The Existence of Double-Burden of Malnutrition in the Same Households in Eastern Indonesia: Analysis using Global vs. Alternative Asian BMI Cut-off Points

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ABSTRACT

The study utilizes the data from the first round of Indonesian Family Life Survey conducted in the eastern part of the country (IFLS East) during 2012 to identify child-mother pairs which experience the Double Burden of Malnutrition (DBM) - a situation where overnutrition of the mother and undernutrition of the child coexist within the same household. The analyisis is done using several cross tabulations and comparisons to determine outcomes for the two separate Body Mass Index (BMI) measurement classifications; the Global-Cut off and the Asian Cut-off. The study also explores the difference in household characteristic as factors contributing to DBM. The results showed that the prevalence of child undernourishment within the IFLS East is considerably high, especially for the stunting prevalence (44%). The results also showed that the use of the Asian-Cut off for classification of BMI raises the prevalence of mothers in the categories of overweight and obese from 32% to 46%, consequently raising the prevalence of DBM child-mother pairs by 6 percentage points. The study was able to detect a significant risk factor for DBM of maternal short stature, but was not able to detect other significant factors leading to the presence of the DBM child-mother pair. The paper argues that more research is required into the special characteristics of the women in between the two cut-off classifications, as well as their children. Findings of the additional research may lead to a determination of the appropriateness of the Asian Cut-off as more accurately capturing the severity and prevalence of double burden of malnutrition amongst the population. Several policy recommendations for the further monitoring and analysis of DBM and obesity amongst women of child bearing age are provided.

Key words: Double Burden of Malnutrition, nutrition transition, Indonesian Family Life Survey, WHO Global BMI Cut-off point, Asian BMI Cut-off point

INTRODUCTION

The Double Burden of Malnutrition (DBM) is a situation where undernutrition and overnutrition coexist within the same country, community or household. The DBM is a global problem, with 25% of the world's population being overweight, while 17% of pre-school children are underweight and 28.5% are stunted and 40% of women of reproductive age have anaemia (UNSCN 2010). The DBM is a particular concern for developing and middle income countries that find themselves in the midst of what is known as the 'nutrition transition'. This term comprises food consumption and physical activity changes that are associated with lifestyle transformations in modernizing or westernizing societies (Popkin 2001). The nutrition transition often occurs in countries experiencing economic growth, but which are also characterized by high rates of undernutrition. The rapid onset of obesity leaves a gap in suitable policies, which remain largely focused on tackling undernutrition. The evidence for the severity and implications of DBM is also still quite limited, making advocacy for the incorporation of actions for its address into policy difficult. The challenge is for the research to catch pace with the rapid onset of the problem which is already considered an epidemic.

The issue of child stunting has become a more widely recognized problem in recent years, however, recognition of the phenomena of the DBM has come to light relatively recently in Indonesia. In Indonesia there is little awareness of the DBM amongst government policy makers, the general public or even within health professional circles. As in many cultures, being overweight is still perceived rather positively in Indonesia and associated with higher social status. In fact there is still widespread denial that obesity is even a disease, where many people believe that obesity is solely the result of poor personal choices. The challenge for the nutrition and medical community is to raise public awareness that obesity is a disease rooted in genetics and biological factors which start as early as conception, which is then compounded by poor nutrition.

In this study, we first present the prevalence of the malnutrition problem amongst the children and mothers in the eastern part of Indonesia based on the analyisis of the 2012 Indonesian Family Life Survey (IFLS East). For the nutritional status of the mother, we use two different classifications: the Global Cut-off and the Asian Cut-off in order to contrast the the severity of the prevalence of the malnutrition problem using those two different classifications. Secondly, we conduct an analysis of the data set to identify the child-mother pairs which are experiencing the DBM. Finally, we compare the DBM child-mother pairs and the normal/well-nourished child-mother pairs utilizing a wide range of household

characteristics to examine potential characteristics which may contribute to the prevalence of DBM within a household.

This study largely complements the 2012 assessment of the DBM in Indonesia by Roger Shrimpton which points to several causes of the DBM and highlights the urgency of policy action. Shrimpton utilizes a four-wave panel from a series of Indonesian Family Life Surveys (IFLS, 1993, 1997, 2000, 2007) to highlight the problem of overweight/obesity and its rapid increase during this period. Also, this study builds on the studies of Römling and Qaim (2012a and 2012b) which also looked at the four-wave panel series of IFLS data for trends in obesity and DBM.

Additional reviews of relevant journals have been carried out for the inclusion of analysis from articles published on topics of relevance to the DBM problem in Indonesia. This paper is not the result of a systematic literature review, but rather discusses relevant literature with the aim of raising attention to the growing body of evidence which shows links between undernutrition and overnutrition within the same household.

The paper also aims to raise awareness of the need for appropriate policy development as Indonesia undergoes its rapid nutrition transition. Various methodologies for determining the severity of the DBM in Indonesia are explored and considered. Specifically, the use of alternative Body Mass Indexes (BMI) classification is reviewed to highlight the need for contextually specific tools for analysis of the DBM. Attention is also drawn to the need for looking not only at the malnourished child, but to the health status and risks of mothers which contribute to the DBM, to determine methods of early identification and prevention for potential inclusion in future policies.

LITERATURE REVIEW

The Double Burden of Malnutrition in Indonesia

Roger Shrimpton, in his 2012 study *The Double Burden of Malnutrition in Indonesia*, also looks at the panel of the IFLSs carried out in 321 communities in 13 provinces including data from 1993, 1997, 2000 and 2007. His work shows that over the fifteen year period, the proportion of thin men and women (BMI<18.5) decreased considerably while the proportion of fat men and women (BMI>25) almost doubled. Shrimpton also points out that according to the national Basic Health Research Survey (Riskesdas) 2010, the proportion of total mortality caused by non-communicable diseases (NCDs) in Indonesia surpassed that of the communicable diseases around the turn of the millennium, and that in 2007 NCDs accounted for nearly 60% of mortality. Stroke was the leading cause of death at 15.4%, followed by

tuberculosis (7.5%), which was the most common communicable disease cause of mortality while cardiovascular disease (CVD) accounted for 30.6% of all NCD deaths. This was followed by cancer (12.9%) and Chronic Obstructive Pulmonary Disease (7.1%) and diabetes (2.9%) (Directorate of Non-Communicable Disease Control – MOH, 2011). The link between the high levels of NCDs and the DBM household is explored further.

Shrimpton's study also noted that Indonesia's most stunted province, East Nusa Tenggara (NTT) with the prevalence of 58%, also has the highest level of low-birth-weight rates in Indonesia at 19%. Young child wasting rates in Indonesia are also high, with eighteen provinces having a prevalence of over 15%, a level which is considered an emergency situation necessitating supplementary feeding the by WHO. However overweight is also a significant problem. Ten provinces have young child overweight/obesity rates of over 15%, and in three provinces both young child wasting and overweight/obesity rates are over 15%. Importantly for this study, Shrimpton noted that rates of adult overweight/obesity are similar if not of greater magnitude in the outer islands – many of which are included in the IFLS east dataset used for this study.

In a study utilizing the four IFLS waves, Römling and Qaim (2012a) shed additional light on the prevalence and trends of obesity in Indonesia. Detailed household and individual level data gathered from adults and spanning the time period from 1993 to 2007 suggests that the obesity pandemic in Indonesia will further increase in extent and severity. The study utilized the Asian Cut-off for BMI classification with a BMI of higher than 27 kg/m^2 categorized as obese, and between 23 and 27 kg/m^2 as overweight/pre-obese. Accordingly, a BMI between 18.5 and 23 kg/m^2 is categorized as normal weight, whereas less than 18.5 kg/m^2 is considered underweight.

