess weight, for example, the index should be interpreted as a "disachievement" index because excess weight is considered undesirable for health. When ill health is more concentrated among distributed to the poor, i.e., CI<0, the "disachievement" index is inflated and shows a larger weighted mean. If the bad health is seen more among the rich, namely CI>0, the achievement index indicates a smaller value than the unweighted sample mean.

$$AI = \frac{1}{n}\sum_{i=1}^{n} h_i(1 - r_i) = \mu(1 - CI) \quad (4)$$

3.3 Decomposition Method

Inequalities in health across the socioeconomic-related distribution can be decomposed into their contributors (Wagstaff, van Doorslaer and Watanabe 2003). The basic idea is based on the assumption that the inequity in health stems from inequalities in the determinants of the health variable. The decomposition allows us to answer the following types of question: how

[4] For the derivation of equation (2), see Wagstaff, van Doolslaer, and Watanabe (2003); Kakwani, Wagstaff, and van Doorslaer (1997).

much can the inequality in education explain the inequity in health? Stated differently, how much is the relative contribution of the inequality in education when explaining the inequity in health? The decomposition thus helps us to identify policy areas for intervention.

Assume any additive linear regression model of health outcome h_i, such that

$$h_i = \alpha + \sum_k \beta_k x_{ki} + \varepsilon_i \quad (5)$$

where x_{ki} is a determinant of health veriable, h_i. Wagstaff, van Doorslaer and Watanabe (2003) introduce a decomposition method (equation 6):

$$CI = \sum_k \frac{\beta_k \bar{x}_k}{\mu} CI_k + \frac{GCI_\varepsilon}{\mu} \quad (6)$$

In equation (6), the concentration index is decomposed into two parts. The first part is the deterministic components, which are equal to the weighted sum of the concentration indices of the explanatory variables x_k (CI_k). The weight is the elasticity of the health index with respect to each factor, x_k , which measures the share of variables explaining the concentration index of interest. The product of the elasticity and CI_k reflects the contribution made by x_k. The second part is called the generalized concentration index for the residual component (GCI_k) (O'Donnell et al. 2008). This second part captures the inequality that cannot be explained by x_k. The percentage of the contribution of the inequality in x_k to the inequality in h_i can be calculated as below (equation 7).

$$\%\ \text{contribution}_{x_k} = \left\{\frac{\beta_k \bar{x}_k}{\mu} CI_k / CI\right\} \text{*100} \quad (7)$$

Wagstaff, van Doorslaer, and Watanabe (2003) and van Doorslaer and Koolman (2004) further introduced an approach to explain changes in the concentration index in a different point of time. They apply an Oaxaca-type decomposition (Oaxaca 1973) to the decomposing equation (6) and derive the following equation (8).

$$\Delta CI_t = \sum_k \eta_{kt}(CI_{k\,t} - CI_{k\,t-1}) + \sum_k CI_{k\,t-1}(\eta_{kt} - \eta_{k\,t-1}) + \Delta(\frac{CG_{\varepsilon t}}{\mu_t}) \quad (8)$$

Where ΔCI_t denotes the change in the concentration index. η_{kt} is the elasticity of the outcome variable at time t with respect to a contributing factor, x_k.

Following equation (8), we decompose the change in the concentration index into the changes in following contributing factors listed in Table 1. Among these factors, our priory interest lies in education, living standards, and food expenditure.

Table 1: Contributing Factors to Explain the Change in the Concentration Index

Contributing Factor	Information
Education	Completion of high school, college education
Living standards	Access to electricity, owning gas stoves and electric stoves, owning a vehicle and home appliances, using a fridge, owning a television
Satisfactory sanitation	Owning a toilet, having access to clean water and basic sanitation
Staple food expenditure	Hulled, uncooked rice, sago/flour, cassava, tapioca, and other staple foods
Meat and fish expenditure	Beef, chicken, and fish
Oil expenditure	Cooking oil such as coconut oil, peanut oil, corn oil, and palm oil
Soft drink expenditure	Soft drinks such as Fanta, Sprite, etc.
Prepared food expenditure	Prepared food (eaten at home and outside of the home)

Source: Authors.

4. RESULTS AND DISCUSSION

4.1 Regression Analysis

We firstly conduct a regression analysis to unveil the social determinants of overweight, obesity, and excess weight. The estimation results are listed in Table 2. As the dependent variables are dichotomous for columns (1) and (2), we perform a probit estimation with a cluster robust covariance estimator. As excess weight is defined to be non-negative, we perform the negative binomial estimation with a cluster robust covariance estimator. The null hypothesis of equidispersion assumed under the Poisson distribution is rejected ($p<0.01$). Columns (1), (2), and (3) show the estimated average marginal effects.

