Nutrition transition and the double burden of malnutrition in Indonesia

A mixed method approach exploring social and contextual determinants of malnutrition

Masoud Vaezghasemi
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This piece of work is wholeheartedly dedicated to my beautiful life companion, my best friend, and my love Julia, whose companionship cannot be expressed in words.
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ABSTRACT

Introduction
Nutrition transition concerns the broad changes in the human diet that have occurred over time and space. In low- to middle-income countries such as Indonesia, nutrition transition describes shifts from traditional diets high in cereal and fibre towards Western pattern diets high in sugars, fat, and animal-source foods. This causes a swift increase in the prevalence of overweight and obesity while undernutrition remains a great public health concern. Thus a double burden of malnutrition occurs in the population. The main aim of this investigation was to explore social and contextual determinants of malnutrition in Indonesia. The specific objectives were: (i) to examine body mass index (BMI) changes at the population level, and between and within socioeconomic groups; (ii) to estimate which context (i.e., household or district) has a greater effect on the variation of BMI; (iii) to assess the prevalence of double burden households (defined as the coexistence of underweight and overweight individuals residing in the same household) and its variation among communities as well as its determining factors; and (iv) to explore and understand what contributes to a double burden of malnutrition within a household by focusing on gender relations.

Methods
A mixed method approach was adopted in this study. For the quantitative analyses, nationally representative repeated cross-sectional survey data from four Indonesian Family Life Surveys (IFLS; 1993, 1997, 2000, 2007) were used. The IFLS contains information about individual-level, household-level and area-level characteristics. The analyses covered single and multilevel regressions. Data for the qualitative component were collected from sixteen focus group discussions conducted in Central Java and in the capital city Jakarta among 123 men and women.Connell's relational theory of gender and Charmaz's constructivist grounded theory were used to analyse the qualitative data.

Results
Greater increases in BMI were observed at higher percentiles compared to the segment of the population at lower percentiles. While inequalities in mean BMI decreased between socioeconomic groups, within group dispersion increased over time. Households were identified as an important social context in which the variation of BMI increased over time. Ignoring the household level did not change the relative variance contribution of districts on BMI in the contextual analysis. Approximately one-fifth of all households exhibited a double burden of malnutrition. Living in households with a higher socioeconomic status resulted in higher odds of double burden of malnutrition with the exception of women-headed households and communities with the highest social capital. The qualitative analysis resulted in the construction of three categories capturing the significance of gendered power relations, the emerging obesogenic environment, and generational relations for child malnutrition.

Conclusion
At the population level, greater increases in within-group inequalities imply that growing inequalities in BMI were not merely driven by socioeconomic factors. This suggests that other under-recognised social and contextual factors may have a greater effect on the variation in BMI. At the contextual level, recognition of increased variation among households is important for creating strategies that respond to the differential needs of individuals within the same household. At the household level, women's empowerment and community social capital should be promoted to reduce inequalities in the double burden of malnutrition across different socioeconomic groups. Ultimately community health and nutrition programmes will need to address gender empowerment and engage men in the fight against the emerging obesogenic environment and increased malnutrition that is evident within households, especially overweight and obesity among children.

Keywords: Double burden of malnutrition, Child obesity, Body Mass Index, Gender relations, Social capital, Multilevel modelling, Grounded theory, Indonesian Family Life Surveys, Indonesia
1. INTRODUCTION

The introduction of this thesis begins with general background information about nutrition transition and double burden of malnutrition globally, and how they are measured across individuals and in different contexts. It later focuses on the status of malnutrition in Indonesia and introduces the conceptual framework adopted for this purpose. Subsequently, it describes different theories applied throughout the four papers and concludes by outlining the gaps in current knowledge and the contribution made by this thesis.

1.1. Nutrition transition

Dr. Barry M Popkin shaped the idea of nutrition transition for the first time in 1993. This theory concerns the broad changes in the pattern of human diet that have occurred across time and space (Popkin, 1993). The nutrition transition theory is used in reference to the contemporary transition of developing countries from traditional diets high in cereal and fibre to more towards Western pattern diets high in sugars, fat, and animal-source food. Two other theories of change preceded or took place concurrently with the nutrition transition. The first of these is the demographic transition theory, which describes the shift from a pattern of high fertility and high mortality to one of low fertility and low mortality. This is typical of modern industrialized countries. The second historic course of change is conceptualized by the epidemiological transition theory, first defined by Omran (1971). This describes the shift from a pattern of prevalent infectious diseases as a result of periodic famine, poor environmental sanitation, and malnutrition to a pattern of prevalent chronic and degenerative diseases associated with urban-industrial lifestyles. These three theories share one common characteristic in which populations continually move from one pattern to the next.

The nutrition transition is outlined by five broad nutrition patterns (Figure 1): (i) collecting food: individuals live highly active lifestyles, hunting and foraging for food. Diets typically are rich in fibrous plants and high in protein from lean wild animals; (ii) famine: famine is common, slowing individual growth and decreasing body fat; (iii) receding famine: famine recedes as income rises and nutrition improves; (iv) degenerative diseases: as income continues to rise, individuals have access to an abundance of high-calorie foods, and they become less active, leading to increases in nutrition related non-communicable diseases such as obesity and obesity-related chronic diseases, i.e., diabetes and heart disease; and (v) behavioural change toward a healthy and balanced diet: in response to increasing rates of obesity and obesity-related chronic diseases, individuals change their behaviour and communities promote behaviour changes to prevent these conditions. Currently, the vast majority of the world's people remain in pattern 3 or pattern 4 (Popkin 2002, 2006, Popkin and Ng, 2007).
1.1.1. Implications of nutrition transition

What is most concerning is that the pace of the rapid nutrition transition shifts in diet and activity patterns seem to be faster and are accelerating in low- and middle-income countries (LMICs) compared to high-income countries (Popkin, 2002, 2006). Consequently, many LMICs are experiencing a swift expansion in the prevalence of overweight and obesity. Countries that already have high obesity prevalence rates are mainly found in Latin America, the Middle East, and North Africa. Many LMICs, e.g., Mexico, Thailand, China, and Indonesia, are experiencing an annual increase (in percentage points more than 1) in overweight and obesity. Only in the United Kingdom and Australia are such rates seen in higher-income countries (Popkin, 2006). What potentially is far more important are the rates of change in the prevalence of overweight and obesity in these countries compared to high-income countries, as reported by the non-communicable disease (NCD) risk factor collaboration study in 200 countries from 1975-2014 (Prospective Studies Collaboration, 2009). The global NCD target on obesity, however, has created new policies that could halt and hinder the worldwide increase in body mass index (BMI) (Dietz et al., 2015, Hawkes et al., 2015, Roberto et al., 2015, Swinburn et al., 2015). Thus, implementing these policies and systematically assessing their effect should be strongly encouraged to circumvent an epidemic of severe obesity, despite industry opposition and government reluctance to regulate a
healthier food environment (Swinburn et al., 2015). Nonetheless, underweight remains a major public health problem in south Asia and central and east Africa causing a double burden of malnutrition. The global pattern of overweight and obesity is shown in Figure 2, based on data from Global Burden of Disease (GBD) in 2013.