The authors disaggregated the data by gender to show that on average both men and women have increased their BMI significantly. The mean of BMIs increased 0.64 points for men and 1.23 points for women from 1993 to 2000, and 1.19 points for men and 1.41 points for women from 2000 to 2007 suggesting that the nutrition transition in Indonesia in also accelerating. While the BMI of individuals is often positively associated with improved living standards, it is also associated with poorer segments of society. Many in the poorer income quintiles have also increased their BMI beyond normal weight levels over the 14-year period of observation. Analysis in the study also showed that the nutrition transition is not an urban phenomenon, but is present in accelerating rates amongst rural areas. The general analysis of the panel data confirms that *'Indonesia is in the process of a fast and profound*

nutrition transition, with constantly rising prevalence rates of obesity' (Römling and Qaim, 2012a).

A separate study by Römling and Qaim (2012b) exploited household panel data from the same four-wave survey data, and as well utilized a Theil Index to determine intra-household nutritional inequality to examine the nature of the nutrition transition in Indonesia. Data showed that the proportion of underweight households (where there is at least one underweight member but no overweight members) declined from 26.3% to 14.9% between 1993 and 2007, however the number of overweight households (where there are no underweight members and at least one overweight) increased from 35% in 1993 to 51% in 2007, while the proportion of the double burden households increased from 12% in 1993 to 17% in 1997 and remain relatively steady up to 2007. The panel data showed that the household nutritional status is actually transitory in nature with 51% of households moving to other categories between periods of observations, with nearly 60% of the normal households moving into different categories; most of them to the overweight group.

The introduction of the Theil Index allowed for a more in-depth analysis of the data showing that intra-household nutrition inequality is highest among the overweight households and is increasing amongst the poor. In 1993 the highest prevalence of double burden households was amongst the richest quintiles, but by 2007 the poorest quintile had the highest proportion of double burden. The study also pointed to higher levels of intra-household nutritional inequality within urban households. Analysis showed that intra-household nutritional inequality may be increasing amongst urban households and households with higher numbers of family members. The authors suggest that this may be due to several reasons including; rising levels of extreme obesity amongst individual household members and the likelihood of larger BMI differences amongst larger households, and the existence of greater choices of poorer quality foods in urban environments.

The Life-cycle Dimension of the DBM and Links to Non-Communicable Disease

Non-Communicable Diseases (NCDs) account for over half of total deaths in the world (Abegunde and Stanciole 2006). The science linking NCDs to intrauterine growth restriction, caused by poor maternal nutrition and leading to intergenerational malnutrition, has been under discussion since the 1960s (Neel 1962). The *fetal origins hypothesis* is based on associations observed between foetal or early growth restriction and the subsequent development of chronic disease, in particular insulin resistance and impaired glucose tolerance (Hales & Barker, 1992). Hofman et al., in 1997 also proposed the concept of *foetal*

salvage in which selective changes in growth rates of certain organs, often the brain and other key organs, are intentionally sacrificed by adaptations in foetal metabolism. The World Health Organization estimates that 66 percent of deaths due to chronic disease and NCDs worldwide now occur in developing countries and that obesity is a primary risk factor in these contexts (WHO 2004). And within such countries, the poor are increasingly affected as development progresses (Monteiro et al. 2004).

Cara Eckardt of the International Food Policy Research Institute (IFPRI) in a review of a series of Latin American and Caribbean studies in 2006 concluded that micronutrient malnutrition may be indirectly contributing to the risk of overweight/obesity and chronic diseases via its relationship with childhood stunting and subsequent short adult stature, which, in turn, increases the risk for overweight/obesity and chronic disease in the context of the nutrition transition (Eckardt, 2006). Several studies propose that the effects of the nutrition transition and the emergence of the DBM problems may also be genetic in nature. It is proposed that genetic factors could endow individuals that were able to efficiently collect and process food to deposit fat during periods of food abundance, which has been called the "*thrifty genotype*" hypothesis (Neel 1962). This thrifty gene then works to the disadvantage of those who are later exposed to a poor diet high in fats and sugars as adults, or as children, who are then predisposed to obesity.

Contributing Factors to DBM

It is generally agreed that DBM is the result of a culmination of factors which are locally specific to the context in which they are found. In a study conducted by Oddo et al (2012) which reviewed data from a total of 247,126 rural households that participated in the Indonesia Nutrition Surveillance System (2000–2003), DBM was observed in 11% of the households in rural Indonesia. The authors found that maternal short stature and older age were strong predictors of DBM. Child characteristics such as older age and being female were associated with increased risk of DBM, whereas currently being breastfed was protective against DBM by 26%. A larger family size and higher weekly per capita household expenditure were also strongly linked to DBM.

CM Doak et al, in their 2004 study, looked into the relationship between urban and rural residence as well as income when comparing the data for DBM in a multi-country data review which included Indonesia. Using the Global Cut-off BMI, all persons were classified into categories of double burden, overweight, underweight and normal. Multiple logistic regressions were used to explore income and urban risk factors. The study found that the

highest prevalence of DBM households were within those countries in the middle range of gross national product (GNP). Importantly, in Indonesia the DBM households were not found to be easily distinguished from 'overweight' only households, implying the identification of DBM households maybe difficult. Due to the complexity of the issue, there is much debate on the contributing factors related to DBM.

Economic Consequences of DBM

Developed and developing countries are both struggling to address the economic consequences of DBM. At the root of this problem is health financing. The problem is urgent as the numbers of obese and DBM are predicted to increase significantly along with aging populations, unplanned urbanization, and unhealthier lifestyles. An Asian Development Bank study showed that when the impact of health care costs on household resources is factored into real costs, about 78,000,000 more people in developing Asia would fall into poverty. For Indonesia this equates to 8.7% more or *1,400,000 more people if based on the current national poverty line of $1.08/day* (ADB 2011). The Asian Development Bank also quotes Harvard University health economist David Bloom who estimates that chronic illnesses, such as heart disease and cancer, will cost the world an estimated $35 trillion over the next 25 years.

Attempts have been made to calculate the costs of gestational malnutrition. There is also evidence that constrained foetal growth produces measureable differences in immunity, as well as a greater propensity for diet related non-communicable diseases such as type 2 diabetes and cardiovascular diseases later in the life course. Based on conservative assumptions related only to lost productivity, the costs of child undernutrition in the Asia region were estimated to be at least 2 or 3 percent of GDP (Horton 1999).

Guillespie and Haddad (2001) assert that the most sustainable and economic pro-poor growth strategies are found in nutrition interventions, however the actual components of a national strategy must be chosen contextually and based on local evidence. They state clearly that a shift from a curative approach to a preventative and promotion-based approach will have the most significant and rapid impact. The authors also suggest that national economic analysts employ the use of the disability adjusted life years (DALY) when analysing and advocating for nutrition financing. The DALY combines years lost due to mortality with years lost due to morbidity and disability which demonstrates that nutrition interventions have a high estimated benefit in terms of reducing the burden of disease and consequentially economic loss. Lastly, the authors recommend the diversion of a small amount of resources

from less effective food assistance programs through improved targeting of direct nutrition programs toward the current generation of infants (2001). The World Bank also notes that annually, Indonesia loses over US$2.6 billion in GDP to vitamin and mineral deficiencies (World Bank 2012), money which could be used to broaden nutrition interventions.