The results hold insightful information. Firstly, the elderly and women are more likely to be overweight and obese ($p<0.01$). Earlier studies, such as Ng et al. (2014), have found similar results for women in developing countries. Living in urban areas increases the probability of being corpulent ($p<0.01$), which could be due to an urban lifestyle typified by high exposure to fast food, sedentary working conditions, and physical inactivity (Popkin 2001). Furthermore, married people and people living in a large family have a higher probability of being obese ($p<0.01$). Secondly, we uncover a significant association between wealth and overweight, obesity, and excess weight ($p<0.01$), which implies that being rich is significantly more likely to lead to a higher BMI and excess weight. Thirdly, although we cannot find a significant relation between higher educational achievement and obesity, the regression results show strong evidence that more educated people have a higher likelihood of being overweight and having excess weight ($p<0.01$).

Finally, the regression results indicate that higher expenditure on meat, fish, oil, soft drinks, and prepared foods are significantly associated with higher levels of overweight and obesity. Alcohol does not show significance, but this can be explained by the fact that Indonesia is an Islamic country in which most people do not drink alcoholic beverages.

Overall, our regression analysis suggests strong evidence that overweight and obesity are influenced by social determinants as well as dietary choices. In Indonesia, people with an advantageous socioeconomic status are more prone to be overweight or obese and have excess weight. These findings are consistent with other studies in developing countries (Monteiro et al. 2000; Monteiro, Conde, and Popkin 2001) and our a priori expectation.

Table 2: Regression Analysis

	(1) Overweight and Obesity	(2) Obesity	(3) Excess weight
Age	0.000703***	0.0000620	-0.00288
	(0.000135)	(0.0000676)	(0.00329)
Male	-0.148***	-0.0563***	-2.729***
	(0.00372)	(0.00222)	(0.0873)
Urban	0.0796***	0.0261***	1.851***
	(0.00434)	(0.00230)	(0.0926)
Married	0.123***	0.0319***	2.355***
	(0.00469)	(0.00271)	(0.110)
Family size	-0.000991	0.00106**	-0.0276
	(0.000987)	(0.000484)	(0.0211)
ln(Wealth)	0.0292***	0.00930***	0.538***
	(0.00127)	(0.000696)	(0.0302)
Car	0.0318***	0.00310	0.663***
	(0.00388)	(0.00202)	(0.0828)
University	0.0413***	0.00437	1.262***
	(0.00711)	(0.00348)	(0.141)
High school	0.0258***	0.00181	0.879***
	(0.00523)	(0.00269)	(0.117)
Junior high school	0.0214***	-0.00196	0.507***
	(0.00472)	(0.00246)	(0.106)
Primary school	0.0292***	0.00463*	0.635***
	(0.00509)	(0.00264)	(0.119)
ln(Staple food)	0.000386	0.000363	-0.00436
	(0.000751)	(0.000404)	(0.0153)
ln(Beef)	0.000659	-0.000159	0.00325
	(0.000517)	(0.000264)	(0.00984)
ln(Chicken)	0.00327***	0.000755***	0.0619***
	(0.000438)	(0.000234)	(0.00877)
ln(Fish)	0.00270***	0.000606**	0.0620***
	(0.000480)	(0.000251)	(0.00977)
ln(Oil)	0.00298***	0.000804**	0.0578***
	(0.000661)	(0.000357)	(0.0126)
ln(Soft drink)	0.00394***	0.00125***	0.0899***
	(0.000543)	(0.000280)	(0.0107)
ln(Alcohol)	-0.001000	-0.00151	0.0128
	(0.00173)	(0.000990)	(0.0328)
ln(Prepared food)	0.00421***	0.00188***	0.106***
	(0.000464)	(0.000266)	(0.00956)
Observations	78,133	78,133	78,133

Notes: Standard errors are in parentheses. Standard errors are cluster robust to arbitrary heteroskedasticity and serial correlations.

Clusters are defined by household units.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