Figure 2. Patterns of overweight and obesity (BMI ≥25) for both adult men and women more than 20 years worldwide

In South Asia and Central and East Africa, where undernutrition is still a public health concern, obesity is rising, causing a double burden of malnutrition. Roger Shrimpton and Claudia Rokx defined double burden of malnutrition as the coexistence of both undernutrition (including micronutrient deficiencies) and overnutrition (overweight and obesity) in the same population and across the life course (Shrimpton and Rokx, 2012). The World Health Organization (WHO) defined malnutrition as nutritional excesses as well as deficiencies of macronutrients and micronutrients (WHO, 1995). Accordingly, undernutrition is the result of insufficient intake, poor absorption, and/or poor biological use of the nutrients, which leads to impaired body functions, impaired growth, and being underweight. On the other hand, overnutrition is the result of excess or imbalanced nutrient intakes, which can cause impaired body functions, as well as being overweight and obesity. In LMICs, as the country’s Gross National Product (GNP) increases, the overweight burden shifts to the low socioeconomic populations, among whom the underweight burden remains high (Monteiro et al., 2004). This transition exposes the low socioeconomic status populations to a double burden of malnutrition. In these populations, where every household endeavours to provide enough food for everyone to eat, economic development and urbanisation along with the globalisation of food markets have resulted in increased availability of larger quantities of low-cost and high-calorie processed foods, as well as food with a higher content of saturated fat, sugar, and salt (Popkin and Gordon-Larsen, 2004). Additionally, decline in physical activity, increase in sedentary jobs, and the introduction of labour-saving technologies have both separately and together led to the deterioration of the health of the population (Popkin, 1994).

WHO used the term malnutrition in all its forms addressing undernutrition, growth faltering, micronutrient malnutrition, overnutrition, and obesity. The concept of double burden of malnutrition first arose in 1992 at the International Conference on Nutrition (ICN) held by the Food and Agriculture Organization of the United Nations (FAO) and the WHO. It was acknowledged that most countries are dealing with both forms of malnutrition simultaneously; therefore, separating the treatment and/or prevention of nutritional deficiencies and excesses is no longer reasonable. Hence, public health experts have called for countries to join forces and to respond to the double burden of malnutrition as a ‘common agenda’, due to its link with the increasing NCD problem in all LMICs. In addition to that, not only individuals endure harmful consequences of double burden of malnutrition, but also the nation’s economy due to lost Gross Domestic Products (GDP) and higher health care costs. Most LMICs are affected by the double burden of malnutrition, with overweight increasing faster than underweight decreasing. While obesity has almost doubled globally in the last three decades, it has tripled in LMICs in just two decades. The double burden of malnutrition can occur in different forms, i.e., across the life course, within an individual, in a household, and in a geographical area (Abdullah, 2015).
1.2.1. Double burden of malnutrition across the life course

"Across the life course" refers to the phenomenon that undernutrition early in life contributes to an increased propensity for overnutrition in adulthood (Shrimpton and Rokx, 2012). This intra-generational form of double burden of malnutrition affects both rich and poor countries, and is a concern in countries where stunting is more prevalent. Stunting during the first two years of life impairs children's capacity to grow, develop, and progress across their life course (Figure 3). Later in life, however, diet and nutrition, and especially overweight and obesity are underlying causes of many NCDs. During the last two centuries, a secular trend occurred mainly in developed countries in which inter-generational increases in height by about one centimetre a decade were evident. A study on a nationally representative sample of households in India examined the intergenerational factors that might also predispose a child to increased health adversity and found maternal height was inversely associated with child mortality or anaemia but was positively associated with child anthropometric failure (Subramanian et al., 2009). This association between maternal height and child mortality and anthropometric failure indicates an intergenerational transfer of poor health from mother to child. In line with this finding, Martin et al. (2004) suggests that a mother's social and nutritional environment during early life is a critical determinant of her children's subsequent health outcomes, perhaps even more than a mother's nutritional status at the time of pregnancy or her diet during pregnancy.

![Figure 3. The double burden of malnutrition: Causes and effects across the life course](source: Shrimpton and Rokx, 2012)
1.2.2. Double burden of malnutrition within an individual

The double burden of malnutrition within an individual child often exhibits as stunting or micronutrient deficiencies co-occurring with overweight and obesity (Tzioumis and Adair, 2014, Tzioumis et al., 2016). This condition can occur when a child has chronic undernutrition (low height for age) accompanied by obesity (high weight for age). In reference to the stunted and overweight phenotype, Martorell coined the phrase “short and plump” (Martorell et al., 1987). There is little known about the causes of double burden of malnutrition within an individual. For instance, if there is enough energy for a child to gain excess weight, then why do children fail to reach their linear growth potential and become stunted? Some studies consider diet composition and quality as relevant factors for this phenomenon (Golden, 1995, Martorell et al., 1987). Golden suggests that the double burden of malnutrition within an individual involves two types of nutrient deficiency: (i) nutrient deficiency that results in a depletion of body nutrient stores but maintenance of linear growth, such as iron and vitamin A (type I), and nutrient deficiency results in decreased linear growth and is associated with poverty (type II) (Golden, 1995).