The DBM and Global Cut-off and Asian Cut-off of BMI Classification

The severity of the problem of the DBM can be determined using varying methodologies. This study looked at two separate standards for classification of overweight and obese for measuring nutritional status of the mothers. The first classification is commonly referred to as the Global Cut-off which utilizes a BMI of >25 kg/m2 to determine overweight status and >30 kg/m2 to determine obesity. The second classification is commonly referred to as the Asian Cut-off which utilizes a BMI of >23 kg/m2 to determine overweight status and >27 kg/m2 to determine obesity. The Global Cut-off has been developed in the context of Caucasian communities, derived largely from mortality statistics from European and American populations and is endorsed by the WHO. For this reason many in Asian countries believe that there is a need to review the WHO recommended cut-off limits for obesity in Asian populations to ensure that populations with a higher health risk and susceptibility to disease are detected.

Several studies have separately established that the BMI cut-off point for obesity for Asian populations is pegged between 23 and 27 kg/m2, challenging the notion that one BMI cut-off point fits all populations (Duren burg et al 1998, and Chang et al 2003). Furthermore, studies have shown that Asian populations have higher risks of type 2 diabetes, cardiovascular disease, and mortality from other causes at a relatively lower BMI, which they postulated to be largely attributable to the higher proportion of body fat in Asian populations (Norgen 1994 and Tai et al. 1999). Using regression analyses to study the relationships between BMI and actual Percentage of Body Fat (PBF), Goh et al (2004) showed that the most appropriate BMI cut-off point for obesity for a sample of local healthy Asian (Chinese/Singaporean) men and women aged 30–70 years was 27. Goh et al (2004) found that if the Global Cut-off BMI of 30 kg/m2 was used, between 86.6% and 93.3% of obese women and men will be misclassified as non-obese. On the other hand, 2.7% and 5.0% of non-obese men and women, respectively, will screen positive. This data supports the need to review the use of the Global Cut-off when discussing health policy for largely homogenous Asian countries. The official communication on the matter of Global vs. Asian Cut-offs from the WHO concluded that the proportion of Asian people with a high risk of type 2 diabetes

and cardiovascular disease is substantial at BMIs lower than the existing WHO Global Cut-off point for overweight (>25 kg/m2). However, available data do not necessarily indicate a clear BMI cut-off point for all Asians for overweight or obesity classification (the numbers did not hold for Japanese and Northern Chinese populations). The cut-off point for observed risk varies from 22 kg/m2 to 25 kg/m2 in different Asian populations; for high risk it varies from 26 kg/m2 to 31 kg/m2. No attempt was made, therefore, to redefine cut-off points for each population separately. The communication did however recognize the need for a variety of health actions along the continuum of BMI and proposed methods by which countries could make decisions about the definitions of increased risk for their specific population (WHO, 2004).

METHODOLOGY

Data Source

The data source of this study is the 2012 Indonesian Family Life Survey East (IFLS-East) which is a data set covering a wide range of characteristics of households which was carried out for the first time in 7 eastern provinces of Indonesia which were not covered in any previous IFLS. The 7 provinces are East Kalimantan, Maluku, North Maluku, East Nusa Tenggara, Papua, West Papua and South East Sulawesi. The questionnaires used in the IFLS East were modified from the previous IFLS in order to capture the specific conditions of the respondents, the field teams and the government implementers in the Eastern provinces of Indonesia. The IFLS East covered 99 enumeration areas in 99 villages, 91 sub-districts, and 52 districts within the 7 provinces. There are 38 villages categorized as urban areas and 61 villages categorized as rural areas. Total number of households interviewed was 2,457.

The questionnaire used in the IFLS East survey consists of four modules: the household, individual, cognitive test and health measurement. The household module was administered to the head of household or the spouse, the individual module was responded by all individuals in the household, the cognitive test was administered to all members of the household who were older than 7 but less than 24 years old, and the health measurement module captured a selection of health indicators for all members of the households.

Measurement of Nutritional Status of Children and Mothers

Nutritional status of children 0-59 months is analysed using Weight-for-Age (WFA) Z-scores, Weight-for-Height (WFH) Z-scores, and Height-for-Age (HFA) Z-scores as

measures of underweight, wasting, and stunting respectively.[1] The following WHO (1995) classifications of the Z-scores are used:

Table 1. The Classification of Nutritional Status of Children under 59 months

Classification	Z-score
Severely undernourished	<-3 Standard Deviation (SD)
Moderately undernourished	≥-3 to <-2 SD
Normal	≥-2 to <2 SD
Overnourished	>2 SD

The following lower and upper SD boundaries are used as cut-offs for Z-scores: WFA -6 to +5, WFH -5 to +5, and HFA -6 to +6, children who have scores outside these boundaries are excluded from the analysis (WHO 2009).

The nutritional status of mothers is evaluated using Body Mass Index (BMI or kg/m2). In this paper, two different classifications are used: the Global Cut-off (WHO 1995, WHO 2000) and the alternative Asian Cut-off (WHO 2004). The classifications of nutritional status based on the BMI of mothers using the two cut-offs is as follows:

Table 2. The Classification of Nutritional Status of Mothers

Classification	BMI Scores	
	Global Cut-off	Asian Cut-off
Underweight	<18.50	<18.50
Normal	≥18.50 to <24.99	≥18.50 to <22.99
Overweight	≥25.00 to 29.99	≥23.00 to 26.99
Obese	≥30.00	≥27.00

Furthermore, all BMIs of <12 or >50 were excluded from the further analysis. Maternal stature was classified as *short* if found to be <145 cm.

Double Burden of Malnutrition Child-Mother Pair Determination

Mothers who have a BMI score ≥25 (using the Global Cut-off) or ≥23 (using the Asian Cut-off) who have a child who has a HFA Z-score lower than -2 SD is categorized as a DBM child-mother pair, while other pairs are categorized as non-DBM. Furthermore, in this

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[1] The Z-score is obtained by comparing the WFA, WFH, and HFA of the children with the WHO reference of children population.

paper, the DBM child-mother pairs will be compared with child-mother pairs where both child and mother have normal/well-nourished nutritional status. Normal for mothers means that the BMI score is between 18.5 and 25 (using Global Cut-off), and normal for children means that the HFZ Z-score is between -2 and 2 SD.

In this study, to link the mothers and the children within the same household, the household roster of the questionnaire is used. The number of households selected for further analysis of child-mother pairs is derived based on those having complete anthropometric data. From the total of 10,745 persons surveyed, 10,705 (99.7%) have complete anthropometric measurements, of which 1,340 contain anthropometric data of children 0-59 months. After data cleaning in regards to height, weight, age, z-scores, and BMIs, the anthropometric data of 1,035 children and 842 of their biological mothers are used for further analysis. If there is more than 1 child age 0-59 months belonging to the same mother, the older child is selected for the pair analysis as it has been shown that there is an association between children's age and DBM, in which households which have older children have increased odds of DBM (Oddo et al., 2012). The identification of the child-mother pairs using the older child ensures the highest capture of DBM households. Furthermore, the IFLS East data used in this study also shows a tendency of poorer nutritional status as the child gets older.

Potential Contributing Factors of DBM

There are several potential contributing factors of DBM. The factors that are analysed in this study are divided into the following categories: Socio-economic and demographic characteristics, food intake/dietary diversity, health status, environmental condition, and access to health care. The explanation of the variables that are included in each categories is provided in the appendix.

FINDINGS AND DISCUSSION

Characteristics of the Subset for the Analysis

In this study, we focus on a subset of households which have children under five years old and their biological mother living in the same house. This subset comprises 824 households and include 1,035 children and 842 mothers. Within the subset, 84% of the children are living with both parents. Most households (70%) are located in the rural areas, and comprise of nuclear families (64%), with an average household size of 5.4 members. The number of biological children of the same mother within households ranges from 1 to 3, with

79% of mothers having only one child under-five years old. The mean age of the father is 34 years and the mean age of the mother is 30 years. The mean year of schooling for the father is 9 years, while for the mother it is 8.6 years. The main occupation of the father is in the informal sector (64%) followed by the formal sector (35%). About two-third of the mothers are working either in the informal (54%) or are not working (32%). Only 13% of the mothers work in the formal sector.