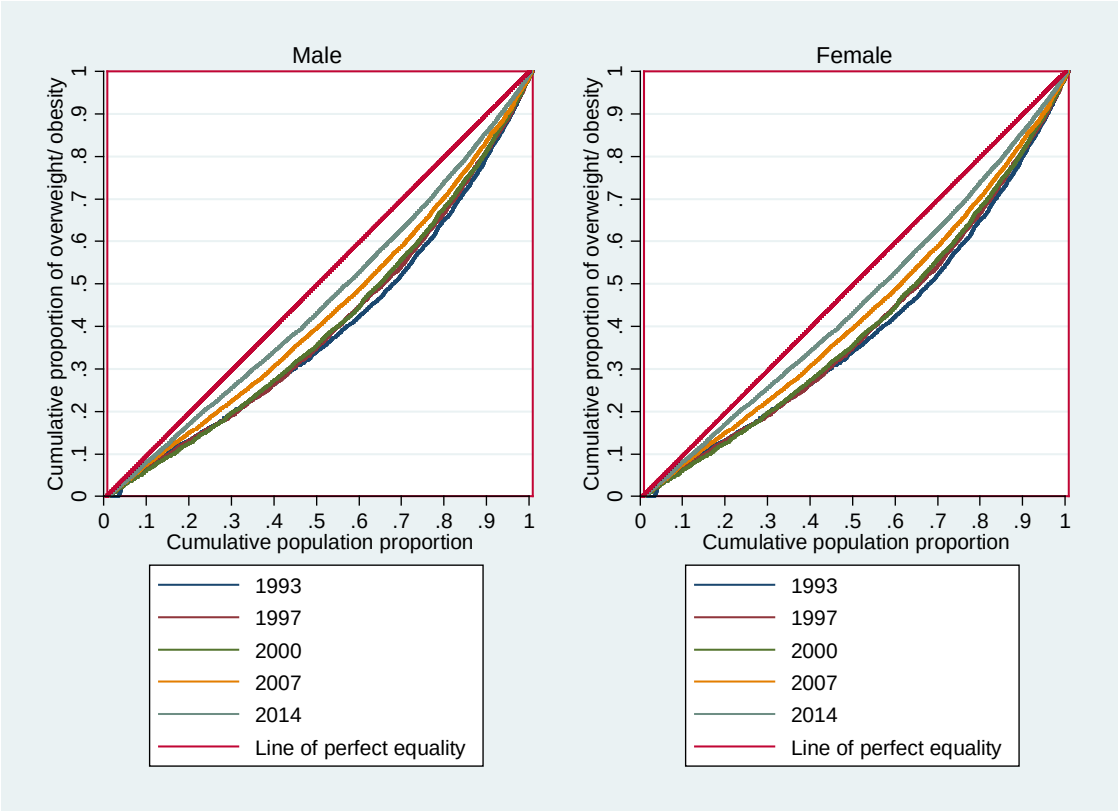
Age: age of the respondent; Male: a sex dummy; Urban: a dummy that becomes 1 if a respondent lives in an urban district; Married: a marital status dummy equal to 1 if a respondent is married; Family size: the number of family members in the household; ln(Wealth): the logarithmic amount of the family-size adjusted wealth of a household; Car: a dummy equal to 1 if a respondent has a car; University, High school, and Junior high school, primary school: educational background dummies that equal 1 if a respondent has completed the respective schooling levels as his/her highest education level; ln(Staple foods), ln(Beef), ln(Chicken), ln(Fish), ln(Oil), ln(Soft drink), ln(Alcohol), ln(Prepared food): the logarithmic amount of family-size adjusted expenditure on foods.

Source: Authors.

4.2 Concentration Curve

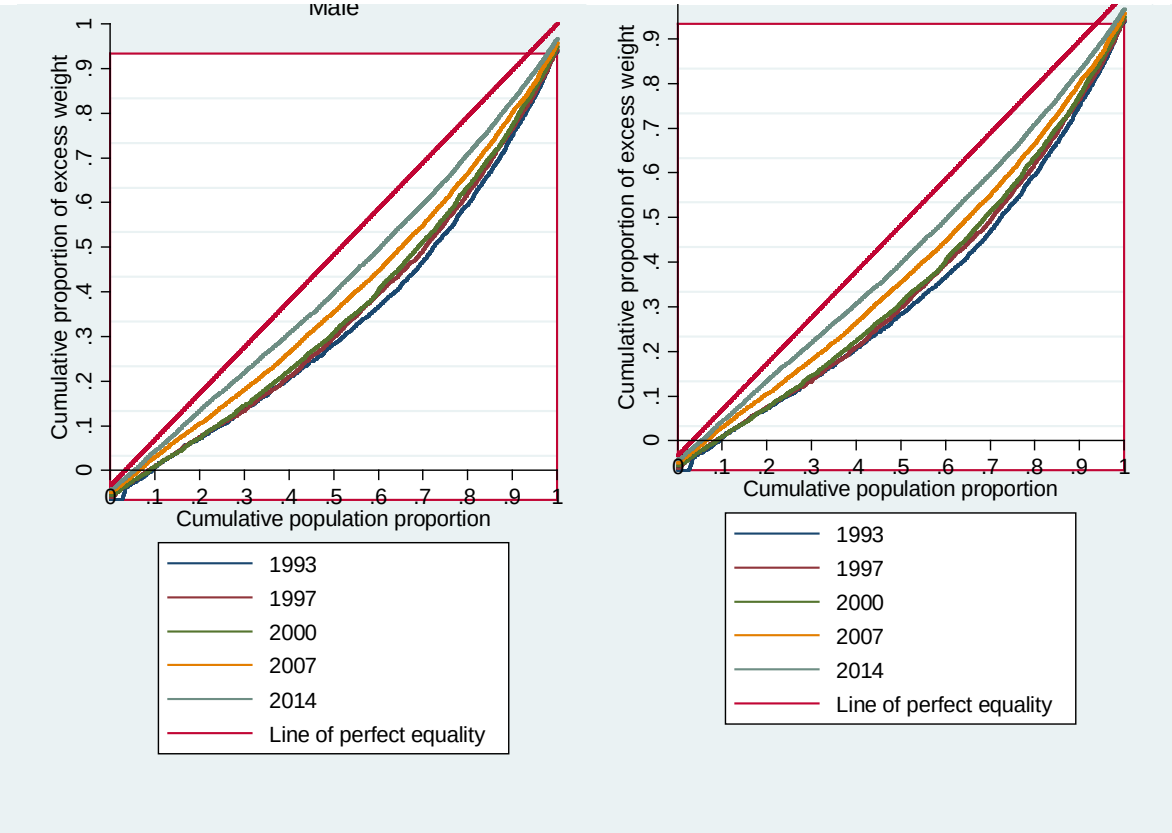
Figure 6 shows the concentration curves at four points in time of the survey for overweight and obesity for both men and women. The wealth-related disparity of overweight/obesity is shrinking in each year for both sexes, meaning more and more people are becoming overweight/obese irrespective of their different socioeconomic statuses. Combined with Figure 5, Figure 6 suggests that the lower socioeconomic groups are steadily catching up with the higher socioeconomic groups in each period. The shrinking gap between rich and poor could be a possible sign of the gradual transition of Indonesia from a low-income country to a middle-income country. During this transition process, the higher-income groups stop having higher rates of overweight, while the prevalence among lower-income groups continues to increase. This tipping point has not yet been reached in Indonesia. Figure 7 shows the concentration curves for excess weight, illustrating a similar trend as we observed in Figure 6. The disparity between poor and rich shrank over time, particularly between 2000 and 2014.