1.2.3. Double burden of malnutrition in a household

Many studies refer to double burden households when an overweight mother and a stunted child coexist in the same household. The global burden of overweight mothers and stunted children demonstrates a critical situation in LMICs. In an investigation by Garret and Ruel, the highest prevalence of this phenomenon was observed in Guatemala (Latin America), Egypt (Africa), and Uzbekistan (Asia) with higher prevalence of a double burden of malnutrition in rural areas compared with urban areas (Garrett and Ruel, 2005). Other studies refer to double burden households as one underweight and one overweight person simultaneously coexisting in the same household. In these studies, a household is classified into four distinct groups: (i) underweight households: a household with at least one underweight member and no overweight member; (ii) normal weight households: a household without underweight or overweight members; (iii) overweight households: a household with at least one overweight and no underweight member; and (iv) double burden households: a household with at least one underweight and one overweight member. All classes of households may contain any number of normal weight persons (Doak et al., 2005, Roemling and Qaim, 2013, Vaezghasemi et al., 2014). Recognising this paradoxical phenomenon (co-existence of both underweight and overweight members in the same household) is important for creating strategies that respond to the differential needs of individuals within the same household rather than considering the household as a whole.
1.2.4. Double burden of malnutrition at the geographic level

Accounting for the multilevel structure of the data and with an explicit interest in modelling the multiple categories of BMI and their correlation at the geographic level of countries and districts within countries, some researchers have adopted a multilevel multinomial modelling approach to estimate the coexistence of both underweight and overweight in populations (Corsi et al., 2011, Hanandita and Tampubolon, 2015, Subramanian et al., 2007, Subramanian and Smith, 2006). In order to predict the nutritional status of individual i residing in district j with three possible nominal outcomes $s = \text{(underweight, normal, overweight)}$ and unknown intra-cluster correlation induced by hierarchical dependence, a multinomial logistic model can be used in which one of the outcome categories is taken as the reference category, as commonly used in binary response models. Using the normal weight category of BMI (18.5–24.9 kg/m²) as the reference, a set of logistic regressions for the underweight and overweight categories is estimated, contrasting each of the categories with the reference category as follows:

$$\log \left[ \frac{Pr(Y_{ij} = s)}{Pr(Y_{ij} = \text{normal})} \right] = X_i \beta(s) + u_j, \quad s = \text{underweight, overweight}. $$

Accordingly, the extent to which underweight (BMI = 18.5 kg/m²) and overweight (BMI = 25.0 kg/m²) correlate at the country-level and at the district-level within each country can be estimated. Another study following Asian population specific BMI classification identified the presence of double burden at a geographical level of a country, if both the proportions of underweight and overweight population separately account for at least twenty percent in that area (Sengupta et al., 2014).

1.3. Nutrition transition and double burden of malnutrition in Indonesia

Increased consumption of unhealthy foods as well as decrease in physical activity level coupled with increase prevalence of overweight and obesity has largely contributed to the concept of nutrition transition in Indonesia (Februhartanty, 2011). Following foreign direct investment by multinational food companies, availability of processed food has risen in developing countries including Indonesia. Transnational food corporations (TFCs) are drivers of the fast-food market, processed foods and Western lifestyle that have become widespread in developing countries (Hawkes, 2005). These Western food types are characterised by high calorie content and are considered to be an important factor in rising obesity in Western countries. Policies of trade liberalisation, which have enabled this growing availability and consumption of meat, dairy products and processed foods, are therefore contributing to the nutrition transition that is associated with rising rates of obesity and chronic NCDs such as cardiovascular diseases (CVDs) and cancer (Thow and Hawkes,
However, the positive side of the trade liberalisation that has contributed to increasing dietary diversity should be acknowledged as well. Indonesia is certainly facing this challenging transition given the nutritional problems burdening its population. Figure 4 illustrates the increasing trend in the prevalence of overweight and obesity in Indonesia. Based on the data from Global Burden of Disease (GBD) in 2013, 39% of women and 29% of men in Indonesia were overweight or obese (Figure 4).

Malnutrition which used to refer to underweight, stunting and wasting bodies, is now also associated with overweight and obesity. Typical undernutrition problems, which have predominated among children and women, are worsened with the emerging overnutrition problem that already starts at a very young age in Indonesia. In general, the nutritional status and health condition of mothers and children (infants and children under five) are improving as reflected by the decreased maternal, neonatal, infants and under-five mortalities. The prevalence of undernutrition among children declined from 31% in 1991 to 18.4% in 2007 and 17.9% in 2010 (National Institute of Health Research and Development (NIHRD) and Ministry of Health, 2010). However, disparities among provinces remain a public health concern. Moreover, the prevalence of stunting in 2010 was 35.6%, which is still far from the national goal of 32% in 2014 (National Institute of Health Research and Development (NIHRD) and Ministry of Health, 2010). Based on the basic health survey in 2013, no progress has been made in reducing the prevalence of stunting which still remained high around 37% (National Institute of Health Research and Development (NIHRD) and Ministry of Health, 2013). On the other hand, there is a trend of an increasing prevalence of infant and children under two years of age who are overweight and obese (National Institute of Health Research and Development (NIHRD) and Ministry of Health, 2010, National Institute of Health Research and Development (NIHRD) and Ministry of Health, 2013). Among adults, over the last two decades, obesity has increased remarkably across all population groups, including rural and low income strata and the problem is particularly severe among women (Roemling and Qaim, 2012). Moreover, the prevalence of double burden of malnutrition in a household has nearly doubled over fifteen years from 11% (Doak et al., 2005) in 1993 to 19% (Vaezghasemi et al., 2014) in 2007.

Indonesia is experiencing a double burden of malnutrition problem at different levels of the population and the government needs to take urgent steps to both prevent it as well as to alleviate its effects in the population and across the individuals’ life course (Shrimpton and Rokx, 2013). Undernutrition is still given more urgency because overweight and obesity are supposed to be a problem of the affluent and an issue of personal choice. However this is not the case as overweight and obesity are already a serious concern across all income levels, and are conditioned by increasingly obesogenic environments, especially among the poorest adults who are the most stunted (Shrimpton and Rokx, 2013). Therefore, it is essential to construct mechanisms and envisage programmes to address both forms of malnutrition in all age groups, and not just maternal and child undernutrition.

1.3.1. Determinants of double burden of malnutrition

Understanding and elucidating the causes of and the risks associated with the double burden of malnutrition is very difficult. This is not only because of the complexity of the issue related to both undernutrition and overnutrition, but also because of the rapidly changing and evolving situation in LMICs and also in Indonesia (Shrimpton and Rokx, 2013). In a review
of the global nutrition policies in countries with a double burden of malnutrition, only one country reported funding partners available to address both aspects of undernutrition, and obesity and diet-related NCDs. Nonetheless, all countries with the double burden reported implementation of most key maternal, infant and young child nutrition interventions (WHO, 2013).