Overall Nutritional Status of Children in the Subset

In the subset, there are 1,035 children under the age of 59 months that have complete data for nutritional status. The majority of the children are found to be within the normal range for each of the nutritional status measures: 55% for stunting index, 82% for wasting index, and 71% for the underweight index. However, only 425 children, or 41.1%, can be categorized as *normal* in all of the indices of nutritional status. The proportion of those considered *moderate* for each of the indices is larger than the proportion of those considered *severe*. Based on the WHO classification, the prevalence of undernourishment in children is considered **high** for underweight and wasting indices, and **very high** for the stunting index.
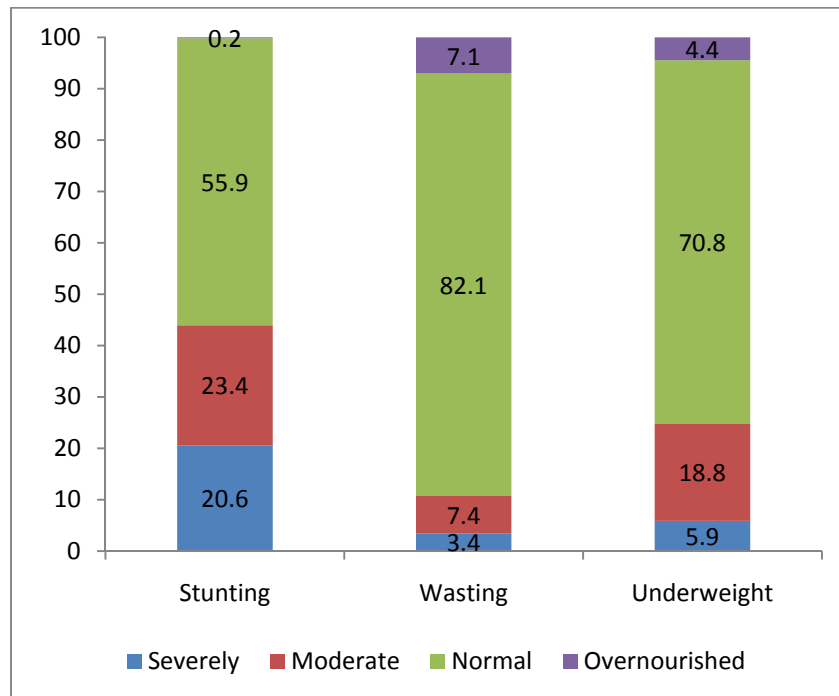

Figure 1. Nutritional Status of Children under the age of five

For HFA levels, it is found that 20.6% of the children are severely stunted, 23.4% are moderately stunted, and 55.9% are of normal height, while 0.2% are overnourished (Figure

1). The Z-score mean is -1.6. The total stunting prevalence among children in the sample is 44.0% which is 25% higher than the national average figure of 35.6% based on Riskesdas 2010.

For WFH levels, it is found that 3.4% of the children are severely wasted, 7.4% are moderately wasted, 82.1% are normal, while 7.1% are overnourished. The Z-score mean is -0.4. The total wasting prevalence among children in the sample is 10.8% which is lower than the national average figure of 13.3% based on Riskesdas 2010. Nationally, the prevalence of overnourished children under the age of five years as measured by WFH index is 14%.

For WFA levels, it is found that 5.9% of the children are severely underweight, 18.8% are moderately underweight, 70.8% are normal, while 4.4% are overnourished. The Z-score mean is 1.0. The total underweight prevalence among children in the sample is 24.7% which is 39% higher than the national average figure of 17.9% based on Riskesdas 2010.
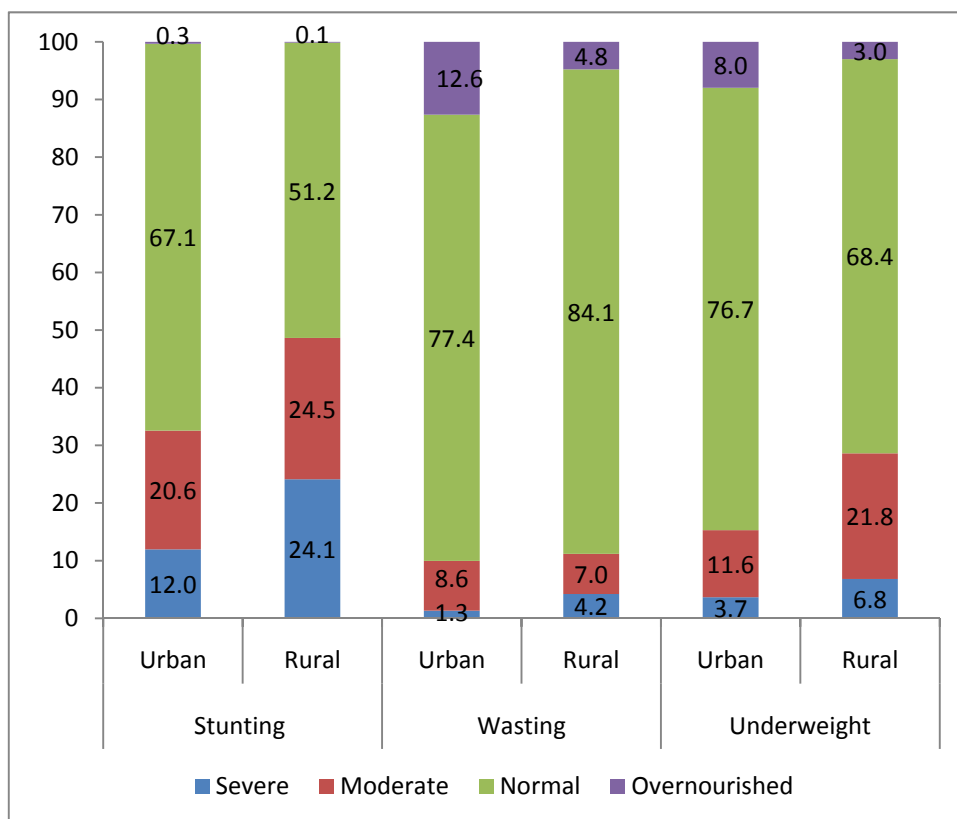

Figure 2. Nutritional Status of Children by Urban/Rural Location

The location in which children reside is not balanced between rural and urban areas. Seven out of ten children live in rural areas. The data shows that undernourishment in rural areas is significantly more problematic than in urban areas for both moderate and severe

classifications (Figure 2). Conversely, there are a higher percentage of overnourished children in urban areas compared to rural areas in terms of WFH (12.6% vs. 4.8%) and WFA (8.0% vs. 3.0%). There is a small percentage, less than 0.5%, of overnourishment in both rural and urban areas in terms of HFA.