Figure 6: The Concentration Curve for Overweight and Obesity



Source: Authors.

Figure 7: The Concentration Curve for Excess Weight for Men and Women



Source: Authors.

The catching up of the lower wealth groups is also prominent from Table 3, which shows the annual growth rate of the prevalence of overweight/obesity from 1993 to 2014 across different wealth quintile groups. During the period, the growth rates of the lowest and lower-middle wealth groups are by far larger than those of the upper-middle and highest groups, resulting in shrinking of the gap of the overweight and obesity rates between the poor and the rich.

Table 3: Annual Growth Rates of the Prevalence of Overweight, Obesity, and Excess Weight across Different Quintile Groups from 1993 to 2014

(%)

Wealth Quintile Level	Overweight or Obesity	Obesity	Excess Weight
Quintile 1	5.14	8.56	5.33
Quintile 2	5.89	9.19	5.69
Quintile 3	4.70	8.62	5.03
Quintile 4	3.62	5.93	3.90
Quintile 5	2.48	4.92	2.89

Source: Authors' calculation.

4.3 Concentration Index

We measure the degree of socioeconomic-related disparity in each period of time by calculating the concentration indices. The results are shown in Table 4. The concentration indices decline consistently over time, with the greatest fall is found after 2000, as we

already inferred by analyzing the concentration curves above. The concentration index for men is consistently higher than that for women.

Table 4: Concentration Index

	Year	Overweight or Obesity		Obesity		Excess Weight
		CI	Adjusted CI	CI	Adjusted CI	CI
All	1993	0.224	0.263	0.288	0.294	0.208
		(0.012)	(0.014)	(0.034)	(0.035)	(0.010)
	1997	0.205	0.245	0.196	0.202	0.191
		(0.011)	(0.013)	(0.029)	(0.030)	(0.009)
	2000	0.188	0.230	0.196	0.202	0.182
		(0.009)	(0.011)	(0.023)	(0.024)	(0.008)
	2007	0.134	0.179	0.181	0.191	0.135
		(0.007)	(0.009)	(0.016)	(0.017)	(0.006)
	2014	0.086	0.117	0.102	0.035	0.086
		(0.005)	(0.007)	(0.012)	(0.004)	(0.005)
Male	1993	0.324	0.362	0.463	0.467	0.285
		(0.021)	(0.024)	(0.070)	(0.071)	(0.016)
	1997	0.344	0.386	0.345	0.349	0.300
		(0.020)	(0.023)	(0.071)	(0.072)	(0.015)
	2000	0.283	0.324	0.302	0.306	0.256
		(0.015)	(0.018)	(0.046)	(0.047)	(0.012)
	2007	0.211	0.258	0.319	0.329	0.205
		(0.012)	(0.015)	(0.031)	(0.032)	(0.010)
	2014	0.175	0.171	0.234	0.041	0.160
		(0.009)	(0.009)	(0.025)	(0.004)	(0.008)
Female	1993	0.178	0.218	0.244	0.252	0.167
		(0.015)	(0.018)	(0.038)	(0.040)	(0.012)
	1997	0.147	0.186	0.162	0.169	0.135
		(0.013)	(0.016)	(0.032)	(0.033)	(0.011)
	2000	0.139	0.180	0.163	0.172	0.136
		(0.011)	(0.014)	(0.026)	(0.028)	(0.010)
	2007	0.090	0.132	0.128	0.138	0.089
		(0.008)	(0.012)	(0.019)	(0.021)	(0.008)
	2014	0.038	0.064	0.058	0.029	0.041
		(0.006)	(0.010)	(0.014)	(0.007)	(0.006)

CI = concentration index.

Note: Standard errors are in parentheses.

Source: Authors' calculation.

4.4 Achievement Index

Table 5 shows the mean and the achievement index of the three conditions. As the health conditions measured are overweight, obesity, and excess weight, it becomes more intuitive if we call it the "disachievement" index. As we have seen before, the means of the prevalence

of excess weight, overweight, and obesity show an increase over time. The "disachievement" indices taking account of the change in the distribution of health show even larger growth rates, because the inequities in overweight, obesity, and excess weight become smaller over the period. In other words, the process of catching up of the poor with the rich leads to the higher "disachievement" indices as more weight is attached to the poorer people when calculating the averages of the health condition variables in the sample.