The conceptual framework for analysing the causality of child undernutrition was developed in 1990 as part of the UNICEF nutrition strategy (UNICEF, 1990). This framework is widely accepted and used in many countries including Indonesia. The framework classifies the causes of malnutrition as immediate, underlying, and basic, where factors at one level influence the other levels. The framework is used at national, district and local levels, to help plan effective actions to improve nutrition. A mapping report on gender and nutrition in South Asia emphasises that gender, a basic determinant, affects nutrition outcomes through all the underlying and immediate determinants (Blumberg et al., 2012). Since men and women have different levels of access to resources and make different choices regarding resource allocation, the effect of gender is present in all links of the conceptual framework (Alderman et al., 1995). Despite the importance of the UNICEF conceptual framework, it is not easily adapted to analysing the causality of both undernutrition and overnutrition across the population, because early life undernutrition can accelerate overnutrition later in life. In assessing the causes of double burden of malnutrition in LMICs and especially in Indonesia, Shrimpton and Rokx (2012, 2013) suggest using a system map of obesity developed by the Foresight Project in the UK (Butland et al., 2007). This map groups more than one hundred variables into four thematic areas: (i) health and biological environment, (ii) economic and food environment, (iii) physical/build environment, (iv) socio-cultural environment. Considering the complexity of the issue related to both under- and overnutrition the focus of this thesis was on the social contextual determinants of health.

1.4. Conceptual framework

Several models have been developed to describe the social or ecological determinants of health – being the ways in which elements of the social, economic, and physical environments interact with individual biological factors and behaviours and shape health status. While some biological inequalities in health may be fixed and outside the control of the individual, it is widely known that other so-called health inequities can be avoided or mitigated as they are the result of ”conditions in which people are born, grow, live, work, and age”, the so-called Social Determinants of Health (SDH) (Commission on Social Determinants of Health, 2008). There are two main levels on which SDH operate: structural and proximal. Structural determinants are the fundamental structures that generate social stratification such as national economy and politics framing the social welfare and educational system. Proximal (also called intermediate) determinants are the circumstances of everyday life, from family relationships through food, housing or access to education. Thinking about health and health
care is a very personal issue for most people. However, assuring the health of the public requires a population health approach and goes beyond focusing on the health status of individuals. Thus, the work of assuring the nation’s health also faces dramatic change, systemic problems, and challenging societal norms and influences (Committee on Assuring the Health of the Public in the 21st Century, 2003). Involvement of governmental public health agencies and the health care delivery system and creation of an effective intersectoral public health system are necessary to best address the social, economic, and cultural environments at national and state levels. Moreover, the efforts of the public health system must be supported by political will and by “healthy” public policy (Committee on Assuring the Health of the Public in the 21st Century, 2003).

Figure 5. Conceptual framework of the thesis. Adopted from the Dahlgren and Whitehead model for social determinants of health

The Dahlgren & Whitehead “determinants of health” model has become axiomatic in public health policy discourse. Similarly, it is time to recognise that health sector policies are nested in wider systems that will largely determine their effectiveness. Dahlgren and Whitehead described a social ecological theory of health and discussed the layers of influence on health. They claimed that policies and strategies have to be based on an understanding of the main influences on health, which can be described in terms of factors threatening health, promoting health, and protecting health (Dahlgren and Whitehead, 1991). Grouping these influences into categories could be beneficial for policy-making, because they could suggest quite distinct levels of intervention. Subsequently, Dahlgren and Whitehead summarised the main influences on health into four distinctive levels (Figure 5). Firstly, there are the major structural environments. Secondly, there are the material and social conditions in which people live and work, determined by various sectors such as housing, education, health care, agriculture and so on. Thirdly, there is mutual support from family, friends, neighbours, and the local community. Finally, there are actions taken by individuals, such as the food they choose to eat, their smoking and drinking habits. The age, sex and genetic make-up of each individual also play a part, of course, but these are fixed factors over which we have little control (Dahlgren and Whitehead, 1991). These four layers of influence translate into four levels for policy interventions. Furthermore, it is important to realise that for any health policy goal or target, strategies can be devised at any of the four policy levels. Policy level 1 is aimed at bringing long-term structural changes. Policy level 2 is aimed at improving living and working conditions through healthy public or business strategies. Policy level 3 is aimed at strengthening social and community support and policy level 4 is aimed at influencing individual lifestyles and attitudes. For instance, with the general goal of increasing the nutritional status of the population, strategies could operate: at levels 1 and 2 by observing the distribution of BMI at the population and across socioeconomic strata to recognise vulnerable groups (PAPER I); at levels 2 and 3 by disentangling the simultaneous effect of multiple settings (i.e., households and districts) on the variation of individuals’ BMI to detect the context with greater effect (PAPER II); at level 3 by identifying households with double burden of malnutrition and their association with social and community networks (PAPER III); at levels 1, 2, 3, and 4 by exploring and understanding how gender ideology and practices operate across these levels and influence households’ nutritional status, particularly children (PAPER IV).
1.5. Theoretical approaches

1.5.1. Preventive strategy

The intricate nature of the double burden of malnutrition and its rapidly changing and evolving situation complicates understanding of associated causes and risks factors and also the development of intervention strategies. Barry M. Popkin argued that a majority of LMICs are not prepared to deal with the shift towards the nutrition transition, which is occurring, at great speed and at earlier stages of these countries’ economic and social development (Popkin, 2002). Whilst parts of the population are becoming rapidly overweight and obese, many are still undernourished and unfortunately policies and programmes are not sufficiently developed to address these new changes in a preventive way. There is much to be understood about the increasing number of individuals exposed to heavy nutrition insult during pregnancy and infancy (foetal origin hypothesis) and the successive prompt shift in energy imbalance, as well as the potential genetic factors related to body composition. Therefore, understanding the causes and consequences of these shifts is essential and should be emphasised much more in the area of prevention (Popkin, 2002).