Moderate undernourishment levels are comparable in both boys and girls for all indices however more boys (52%) are severely stunted as compared to girls (35%) as shown in Figure 3. The prevalence of overnourishment is similar for both boys and girls across the three measures of nutritional status. The prevalence of overnourished boys based on WFH is 7.8% and for girls 6.3%.
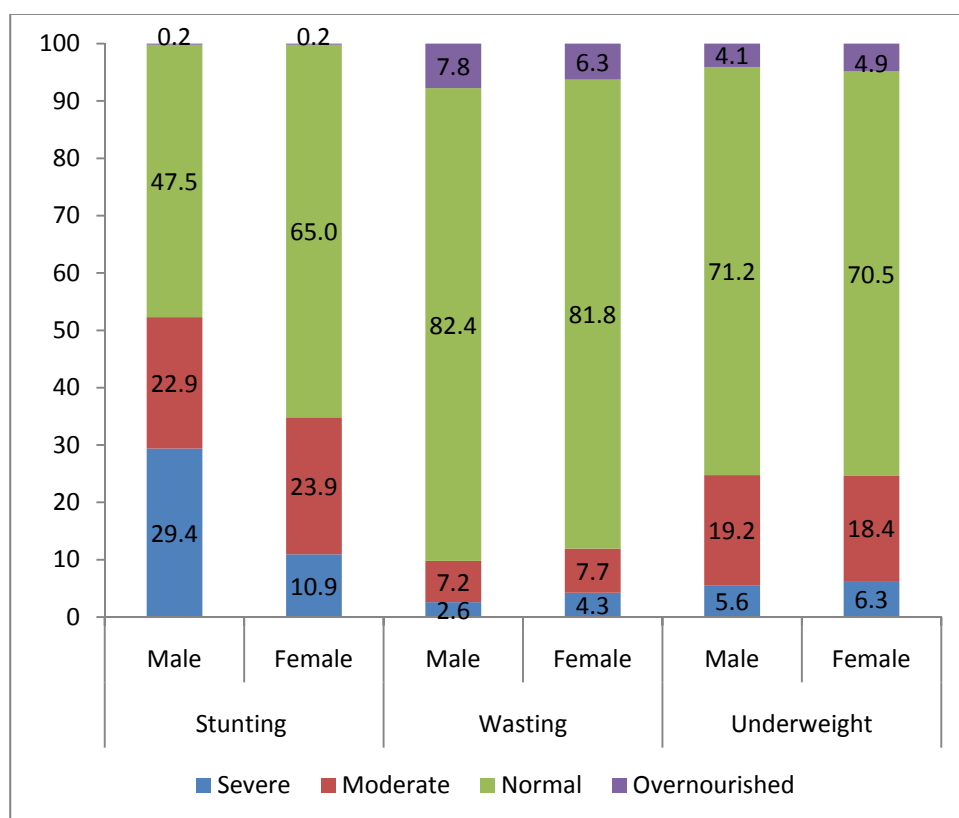

Figure 3. Nutritional Status of children based on Sex.

In term of the economic status of the households, the data shows a clear pattern of nutritional status in terms of stunting and underweight, and the measure of relative poverty which is measured by quintiles of expenditure amongts the households that have children 5 years old or younger. The figure below shows the prevalence of stunting, wasting and overweight, for both severe and moderate classifications in each quintile. The prevalence of malnutrition, particularly the stunting and the underweight, is higher in the lowest quintile (the poorest) compared to the higher quintiles (richer).
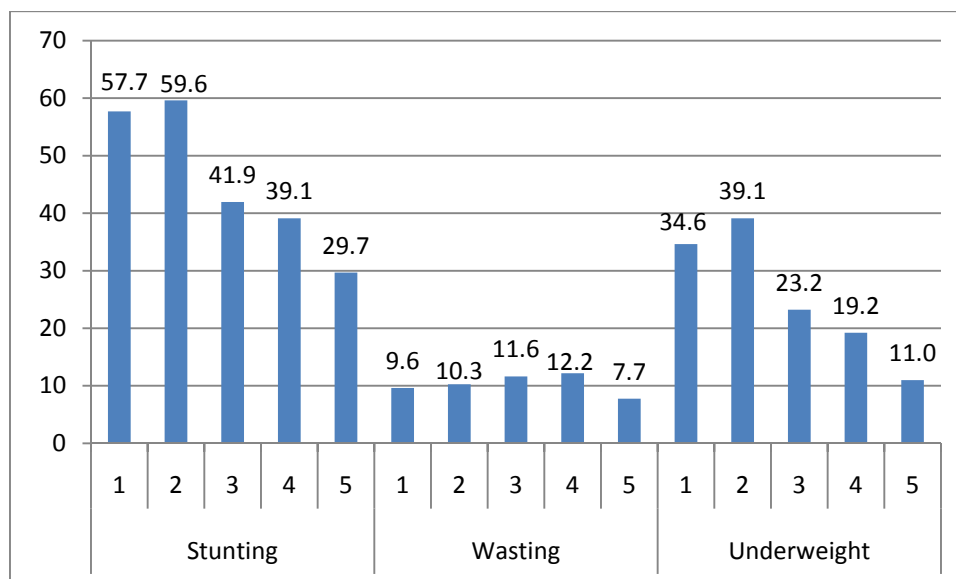
Figure 4. Nutritional Status of children based on Poverty Measurement

Amongst the children, acute child morbidity such as influenza, cough, fever, and anaemia within the last 4 weeks is very common. The prevalence is as follows: runny nose 56%, cough 52%, fever 48%, anaemia 61%. Diarrhoea in the last 4 weeks was recalled in 12% of the children.

Nutritional Status of Mothers within the Subset

Figure 5 below shows the nutritional status of the 842 mothers using the two Body Mass Index (BMI) classifications: the Global Cut-off and the Asian BMI Cut-off points. The majority of the mothers in the subset are found to be of normal BMI when using both the Global Cut-off point and the Asian Cut-off point.

The implication of using the Asian Cut-off is that there are significantly more mothers within the sample that can be categorized as either *overweight* and *obese* (45.6%), than when using the Global Cut-off (32.2%). The percentage of obese mothers is more than doubled from 8.8% under the Global Cut-off to 20.7% using the Asian Cut-off. By using the Asian Cut-off, 23.3% of mothers that are categorized as normal when using the Global Cut-off become categorized as overweight, and 50.8% of the overweight mothers are categorized as obese. In summary, nearly one quarter of mothers (25.3%) are re-categorized when applying the Asian Cut-off BMI.
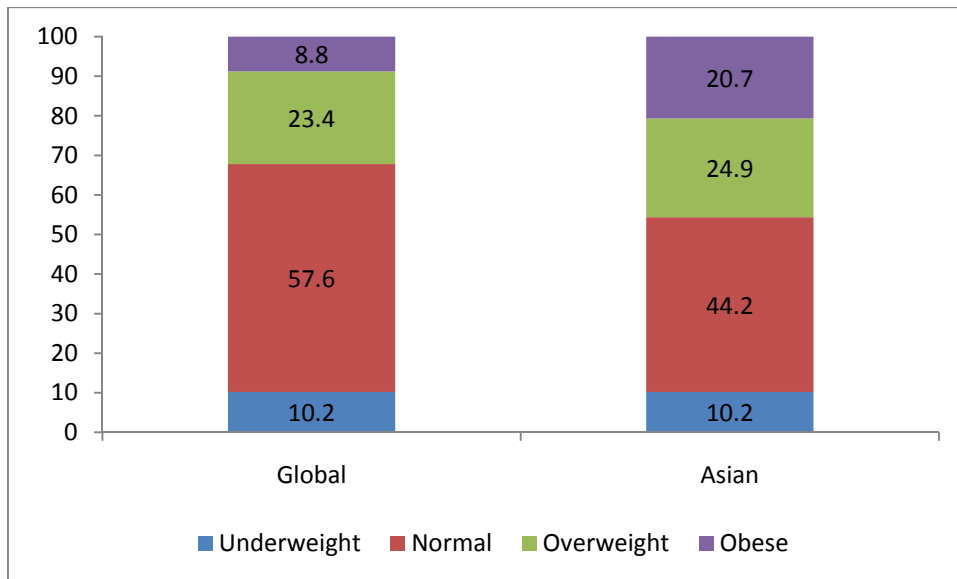
Figure 5. Nutritional Status of Mothers