Table 5: Achievement Index

	Year	Overweight or Obesity		Obesity		Excess Weight	
		Mean	AI	Mean	AI	Mean	AI
All	1993	0.149	0.115	0.022	0.015	2.603	2.060
	1997	0.166	0.132	0.028	0.023	2.988	2.419
	2000	0.181	0.147	0.032	0.026	3.296	2.697
	2007	0.252	0.219	0.054	0.044	4.621	3.999
	2014	0.341	0.311	0.087	0.078	6.291	5.752
Male	1993	0.105	0.071	0.010	0.005	2.056	1.469
	1997	0.108	0.071	0.011	0.008	2.230	1.561
	2000	0.125	0.090	0.014	0.010	2.551	1.897
	2007	0.181	0.143	0.030	0.020	3.653	2.906
	2014	0.245	0.203	0.043	0.033	4.853	4.077
Female	1993	0.183	0.151	0.031	0.024	3.042	2.535
	1997	0.211	0.180	0.042	0.035	3.596	3.109
	2000	0.230	0.198	0.048	0.040	3.952	3.415
	2007	0.316	0.288	0.076	0.066	5.480	4.990
	2014	0.424	0.408	0.124	0.117	7.548	7.237

AI = achievement (disachievement) index.

Source: Authors' calculation.

4.5 Decomposition Analysis

Finally, we decompose the aforementioned, relatively large change between 2000 and 2014 in the concentration index of excess weight. As a first step, we calculate the inequalities in each individual potential contributing factor (Table 6). University education achievement, gas stove possession, refrigerator use, and expenditure on beef show higher values, which means that they are particularly commonly seen among the rich. The elasticity measures the share of the factors explaining the inequality in health (in our case excess weight) in the respective year. Positive elasticity means a positive link between the inequality in a factor and the health inequity. The larger the absolute elasticity, the stronger the connection is.

Table 6: Decomposition of the Concentration Index of Excess Weight in 2000 and 2014

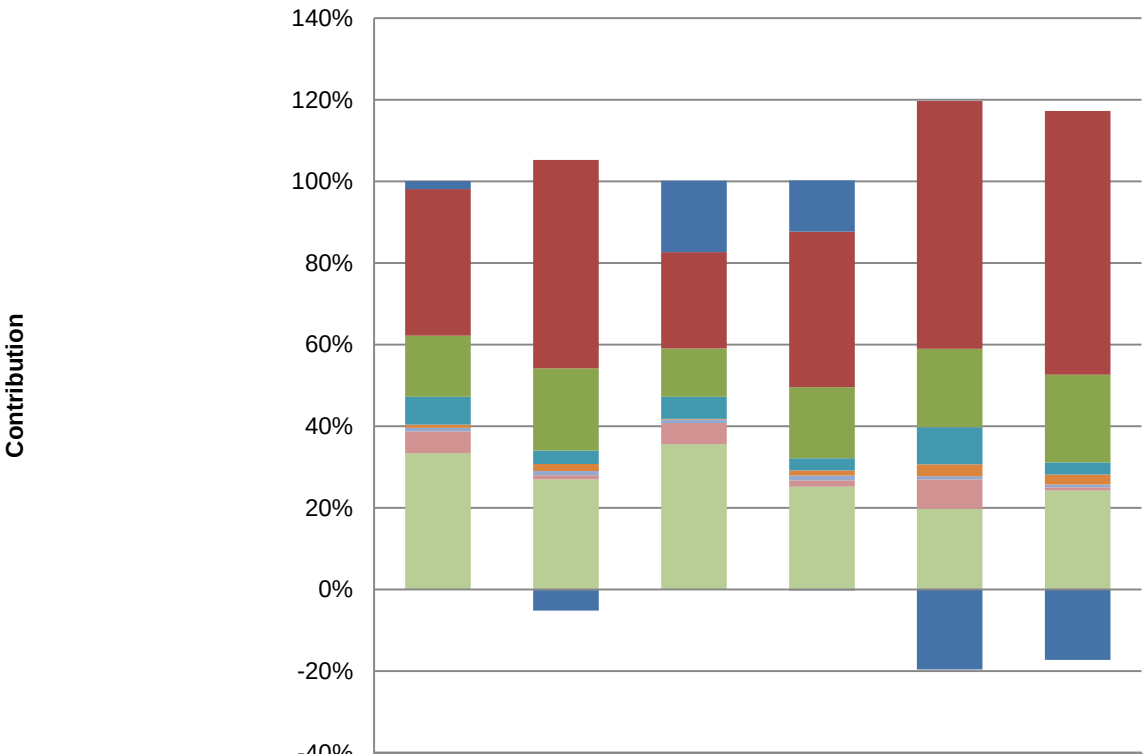
Individual Contributing Factors	All				Male				Female			
	2014		2000		2014		2000		2014		2000	
	E	CI	E	CI	E	CI	E	CI	E	CI	E	CI
High school education	-0.01	0.04	-0.04	0.26	0.06	0.05	0.08	0.25	-0.02	0.02	-0.07	0.26
University education	0.01	0.35	0.00	0.44	0.07	0.36	0.03	0.45	-0.02	0.33	-0.01	0.43
Electricity	0.14	0.00	0.16	0.04	0.22	0.00	0.06	0.04	0.06	0.00	0.21	0.04
Electronic stove	0.00	-0.10	0.00	0.23	0.00	-0.10	0.00	0.23	0.00	-0.09	0.00	0.23
Gas stove	0.18	0.07	0.03	0.47	0.18	0.07	0.04	0.48	0.16	0.07	0.02	0.47
Clean water	0.04	0.04	0.05	0.14	0.04	0.04	0.06	0.13	0.04	0.05	0.05	0.15
Own toilet	0.07	0.07	0.09	0.15	0.14	0.07	0.13	0.15	0.02	0.07	0.05	0.15
Sanitation	0.06	0.09	0.07	0.21	0.08	0.09	0.09	0.20	0.05	0.09	0.06	0.23
Vehicle	0.06	0.08	0.05	0.16	0.10	0.08	0.07	0.16	0.05	0.07	0.03	0.16
Appliances	0.10	0.01	0.04	0.09	0.06	0.01	0.03	0.08	0.17	0.01	0.06	0.09
Fridge use	0.04	0.17	0.05	0.46	0.06	0.18	0.06	0.46	0.02	0.17	0.04	0.46
Television	0.15	0.03	0.21	0.18	0.13	0.03	0.19	0.18	0.15	0.03	0.21	0.18
Staple foods	0.00	0.01	-0.01	0.02	-0.01	0.02	-0.02	0.02	0.00	0.01	-0.01	0.02
Beef	0.01	0.18	0.00	0.30	0.00	0.17	0.00	0.31	0.01	0.19	0.01	0.30
Chicken	0.02	0.15	0.01	0.22	0.02	0.15	0.02	0.22	0.01	0.15	0.00	0.23
Fish	0.02	0.12	0.02	0.12	0.04	0.12	0.03	0.11	0.01	0.13	0.01	0.13
Oil	0.01	0.06	0.03	0.11	0.00	0.06	0.03	0.11	0.02	0.06	0.03	0.11
Soft drink	0.00	0.17	0.01	0.33	0.01	0.17	0.01	0.33	0.00	0.16	0.00	0.33
Prepared food	0.03	0.17	0.01	0.21	0.05	0.16	0.02	0.21	0.02	0.18	0.00	0.21