In 1992, Geoffrey Rose introduced the strategy of preventive medicine (Rose, 1992). In his book, Rose pointed out that diseases or risk factors are not binary in nature, while they are distributed along a continuum in the population. Thus, a small shift in the distribution of risk in the population can make large differences in the health status of the population. Understanding the dynamic of why some populations have a certain distribution of diseases and risk factors results in a very distinctive aetiological question rather than asking “why did this patient get this disease at this time?” or why some individuals are in the tail of a distribution. Therefore, aetiology confronts two distinctive issues: (i) the “high-risk strategy”, in which prevention strategies seek to identify vulnerable individuals and to offer them some individual fortification, and (ii) the “population strategy”, in which prevention strategies seek to harness the determinants of incidence in the population as a whole (Rose, 2001).

1.5.2. Health inequalities

Health inequalities can be better addressed by understanding how these social environments act as protective or risk factors. For instance, we might ask how mean BMI of the poor compares to that of the rich countries. Therefore, it is important to recognise social group differences in order to target investments for disadvantaged groups and also to establish policies and programmes that seek to eliminate social group differences. Moreover, since these differences are created by unjust distribution of social determinants of health, tracking these differences is essential for scrutinising equity in a society.
Alternatively, health differences can be observed across individuals by describing the range or variance of a given measure across an entire population. This method is independent of social group differences, which collapses all individuals into one distribution. Murray et al. and Gakidou et al. defined this as variation in health status across individuals in a population (Gakidou et al., 2000, Murray et al., 1999). Studying inequalities across individuals offers important information on how a given health outcome is distributed in the entire population, yet, it does not allow us to identify the advantaged or disadvantaged, or whether the gap between the healthy and the sick is unjust or avoidable. Therefore, in order to study health inequalities, Murray et al. and Gakidou et al. proposed two complementary approaches: (i) measuring social group inequalities by differences in mean values or the prevalence of health outcomes between social groups and (ii) measuring individual's inequality by differences between individuals and within social groups to explain inequalities in the distribution of health outcomes. They believe inequalities in health, both between and within the population, are a fundamental public health concern. Variation across individuals, however, seems more important than differences between populations because the same average level of health could correspond to massively disperse distributions across individuals in that population. Hence, social group indicators disguise part of the dispersion present in the population, as they are summary measures of subgroups of the population and thus do not allow for scientific inquiry into other key determinants of health inequality.

1.5.3. Contextual effect

The reality acknowledged by social or behavioural scientists to understand social determinants of health and social disparity is principally a multilevel or multilayer phenomenon (House, 2002, Kaplan et al., 2000, Lynch, 2000, Marmot, 2000). It assumes that human development, behaviour, health, and disease are influenced or occur within multiple social and physical contexts. Individuals simultaneously belong to multiple settings or levels that can each independently affect their health, hence, supposing that individuals are nested in one and only one context may be an over-simplification of reality. The observations that characterise the social environment that are associated with health and sickness have urged the development of numerous multilevel theoretical frameworks, such as Krieger’s eco-social theory (Krieger, 2001), social-ecological theory (Stokols, 1996), Doyal’s political economy of health (Doyal, 1979), Bronfenbrenner’s ecosocial and more recent bio-ecosocial theory (Bronfenbrenner, 1979, Bronfenbrenner and Morris, 2006), and Tseng's and Seidman's system framework which includes community- or setting-level theories (Tseng and Seidman, 2007).

Multilevel theories, in general, posit that multiple contexts influence individual and population health simultaneously. These theories explain individual or group experiences and outcomes in terms of the multiple contexts in which developments arise. Conceptually, these
frameworks assess one or more systems or environments such as families, schools, and neighbourhoods, which are most often hierarchically nested within one another (Dunn et al., 2014). For instance, individuals are nested within a household and households are nested within neighbourhoods or districts. Although the focus of these theories are different with respect to populations and constructs, all multilevel theories underscore two central features: (i) there is individual and environmental-level variability; (ii) the interplay between the individual and the environment is dynamic (Dunn et al., 2014). Thus, multilevel theories stress the need for methodological approaches and statistical methods that: (i) assess variability at the level of individuals and their environment both in measured characteristics and in association effects; (ii) study the effect of different time scales (e.g., change in development over time; effect of specific periods of development); (iii) allow for mediation pathways (or allow one to examine how changes in one variable lead to changes in another variable, which in turn predict a subsequent outcome); and (iv) assess ways in which individual outcomes are influenced by environmental-level effects (contextual effect) and how the environment, especially the social environment, can be shaped by individual-level effects (compositional effect). Dunn et al. (2014), considered these as the key issues in translating multilevel theories into empirical research.

1.5.4. Social capital

Social capital can be thought of as a key concept that has been around since scholars initiated examining the relationship between society or environment and individuals’ health. Social capital comes in two forms; it can be a property of individuals (individual social capital) or a property of a community (collective social capital). Portes defined social capital as “the capacity of actors to secure benefits by virtues of memberships in networks and broader social structures”; therefore, he conceived of social capital as a property of individuals (Portes, 1998, p. 6). On the contrary, Putnam defined social capital as “features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit”; therefore, he envisioned social capital as a property of communities (Putnam, 1995, p. 67). The theoretical relationship between social capital and health has been demonstrated by studies in the field of social epidemiology (Seeman, 1996, Kawachi et al., 1997, Subramanian et al., 2002, Lindau et al., 2003, Yip et al., 2007). These studies concluded that social connections are key to health. Despite the intrinsic appeal of measuring social capital in the literature, Fukuyama states, “one of the greatest weaknesses of the social capital concept is the absence of consensus on how to measure it” (Fukuyama, 2001, p. 12). Collective social capital is most commonly measured through aggregating measures of individual trust and participation (Kawachi et al., 2010). This measure collective or community social capital can be challenging, since individual access to trust and participation does not necessarily related to the living area. Henceforth, the need for more area-based indicators of collective or community social capital has been emphasized (Harpham et al., 2002). Community social capital can be best addressed within a multilevel analytical framework with its simultaneous
analysis of the characteristics of individuals at one level and the context in which individuals are located at another level (Kawachi et al., 2010). In this study, individual outcome, individual covariates, and ecologic exposure (i.e., community social capital) are analysed concurrently. Therefore, it is increasingly important to distinguish “neighbourhood differences in health” from “the differences neighbourhood makes to individual health outcomes” (Moon et al., 2005).