Figure 6 below shows the distribution of the nutritional status by the age groups of the mothers using the two different cut-off classifications. As it is can be seen from the figure there is a much higher percentage of mothers with overweight and obesity in the age group of 31-40 than in any other age groups. A similar tendency also emerges as the Asian Cut-off is being used. Furthermore, using the Asian Cut-off, the proportion of 31-40 years old mothers who are overweight is slightly larger than the proportion of normal mothers.
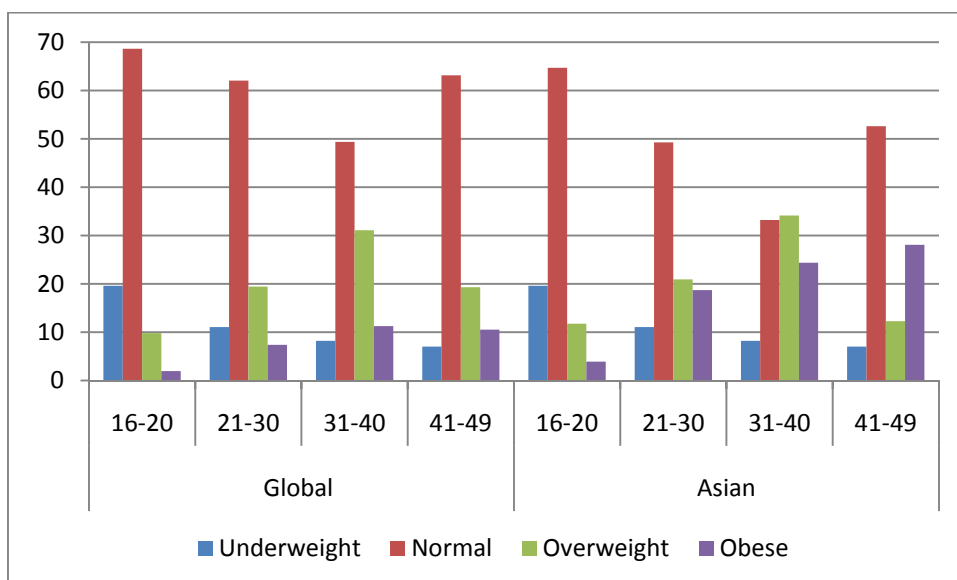

Figure 6. Nutritional Status of Mothers by Age Group

The figure below shows the prevalence of overweight and obesity amongst mothers disagregated by expenditure quintiles. The data shows that there is a positive correlation between expenditure quintiles and the percentage of obese mothers in each quintile. This shows that at this point of the nutrition transition in Indonesia, obesity is still most prevalence amongst the wealthier, however, the prevalence is also alarming for the poor. This is supportive of the findings of Romling and Qaim, 2012a.
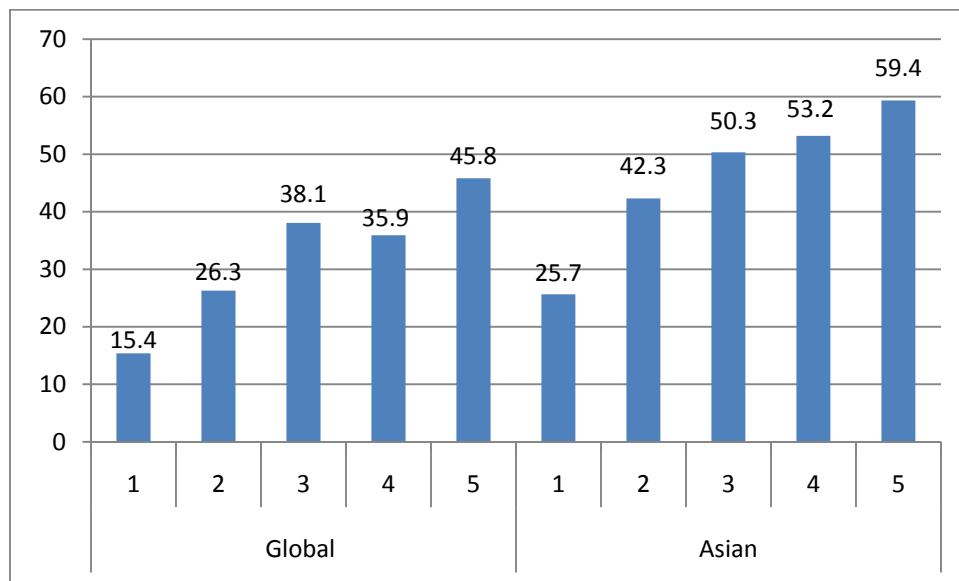

Figure 7. Nutritional Status of Mothers and Poverty Measurement

Prevalence of Double Burden of Malnutrition in Child-Mother Pairs

In this section, the double burden of malnutrition is discussed for child-mother pairs where the total subset is 842 pairs. For the analysis, the HFA index (stunting) is used for the children's nutritional status and the BMI is used for the mother's nutritional status. Data for the two measures are cross-tabulated. As mentioned above, only one child per mother is included in the analysis, that being the oldest child under-five.

Table 3 shows the tabulations using the two cut-offs of BMI. Using the Global Cut-off, 32% of the child-mother pairs can be categorized as normal, while 13% of the child-mother pairs can be categorized as a DBM pair. However, when using the Asian Cut-off, the child-mother pairs that can be categorized as normal are 25%, while those categorized as DBM pairs is 19%. Household characteristics of the DBM child-mother pairs are analysed and compared for both Global and Asian Cut-off points to determine whether the child-mother pairs have any differences in observable characteristics between the two different cut

off. The *t-test* results for detecting the difference-in-means do not detect any significance difference between the two groups for any of the variables. As there was no detectable difference in the analysis of variables between the two child-mother pair groups, the Global Cut-off will be used to analyse the difference between normal/well-nourished child-mother pairs in the sample and those categorized as DBM pairs.

Table 3. Nutritional Status of Child-mother pairs using the Global and Asian Cut-off points

HFA of children 0-59 months	BMI of mothers using **Global Cut-off**					BMI of mothers using the alternative **Asian Cut-off**				
	Under-weight (%)	Normal (%)	Over-weight (%)	Obese (%)	Total	Under-weight (%)	Normal (%)	Over-weight (%)	Obese (%)	Total
Severe stunting	2.3	12.2	4.2	1.3	20.0	2.3	9.3	5.1	3.3	20.0
Moderate stunting	3.7	13.2	5.8	1.9	24.6	3.7	10.1	6.2	4.6	24.6
Normal	4.3	32.1	13.4	5.6	55.3	4.3	24.7	13.7	12.7	55.3
Overnourished	0	0.1	0	0	0.1	0	0.1	0	0	0.2
Total	10.2	57.6	23.4	8.8	100	10.2	44.2	24.9	20.7	100

Potential Risk Factors Contributing To DBM

When the well-nourished child-mother pairs are compared with the DBM pairs utilizing the Global Cut-off, the results of both groups were more or less similar in regards to nearly all variables studied using the level of significance of 5% as shown in Table 4. However, for the variable of maternal short stature the DBM pairs showed statistically significant differences in the number of mothers considered short ($p<0.05$). This finding supports commonly held theories of intergenerational transmission of stunting. The mother, likely being born from an undernourished woman herself, developed undernourishment starting from in-utero resulting in her own short stature (145 cm, WHO standard). When she experiences poor nutrition during pregnancy, the chance of her baby having low birth weight, complications and growth restriction is higher (Bhutta et.al. 2013). Our finding on the significance of maternal short stature is similar to the findings from the Indonesia Nutrition Surveillance System data of 2000-2003 (Oddo et al 2012). Maternal and foetal undernutrition increased the susceptibility of the child to overnutrition and diet-related NCDs in adulthood.