CI = concentration index, E = elasticity.

Source: Authors' calculation.

The products of the elasticity and the concentration indices of the individual factors produce the contributions to the inequality in health, illustrated in Figure 8. During the period, our data shows an alleviation of educational inequality in Indonesia. Table 6 indicates that the concentration index of university education decreased by 0.09 (=0.44–0.35); a decrease that applied to both sexes. However, the more equalized access to education did not lead to consistent results for men and women in terms of lowering excess weight disparities. For men, the inequality in education is correlated with the inequality in the distribution of excess weight, but we cannot see the positive correlation for women. This difference comes from the opposite sign of the elasticity of education.

Figure 8: Percentage Contributions to Inequality in Excess Weight in 2000 and 2014



	All 2014	All 2000	Male 2014	Male 2000	Female 2014	Female 2000
Education	1.9%	-5.0%	17.4%	12.5%	-19.6%	-17.2%
Standards of living	35.9%	51.1%	23.6%	38.2%	60.6%	64.6%
Sanitation	15.0%	20.2%	11.9%	17.4%	19.2%	21.5%
Expenditure on staple food	-0.1%	-0.2%	-0.1%	-0.2%	0.0%	-0.1%
Expenditure on meat and fish	6.8%	3.3%	5.4%	3.0%	9.1%	3.0%
Expenditure on oil	0.8%	1.7%	0.2%	1.3%	2.9%	2.4%
Expenditure on soft drink	0.9%	1.0%	0.8%	1.1%	0.8%	0.8%
Expenditure on prepared foods	5.3%	1.0%	5.2%	1.6%	7.2%	0.8%
Residuals	33.4%	27.0%	35.6%	25.2%	19.7%	24.2%

Source: Authors' calculation.

Next we attempt to decompose the change in the concentration index between 2000 and 2014 into the change in the concentration indices of the factors. The results of the decomposition of the change are shown in Table 7. The second column, labelled "changes in inequality," corresponds to the first term of the left-hand side of equation 8 and the third column, labelled "changes in the elasticity," corresponds to the second term in equation 8. The changes in inequality measure the part that can be attributable to the change in the concentration index for each factor given the constant elasticity. The change in elasticity reflects the change in the relative importance of each factor in explaining the change in the distribution of excess weight. The final column, which is an aggregated value of these two changes, denotes how much the concentration index changes can be explained by changes in each factor.