As a country with a long-standing local tradition of community involvement, Indonesia provides a unique setting to study the relations between community social capital and malnutrition. The majority of adult Indonesian women have only elementary education, thus, community participation and social interaction could have enormous potential for enriching Indonesian women— as well as men— with additional knowledge that was not received from formal schooling. In fighting against malnutrition, the Indonesian government has put special emphasis on community activities and more importantly improving community nutrition programmes, which is reflected in its National Nutrition Strategy (Republic of Indonesia, 2014). Based on the national food and nutrition action plan (RAN-PG), the general policy on food and nutrition aims to improve community nutrition through provision of adequate food availability, increasing access to sufficient and safe food, and improving a healthy life style especially among mothers and their children. This is done by improving community participation and mobilisation through integrated health post (posyandu) activities that include: monitoring the nutritional status of infants and toddlers through observation of monthly body weighing, complete basic immunisation and other health services. In this thesis social capital is considered as a property of communities. Many empirical studies in Indonesia have shown the positive influence of the tradition of community involvement and activities on development outcomes such as household’s welfare, more household expenditure per capita, more assets and more savings (Grootaert, 1999), general adult health and decrease in poor physical activities (Miller et al., 2006), children’s health especially children whose mothers have less education and living in poorer families (Nobles and Frankenber, 2009), and children’s height-for-age (stunting) as well as weight-for-age (wasting) (Sujarwoto and Tampubolon, 2011). Therefore, the availability of and access to resources and activities within communities becomes central to the individual’s health and wellbeing.

1.5.5. Gender relations

Today, gender inequality is pervasive in all societies and sex is one of the most important distinguishing aspects of the privileged and disadvantaged groups. A globally held perception supports the fact that women are socioeconomically less privileged than men (Keleher and Franklin, 2008). Thus, such uneven and unfair distribution influences health. In the early 1970s, the development of the gender concept was based on the differences between sex as biology and gender as the social construction of men and women in life (Rubin, 1975). Until the 1990s, the gender inequalities in health have been investigated by many scholars with
regard to gender and the body, representing two distinct and influential models in medicine (Connell, 1995). Firstly, the biological sex model: this considers the “body” as a machine, and taking care of health is regarded as fixing a machine. Secondly, the human being as a social construction: in this model “body” is influenced by social processes and the cultural setting. However, in the late 1990s, a third model was developed emphasising the interaction between those models taking into account both the biological body and social and cultural influences (Fausto-Sterling, 1997). Subsequently, Krieger in 2005 revisited and acknowledged embodiment to be the central construct of an eco-social theory and in epidemiological inquiry, recognising that human beings are social beings and biological organisms (Krieger, 2005). She considered these two dimensions of bodily existence as a means for understanding both population health and social inequities in health. Apart from the biological differences between men and women, this theory explores the possible impact on gendered health patterns of the differently defined social groups to which men and women belong, as well as comparing groups rather than individuals. Although within the queer theory (Butler, 1990) identities are not considered as fixed characteristics and do not determine who we are as men or women with common characteristics and interests. Rather than being a fixed attribute in a person, gender should be seen as a fluid variable which shifts and changes at different times and in different contexts. However, in this thesis the dichotomous model of gender with only two sexes is addressed. Accordingly, such comparison between men and women will exhibit two groups with different health conditions. Gender is generally used as a variable for controlling significant differences between men and women in epidemiological studies. However, it has greater potential to address health issues between these two groups of individuals, if this variable is used within a theoretical framework (Öhman, 2008).

The position of women has changed to a large extent globally over the past century, but nevertheless the progress has been uneven and challenging. Based on a report from UN to the Fourth World Conference on Women in Beijing in 1995, “Nowhere is the gap between de jure and de facto equality among men and women greater than in the area of decision-making”. In a Muslim dominated country such as Indonesia, women engage in only a small percentage of all the policy and decision–making positions in spite of making up half the population. This low engagement is also mirrored in all public office and civil services (International Idea Institute for Democracy and Electoral Assistance, 2000). Inequalities also emanate in women’s education where it is the boy child who goes to school, if a family has to choose between a boy and a girl child. While in primary and secondary schools the number of boys and girls are approximately equal (64% and 58%, respectively), this is not the case in higher education in Indonesia (International Idea Institute for Democracy and Electoral Assistance, 2000). It is also more likely for girls to drop out of school due to early marriage or meeting family obligations, whereas boys can go on because their parents place a higher value on their education. Allocating lower value to girls is an extension of society’s value towards women. In such a society where men are perceived to have better jobs, earn more money, and have better access to economic resources and promotion, women and girls are referred to as
“second class”. In Indonesia, the national ideology on gender is reflected in a nationwide organisation called Dharma Wanita (Women’s Dedication). Although husbands and wives have equal rights within their marriage, husbands are the head of households and the main role of women includes being their husband’s companion and caregiver of their children, which is legally regulated within the marriage law No. 1/1974 (State Secretariat of the Republic of Indonesia, 1974). Additionally, socio-cultural values in general are also still putting women in a subordinate position. Thus, the presence of women as heads of households is not fully acknowledged in both the legal system and in the social life of the community. Consequently, women-headed households face discrimination that downgrades their rights in their socio-political life (PEKKA, 2000). This kind of gendered social structure of oppression exists in patriarchal societies where men as the main breadwinners for the family are given the power and right to control women.

Connell adopted a social constructionist perspective on gender and defined gender as “patterns of social relations in which the position of women and men are defined, the cultural meaning of being a man and woman are negotiated” (Connell, 2006). From this perspective, gender is not only the direct relation between men and women, but also indirect relations through work, family, and symbols. Considering the relations between women and men are central, Connell believes the meaning of being a woman and being a man are always changing and being negotiated (Connell, 2006). Thus a relational approach to gender opens a window of opportunity to analyse and explore how different contexts and situations can influence women’s and men’s health and illness (Schofield et al., 2000). Within the discipline of public health, however, analyses on how gender relations might influence social inequalities in health are limited and require further attention (Hammarstrom and Ripper, 1999, Ohman, 2008).