Table 4. Household Characteristics of well-nourished vs. DBM child-mother pair

Type of characteristics	N	Well-nourished Child-Mother Pair	DBM Child-Mother Pair	Diff.
		(A)	(B)	(A)-(B)
HOUSEHOLD SOCIO-ECONOMIC AND DEMOGRAPHIC				
Average household size	380	5.3	5.6	0.3
Average age of child	380	28.9	37	8.1
Education of head of household	380	8.5	9.1	0.6
Education of biological mother	380	9	8.8	-0.2
Education of biological father	320	9.4	9.7	0.3
Location in urban areas	380	30.1	24.3	-5.8
Working Mother	380	62.8	71.2	-8.3
Working Father	299	98.6	100	-0.1
NUTRITIONAL STATUS				
Average birth weight of Child	268	3.3	3.2	-0.1
Short Stature-Mother	380	5	12	7 **
Anemia-Mother	371	55.6	45.6	-10 **
FOOD INTAKE				
Dietary diversity - child	232	4.8	5.2	0.4
Dietary diversity - mother	265	5.2	5.4	0.2
HEALTH STATUS OF THE CHILD				
Influenza	380	57.9	48.3	-9.6
Cough	380	50.4	48.3	-2.1
Fever	380	50	51.8	1.8
Diarrhoea	380	10.5	12.3	1.8
Anaemia	258	62.5	60	-2.5
ENVIRONMENTAL HEALTH				
Distance to clean water	380	63.6	23.2	-40.4
Open Type of Water sources	380	80.1	83.3	3.2
Open Type of Latrine	380	19.6	22.8	3.2
Inadequate Condition of garbage disposal	380	42.1	47.4	5.3
Inadequate Condition of sewage draining	380	59.8	61.4	1.6
ACCESS TO HEALTHCARE				
Time needed to reach healthcare facility	374	0.6	2	1.4
Time needed to reach posyandu	380	0.1	0.1	0
Number of weighing in the last 6 months	376	3.3	2.8	-0.5
Ownership of child growth monitoring card (KMS)	380	1	0.9	-0.1

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

The anemia prevalence amongst mothers is considerably high. Within the well-nourished child-mother pairs the prevalence is 55% and amongst mothers in the DBM child-mother pairs, the rate is 45%. The difference of the prevalence (10%) in the two groups is

statistically significant. Similar findings were shown in studies conducted among Chinese and Egyptian samples which linked obesity to lower rate of anemia when compared to well nourished individuals (Qin et al, 2013, Eckhardt et al., 2006). Both studies were inconclusive in the correlation between obesity and anemia and cited differences in absorbable iron contents within diets, more study is required in this area.

Although our analysis did not show differences in characteristics of DBM households measured using Global Cut-off and Asian Cut-offs for BMI, the lower Asian Cut-off can be used as a tool for the early detection of those categorized as overweight and at risk for NCDs. Several studies have supported the use of 23 kg/m2 as a cut-off for overweight for Asian based on studies in Bangladesh, Indonesia, and Vietnam (Oddo et al 2012, Usfar et al 2010).

Furthermore, while the data is not presented in the table above, we find when using of the Asian Cut-off, several variables which are not significant at 5% under the Global Cut-off, become significant under the Asian Cut-off. This might be due to the sample size in the two groups, DBM and non-DBM, becoming more balanced when the Asian Cut-off is used. Using the Asian Cut-off, it is shown that 74% of mothers are working in the DBM pairs whereas 58% of mothers are working in non-DBM (normal/well nourished) pairs. This result could be atributable to less time available for child care activities. Interestingly, dietary diversity scores were higher amongst children in the DBM households by 0.5. Lastly, the birthweight of children in the DBM pairs is 0.21 kilograms less than that of the non-DBM pairs. This finding is inline with previous studies which link maternal malnutrition with low birth weight.

Limitation of the Study and Analysis

The non-representativeness of the data may inhibit generalization of the situation in the eastern part of Indonesia. The data also cannot be considered as representative of the provincial situation due to the limited coverage and sample size. Nor is the sample representative of the eastern region as it comprises of only the 7 selected provinces. Because of the final size of the sample, it is difficult to observe possible trends in the nutritional status of children or their mothers within the various provinces. However, there seems to be no difference in terms of proportion of stunted children between locations (range 11%-18%).

The NCD data of the mothers were collected based on self-reporting, of an earlier diagnosis by health professional (diabetes, CVD, stroke and cancer) or through direct measurement for hypertension and cholesterol. However, the self-reporting method of data

collection may not provide reliable data due to memory recall bias. Due to this data limitation, we were not able to link the high cases of overweight and obesity of the mothers with her NCD data. For a future study it may be more valid to include only data for those illnesses measured directly.

POLICY IMPLICATIONS AND RECOMMENDATIONS

The nutrition transition is evolving rapidly in Indonesia. Households are moving out of undernutrition status and into the double burden and overweight categories as nutrition and physical activity behaviours are changing. Statistics for undernutrition remain a great concern, however the rapid increase in obesity amongst adults, and particularly among pregnant women and in children, is particularly alarming. Food and nutrition security policies should be developed in consideration of the DBM and detailed with evidence based interventions targeting specific phases of the life course (pregnancy, 0-6mths, early childhood, adolescence, reproductive age, etc). Interventions which address the direct causes of malnutrition (nutrition specific) and interventions which impact the contributing factors of malnutrition (nutrition sensitive) are included in the Scaling Up Nutrition movement that was adopted into Indonesian policy in 2012, but need to be reviewed for language and messages that also include overnutrition and obesity as well as undernutrition.

BMI screening for expecting mothers could be included within pre-natal and post-natal check-ups to allow health professionals to provide enhanced counselling to mothers at risk of obesity. The use of the Asian BMI Cut-off in such screenings could be rolled out within the national Jampersal program which provides free pre-natal and post-natal health services. Education of BMI and its impact on maternal and newborn health should also be included in family planning strategies.

Rates of stunting in the IFLS East sample are very high (44%) when compared to the 2010 Riskesdas national average of 35.6. Further training of health workers and volunteers to recognize when children are stunted and to provide appropriate counselling to mothers of stunted children is still required. Targeted messaging related to the linkage between malnourished mothers and child health outcomes should be a priority.

Additionally, programs and policies that promote diet quality among all people throughout the life cycle and across socio-economic status should be a major focus for policy makers as the nutrition transition escalates in Indonesia and western lifestyles are adopted. Campaigns could make use of a variety of media sources to target various education levels and more isolated locations.

The findings support the arguments for the intergenerational nature of malnutrition. Short mothers who are malnourished are giving birth to stunted children who will in turn pass NCDs on to their own children. National campaigns need to target adolescent girls and women of child-bearing age with nutrition education, behaviour change communication, and improved access to iron and multiple micronutrient supplements.

Additional analyses are required to determine the pattern of overlapping malnutrition and overweight/obesity with respect to socio-demographic characteristics and diet patterns in different areas of the country. Further research into the cultural factors around pregnancy, child birth and child care may be important to better understand nutritional trends and outcomes.

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DISCLAIMER

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REFERENCES

1. Abegunde D and A. Stanciole. 2006. An estimation of the economic impact of chronic non-communicable disease in selected countries. World Health Organization Department of Chronic Diseases and Health Promotion (CHP). http://www.who.int/chp
2. Asian Development Bank. 2011. Who will pay for Asia's Double Burden?
3. Bhutta ZA, Das JK, Rizvi A, et al. 2013. The Lancet Nutrition Interventions Review Group, and the Maternal and Child Nutrition Study Group. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *Lancet;* published online June 6. http://dx. doi.org/10.1016/S0140-6736(13)60996-4.
4. Chang CJ, Wu CH, Chang CS, et. al. 2003. Low body mass index but high percent body fat in Taiwanese subjects: implications of obesity cutoffs. *Int. J. Obes. Relat. Metab. Disord.* 27: 253–259.
5. Directorate of Non-Communicable Disease Control Ministry of Health. 2011. Prevention and control of Non-Communicable Diseases in Indonesia. Jakarta.
6. Doak CM, Adair LS, Bently M, Monteiro C, and Popkin BM. The Dual Burden Household and the Nutrition Paradox. 2005
7. Eckhardt C. 2006. Micronutrient Malnutrition, Obesity, and Chronic Disease in Countries Undergoing the Nutrition Transition: Potential Links and Program/Policy Implications. International Food Policy Research Institute.