Table 7: Results of the Decomposition of the Change in the Concentration Index from 2000 to 2014

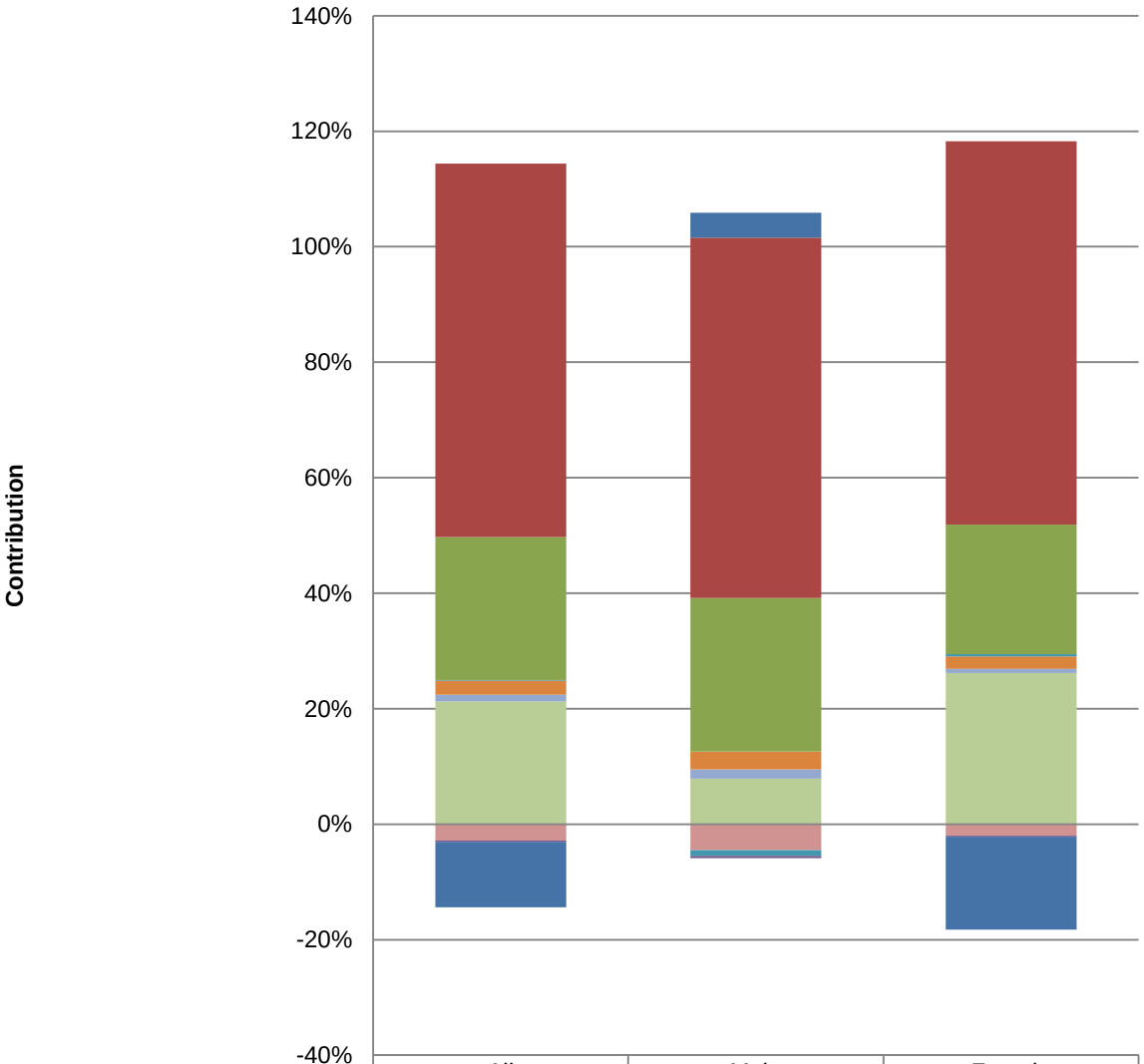
Contributing Factor	All			Male			Female		
	Changes in Inequality	Changes in the Elasticity	Total	Changes in Inequality	Changes in the Elasticity	Total	Changes in Inequality	Changes in the Elasticity	Total
Education	0.002	0.009	0.011	-0.018	0.014	-0.004	0.008	0.007	0.015
Standards of living	-0.124	0.062	-0.062	-0.127	0.067	-0.060	-0.115	0.053	-0.062
Sanitation	-0.017	-0.006	-0.024	-0.023	-0.003	-0.026	-0.012	-0.009	-0.021
Expenditure on staple food	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Expenditure on meat and fish	-0.002	0.002	0.000	-0.002	0.003	0.001	-0.002	0.001	0.000
Expenditure on oil	-0.001	-0.002	-0.002	0.000	-0.003	-0.003	-0.001	-0.001	-0.002
Expenditure on soft drinks	-0.001	0.000	-0.001	-0.001	0.000	-0.002	0.000	0.000	-0.001
Expenditure on prepared foods	-0.001	0.004	0.003	-0.002	0.006	0.004	-0.001	0.002	0.002
Residuals			-0.020			-0.008			-0.025
Total			-0.095			-0.096			-0.094

Source: Authors' calculation.