Gender relations - according to Connell - are defined as the relations of power and dominance that structure the life chances of women and men in specific social contexts (Connell, 1987). Relational theory recognises gender as multidimensional: “embracing at the same time economic relations, power relations, affective relations and symbolic relations; and operating simultaneously at intrapersonal, interpersonal, institutional and society-wide levels” (Connell, 2009, p. 3). These structures and identities are open to change and subject position in discourse. Given the multidimensional and changing structure of relations, the complex effect of gender on health is evident. Hence, relational gender theory underscores the processes by which the social world is brought into being, through time (Connell, 2012). Collective actions or practices comprise the social world we are moving towards; at the same time, they are shaped by social structures triggered from the past. The changing nature of social practices destroys what previously appeared as solid and creates a new fact which constitutes gender through which we express ourselves as masculine or feminine (Connell, 2012). Furthermore, Connell stated multidimensionality of gender relations necessitates recognition of social relations beyond institutionalised inequality or a patriarchal system and proposes four dimensions of gender relations: power relations, production relations,
emotional relations, and symbolic relations (Connell, 2002, 2009, Connell and Pearse, 2014). Power relations are implied as institutionalised (as for example a country’s gender policy or ideology) and discursive (for instance in norms and beliefs about gender) relations that indicate subordination of women and dominance of men despite many local reversals (i.e. women-headed households and female teachers with male students). Production relations mean the gendered process of production and consumption, including gender division of labour in the form of the allocation of tasks or paid and unpaid work. Such a gendered division of labour depicts particular work as masculine and other work as feminine. Emotional relations or cathexis refers to the gendered emotional relations of desire between men and women, as well as among men and among women, implying different expectations on men and women to engage and commit in emotional relations. Symbolic relations include the construction of gender identities expressed and draw attention to how gender discourses are symbolised through language, dressing, media, and gestures, which are run by cultural beliefs of how men and women should behave and act. These theoretically distinguished dimensions – though intimately interwoven in practice – may cause different forms and degrees of inequalities for women, varying over time and place and with different levels of stability and vulnerability to dynamic for change.

1.6. Gap in knowledge and contribution made by this thesis

1.6.1. Nutrition transition and increasing patterns of weight gain (PI)

Due to rapid nutrition transition, obesity is increasing and present interventions and policies have not been able to prevent the rise in BMI in most countries, including Indonesia. In population studies, there has been a special reliance on the summary estimates of population change, such as increases in the mean BMI or the proportion of the population with overweight and obesity in describing the global pattern of weight gain. The tacit assumption in such descriptions of change is that while the entire distribution of BMI is moving to the right, the distribution or the dispersion in the population has remained constant.

Describing patterns of population change, Geoffrey Rose hypothesised that for most risk factors such as the average level in the population changes, the dispersion around the average remains rather constant (Rose et al., 2008). However, as the mean BMI increases in a population, the level of deviance (increase in prevalence of underweight versus overweight and obesity, or at low BMI versus high BMI) may not change in the same way. Therefore, systematic examinations of changes in the distribution of BMI within and across populations over time are required, especially in the settings with high prevalence of both underweight and overweight. This thesis examines changes in the distribution of BMI across various percentiles of the population.
1.6.2. Health inequalities or social group differences (P I)

The concept of "health inequalities" proposed by Murray et al. (1999) and Gakidou et al. (2000) that is, studying inequalities across individuals was criticised by Braveman et al. (2000) for degrading research on social group inequalities in health. Braveman and colleagues argued that studying social group inequalities in health does not mean prejudging causality or disguising intra-group variations and why should one consider the "social group" approach – i.e. differences between social positions, material resources such as income, wealth, education or occupation, gender, race/ethnicity and other social categories – a hindrance to the scientific study of population health (Braveman et al., 2000).

Inequalities in mean BMI or prevalence of overweight and obesity between social and economic groups in Indonesia are well documented. Social group differences in health are necessary for targeting investments to the worst-off groups. Additionally, a group-level approach can support the creation of laws and programmes that seek to eliminate social group differences. For instance, we might ask how mean BMI of the poor compares to that of the rich (Prospective Studies Collaboration, 2009). Likewise, for the purposes of monitoring health inequities, the WHO has recommended health indicators should be reported by "equity stratifiers" or groups (Zheng et al., 2011). However, whether inequalities in BMI are occurring within groups or a specific segment of the population remain understudied in Indonesia. This thesis addresses both between-group inequalities in mean BMI as well as inequalities across individuals within groups by utilising standard deviation (SD) and variance as a measure of dispersion.

1.6.3. Contextual effect and the implication of omitted level (P II)

The societal context in which the individual lives has a profound effect on the individual’s health. It is of particular importance in public health to identify the social and geographical environment that determines the variations in individual health, since many social processes take place over space (Cummins et al., 2007, Kaplan, 1999, Merlo, 2011). Most research investigating the effect of context on individual health outcomes has mainly operationalised context within the area of residential environment, which generally refers to areas, neighbourhoods or communities. Consequently, individuals happen to be nested within their neighbourhoods or communities, ignoring the intermediate context that lies between individuals and their residential environment such as schools, households, and workplaces. The reality acknowledged by social or behavioural scientists to understand social determinants of health and social disparity is largely multi-layered (House, 2002, Kaplan et al., 2000, Lynch, 2000, Marmot, 2000). Assuming that individuals are nested in one and only one context may be an over-simplification of this reality, as individuals simultaneously belong to multiple settings or levels that can each independently affect their health.
There is an overwhelming number of studies observing the trend and assessing the associated factors of ever-increasing mean BMI. However, limited studies disentangled the simultaneous effect of multiple settings on individuals' BMI. This thesis attempts to disentangle the relative influence of households and districts on the variation of BMI over time (1993, 1997, 2000, and 2007), in the Indonesian setting.

1.6.4. Double burden of malnutrition within households and community social capital (P III)

The LMICs have just begun to discuss and consider possibilities for dealing with obesity. Concerns for poverty and hunger dominate the attention of the public and politicians, and make it difficult to get governments to focus on NCDs (Shrimpton and Rokx, 2013). It must also be realised that these problems of over- and undernutrition coexist in many LMICs hence solutions for each problem must not adversely affect the other. Ultimately, as with any other epidemic, greater attention is needed on societal and contextual solutions (Popkin and Ng, 2007).