8. Eckhardt CL, Torheim LE, Monterrubio E, et.al. 2006. Overweight and Obese Women Remain at Risk for Anemia in Countries Undergoing the Nutrition Transition. *The FASEB Journal*. 20: A986-A987.

9. Goh V, Tain CF, Tong TY, et. al. 2004. Are BMI and other anthropometric measures appropriate as indices for obesity? A study in an Asian population. J. Lipid Res. 45: 1892-1898.

10. Government of Indonesia Ministry of Health, Research and Development Agency. Basic Health Survey (Riskesdas) 2010. Jakarta.

11. Government of Indonesia, National Statistics Bureau. 2012. Number and Percentage of Poor People, Poverty Line, Poverty Gap Index, Poverty Severity Index by Province, September 2012. http://www.bps.go.id/eng/tab_sub/view.php?kat=1&tabel=1&daftar= 1&id_subyek=23&notab=1. Accessed June 25, 2013.

12. Guillespie S and L Haddad 2001. Attacking the Double Burden of Malnutrition in Asia and the Pacific. Asian Development Bank and International Food Policy Research Institute.

13. Hales CN and Barker DJP. 1992. Type 2 (non-insulin-dependent) diabetes mellitus: the thrifty phenotype hypothesis. *Diabetologia*, 35:595–601.

14. Hofman PL et. al. 1997. Insulin resistance in short children with intrauterine growth retardation. *J Clin Endocr Metabl*; 82:402–6.

15. Horton S. 1999. Opportunities for investments in nutrition in low-income Asia. *Asian Development Review* 17 (1-2): 246-273

16. Monteiro CA, Conde WL, Lu B, et. al. 2004. Obesity and inequities in health in the developing world. *International Journal of Obesity and Related Metabolic Disorders* 28 (9): 1181-1186.

17. Neel JV. 1962. Diabetes mellitus: a thrifty genotype rendered detrimental by progress? *Am J Hum Genet;* 14:353–62.

18. Oddo VM, Rah JH, Semba RD, et. al. 2012. Predictors of maternal and child double burden of malnutrition in rural Indonesia and Bangladesh. *American Journal of Clinical Nutrition 95: 981-8.*

19. Popkin BM. 2001. The nutrition transition and obesity in the developing world. Journal of Nutrition 131, 871s-873s.

20. Qin Y, Melse-Boonstra A, Pa X, et. al. 2013. Anaemia in relation to body mass index and waist circumference among chinese women. *Nutrition Journal* 12:10.

21. Römling C and Qaim M. 2012a. Obesity Trends and Determinants in Indonesia. Appetite 58; 1005–1013.

22. Römling C and Qaim M. 2012b. Double Burden Households and Nutritional Inequality In Indonesia. Global Food Discussion Papers. Georg-August University of Gottingen.

23. Sandjaja, Budiman B, Herartri R, Afriansyah N, et. al. 2009. Kamus Gizi. Pelengkap Kesehatan Keluarga. Persatuan Ahli Gizi Indonesia. Jakarta.

24. Shrimpton R. World Bank 2012. The Double Burden of Malnutrition in Indonesia.

25. Tai ES, Ho SC, Fok AC, et. al. 1999. Measurement of obesity by anthropometry and bioelectric impedance analysis: correlation with fasting lipids and insulin resistance in an Asian population. *Ann. Acad. Med. Singapore*. 28: 445–450.

26. UNSCN 2010. 6th Report of the World Nutrition Situation. Geneva: UNSCN.

27. Usfar AA, Lebenthal E, Atmarita, et. al. 2010. Obesity Reviews. Obesity as a poverty-related emerging nutrition problem: the case of Indonesia.

28. WHO. 1995. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. WHO Technical Report Series 854. Geneva.

29. WHO. 2000. Obesity: preventing and managing the global epidemic. Report of a WHO Consultation. WHO Technical Report Series 894. Geneva.

30. WHO. 2004. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. WHO expert consultation. Lancet; 363: 157–63.
31. WHO. 2009. WHO AnthroPlus for Personal Computers: Manual. Software for Assessing Growth of the World's Children and Adolescents. Geneva.
32. WHO. 2011. Hemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and Mineral Nutrition Information System. Geneva. (http://www.who.int/vmnis/indicators/ haemoglobin.pdf; accessed June 11, 2013.
33. WHO. Global data base on child growth and malnutrition. http://www.who.int/ nutgrowthdb/en/. Accessed May 17, 2013.
34. World Bank, 2012. Indonesia Health Sector Review. Indonesia: Facing up to the Double Burden of Malnutrition.
35. World Bank. Nutrition at a Glance Indonesia. http://siteresources.worldbank.org/ NUTRITION/ Resources/2818461271963823772/Indonesia.pdf

Appendix 1. Explanations of variables

The following indicators are used to describe ***socio-economic and demographic characteristics*** of the households: household size, age of the child, education of the biological father and mother (years of schooling), employment status of the mother and father, and location (urban/rural).

Dietary diversity score is calculated based on 10 food items captured in the IFLS East questionnaire, namely: tubers, eggs, fish, meat, dairy products, green leafy vegetables, banana, papaya, carrot, and mango. A score from 0-10 was used with 10 being the most diverse consumption score.

Data on the ***health status*** of the children was gathered based on recall information from the mothers for specific illnesses within the last 4 weeks, including: influenza, cough, difficulty of breathing, fever, and diarrhoea. Anaemia for children 6-59 months was classified as <120 g/l (WHO 2011).

The following indicators are used as a proxy for the ***environmental conditions***: access and distance to a clean water source, place of defecation, garbage disposal, and type of sewage system. Access to drinking water is divided into closed and open sources. Closed sources are considered: mineral water (bottled), piped, and well/pump (electric/hand). Open sources are considered: open well (manually drawn), rain water, river water, pond water, open storage tank, and others. Distance to water source is measured in meters. The main place of defecation is categorized into closed latrine and open defecation. Closed latrines are considered: own latrine with septic tank, own latrine without septic tank, shared latrine, or public latrine. Open defecation includes those defecating in the river, yard/paddy field, drainage canals, ponds, animal pens, sea/lake, and other responses. Garbage disposal is considered adequate if it is thrown into a garbage container, picked-up, or burnt. Inadequate disposal is considered thrown into the river/yard/garden, left on the open ground, thrown into an open hole/forest/mountain, thrown into the sea/lake/beach/rice field, and others. Adequate household drainage system is noted when the household is connected to a running sewer system or a covered permanent hole outside of the home. Inadequate household drainage includes blocked sewers, or drainage into a river, beside/behind the house/yard, into a pond/lake, animal pens, paddy field, sea/beach, and others.

Access to health care is measured against use of two types of responses; use of village health post (Posyandu) and use of other health facilities including hospitals (government or private), doctors, private clinic, midwife, nurse, or government health clinic. Attendance at a Posyandu is noted when it was stated that a visit was made in the last 6 months prior to the survey. The variable for the ownership of a health monitoring card is based on the mother's statement. The travel time to the Posyandu and health facilities is also noted.