Figure 9 gives us a visual interpretation of the result. The table in the diagram shows the percentage contribution of the factors. For example, 64.7% of the reduction in the inequality of excess weight is explained by the decrease in the inequality in living standards. It is thus reasonable to conclude that the improvement of the living environment among the poor might have enabled them to become overweight. As a result, the poor caught up with the rich in terms of gaining weight.

We find that during the period studied, the decrease in the educational inequality did not contribute to a decrease of disparity of excess weight. Looking at the male and female samples separately, however, reveals an interesting difference; a positive contribution is only found in the male sample. In other words, the more equalized access to education among men partly explains the fall in the concentration index of excess weight. More equal access to education allowed the poorer men to catch up with the richer men in the sense that they gained weight at a faster speed than the rich. An alternative interpretation is also possible; the rich men may have realized the importance of a healthy diet and lowered their weight gains. As a result, the gap between them shrank. In contrast, the negative percentage contribution found among women suggests that the reduction in the inequality in education slowed the speed of the poor becoming overweight and/or accelerated the rich becoming more overweight.

Figure 9: Percentage Contributions to the Change of the Disparity of Excess Weight from 2000 to 2014



	All	Male	Female
Education	-11.33%	4.31%	-16.08%
Standards of living	64.65%	62.36%	66.38%
Sanitation	24.80%	26.60%	22.45%
Expenditure on staple food	-0.24%	-0.37%	-0.15%
Expenditure on meat and fish	0.11%	-1.02%	0.34%
Expenditure on oil	2.44%	3.09%	2.18%
Expenditure on soft drink	1.17%	1.59%	0.73%
Expenditure on prepared foods	-2.82%	-4.47%	-2.03%
Residuals	21.23%	7.90%	26.18%

Source: Authors' calculation.

5. CONCLUSION AND DISCUSSION

This paper studies the socioeconomic disparities of overweight, obesity, and excess weight in Indonesia from 1993 to 2014 and their changes during the period. First, we showed that the proportion of overweight and obese people grew rapidly in the country and overweight and obesity were becoming rapidly more prevalent among the less wealthy groups. Although

the overweight and obesity prevalence rate was still higher among the wealthy, the growth of the prevalence rate among the less advantaged groups was higher than that of the rich. Second, from the concentration index in each year of the survey, we found that the socioeconomic-related disparity decreased over time. The largest fall was found after 2000 for both women and men, suggesting that all findings considered, overweight and obesity are no longer problems only for the rich people but increasingly for the poor.

Third, we implemented decomposition analyses. We decomposed the concentration index for excess weight in 2000 and 2014 for both sexes. Most parts of the concentration index were explained by the unequal distribution of living standards and sanitary conditions. Finally, we decomposed the largest change in the concentration index of excess weight, found between 2000 and 2014. The results showed that a large part of the change could be explained by the decrease in inequality in living standards, sanitary conditions.

Increase in weight among the poor is not necessarily a bad outcome. As can be seen in Figure 3, the number of underweight people has also drastically fallen over the observation period. And the prevalence of underweight is particularly high among the low-income groups. However, the rapid growth of people with excess weight in the lower income quintiles is a worrisome development. Overweight is one of the main risk factors for developing chronic diseases, which require substantive medical expenditures often borne by the patient in developing countries. Lower-income groups are particularly ill prepared for such high expenditures. The question is what policies could help to dampen the rapid increase of weight in lower income quintiles, while at the same time ensuring that under-nutrition is reduced. Education might be the first bet.

In our study we found that during the observation period the inequality in high school and university education was indeed mitigated both for men and women. Results for the overall sample suggest evidence that providing equal educational opportunities lessened the speed of the poor becoming as overweight as the rich. Greater equality in education may have made the poor, especially poor women, realize the importance of not becoming overweight. However, we uncovered a different effect of contributing to mitigation among women and men. The more equalized educational opportunity allowed the less wealthy men to catch up quickly with the rich in terms of extra weight. For women, on the contrary, the opposite result was found. Further research is needed to see why the effect is not the same for both men and women.

This paper presented new evidence that the socioeconomic disparity of overweight and obesity in Indonesia has been rapidly changing over the past 2 decades. Hand in hand with economic growth, lower income groups increased in body weight at a higher pace than higher income groups. Overall, overweight in Indonesia is no longer affecting only the wealthier segments of the population, but the entire socioeconomic spectrum. This also implies that population groups that are less well prepared for the incidence of noncommunicable diseases are now running a higher risk of developing them. Policy makers in Indonesia need to think about policies to effectively slow down the increasing speed of the prevalence of obesity, especially among poorer households. Targeted educational efforts are one option. Another option might be the introduction of taxes on unhealthy foods, such as soft drinks. These tax measures need to be well designed in order to make sure they achieve their policy objectives while maintaining enough healthy and affordable food choices. Given the sharp increase in overweight and obesity in Southeast Asia, more research is needed to better understand the problem and to be able to design appropriate responses that fully take into account the strong socioeconomic disparities.

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