The double burden of malnutrition at the household level implies that there are both underweight and overweight individuals coexisting in the same household (Doak et al., 2005, Roemling and Qaim, 2013). Such inequalities in nutritional status between individuals within the same household complicate policy designs, because food and nutrition interventions need to be targeted more specifically at individuals and subgroups within households. Using cross-sectional data, previous studies on double burden households have addressed the relationship between double burden and household income or socioeconomic status (Doak et al., 2002, Doak et al., 2005), or more specifically focused on the overweight mother and underweight or stunted child (Jehn and Brewis, 2009, Khor, 2008, Lee et al., 2010, Lee et al., 2012). Roemling and Qaim used panel data to explore whether a double burden household in one period was also classified as double burden household in previous or subsequent periods in Indonesia (Roemling and Qaim, 2013). However, the contextual effect of double burden households was not previously addressed. For instance, how double burden households are distributed across the provinces in Indonesia and how much of the variation of double burden households is attributable to the community level, and explained by the community level characteristics such as social capital. In addition to that, in order to have a better understanding of the relationship between income or household’s socioeconomic status with the double burden of malnutrition at household level, in this investigation the analysis is stratified based on men-headed or women-headed households, lowest or highest community social capital, and urban or rural residence.
Gender relations and malnutrition within households (P IV)

General points can describe the nutrition transition at the global level, however the way in which it occurs in different places and the underlying factors for it, are largely context-related. The effects of changes in diet and physical activity on health and nutritional status vary by gender and age. Apart from the biological differences that can make women more prone to excess weight than men, the explanation may also lie in social factors such as gender roles and relations as well as gender ideologies and practices (Hansford, 2010). Though women’s low social status was one of the key factors recognised early on as a potential key contributor to malnutrition in South Asia (UNICEF, 1996), there is still a growing body of research that recognises women’s empowerment as an important point of intervention for improving nutrition within households (Ruel et al., 2013, USAID, 2013). Women’s access to resources and choices are formed by social norms that express acceptable behaviours, rights, and the power to make decisions. Based on the report from USAID on gender equality and female empowerment policy, female empowerment “is achieved when women and girls acquire the power to act freely, exercise their rights, and fulfil their potential as full and equal members of society” (USAID, 2012).

Addressing child undernutrition, previous studies have mainly focused on the maternal perspective by over emphasising interventions related to breastfeeding, complementary feeding, micronutrients nutrition, and therapeutic and supplementary feedings. This approach disregards the broader context of the household’s socioeconomic susceptibilities to which both the child and mother (and other members) are exposed (Corsi et al., 2016). Furthermore, despite explicit recognition of nutrition transition and double burden of malnutrition within households, knowledge on how gender relations (the relationship between men and women within a household) and generational relations (the intersection between parents’ and children’s relationship) influence the extent of the double burden of under- and overnutrition within the same household is deficient. This thesis attempts to explore and understand how gender relations contribute to child malnutrition within a household in the Indonesian context. To do this, Connell’s relational theory of gender is used to study gendered relations and their connection with health issues. This approach treats gender as a multidimensional structure operating in a complex network of social contexts (Connell, 2012). This theoretical model serves as a useful tool in describing and analysing how gendered power structures function in a specific context and how the intricate relationship between men and women within a household works with regard to child malnutrition.
1.7. Aim and objectives

The aim of this thesis was to explore social and contextual determinants of malnutrition in Indonesia.

Specific objectives

This thesis sought to:

- Examine how BMI is changing at the population level, and between and within socioeconomic groups;
- Estimate which context (i.e., household or district) has a greater effect on the variation of BMI in the population;
- Assess the prevalence of households with double burden of malnutrition and its variation across communities as well as its determining factors;
- Explore and understand how gender relations contribute to the double burden of malnutrition within a household.
2. MATERIALS AND METHODS

2.1. Study setting

2.1.1. Geography and demography

Indonesia is the largest archipelagic nation in the world located in South-East Asia with a total population of 257,563,815 million; almost 120 million live on Java Island. Only 1000 out of 17000 islands of this archipelago are permanently inhabited. Figure 6 illustrates the map of Indonesia and all its provinces (WorldOfMaps, 2016). Sixty-nine percent of the population lives in rural areas. Ethno-linguistic groups living in Indonesia are highly divergent (around 350), and the largest – and politically dominant – ethnic groups are the Javanese. Muslims are the largest religious group comprising 80% of the total population. Despite the diversity, a shared identity defined by a national language, ethnic diversity, religious pluralism within a Muslim-majority population, has developed. Indonesia’s national motto, “Bhinneka Tunggal Ika” (“Unity in Diversity” literally, “many, yet one”), articulates the diversity that shapes the country. Indonesian culture has been shaped by longstanding interaction between original indigenous customs and numerous foreign influences by many countries as well as multiple religions such as Hinduism, Buddhism, Confucianism, and Islam.

2.1.2. Economic indicators

Indonesia had enjoyed over three decades of remarkable social, economic, and demographic change until the middle of the 1990s. Since 1960, a significant increase in per capita income occurred (from around US$50 to more than US$1,100 in 1997), primary and secondary school enrolments as well as substantial decline in poverty (from over 40% in 1976 to just 18% in 1996), infant mortality rate (from 118 per thousand live births in 1970 to 46 in 1997) and fertility rate (from 5.6 in 1971 to 2.8 in 1997). In the late 1990s, the economic position began to change as Indonesia was stuck by the economic crisis that affected much of Asia. Across Indonesia there was sizeable variation in the impacts of the crisis, as there had been for the earlier economic success (Strauss et al., 2016). In 2015, the GDP per capita in Indonesia was highest and recorded at 3834.66 US dollars, which is equivalent to 30 percent of the world’s average.
This investigation used a mixed methods approach, applying both quantitative and qualitative research methodologies, in order to enhance our understanding of the research problem from different perspectives. The quantitative studies help to show a broad picture of the detailed and complex relationships and associations between different forms of malnutrition and relevant social and contextual factors. The qualitative study reveals deeper insights into how changes in the population’s nutritional status were occurring within households and how these changes were influenced by social, cultural, and institutional norm and practices. The remainder of the methods section comprises the quantitative, qualitative and mixed method components of the thesis.

2.2. Quantitative component

2.2.1. Data source

The quantitative part of this project utilised data from an on-going longitudinal socioeconomic and health survey, called the Indonesian Family Life Survey (IFLS). The survey was carried out by RAND Corporation, an independent non-profit global organisation operated since 1948. The main mission of RAND is to help improve policy and
decision-making through research and analysis. The IFLS is designed to provide data for studying behaviours and outcomes. The survey contains rich information collected at the individual and household levels, including several indicators of economic and non-economic well-being: consumption, income, assets, education, migration, labour market outcomes, marriage, fertility, contraceptive use, health status, use of health care and health insurance, relationships among co-resident and non-resident family members, processes underlying household decision-making, transfers among family members and participation in community activities (Strauss et al., 2016). So far, IFLS consists of five waves from data collected in 1993, 1997-8, 2000, 2007-2008, and 2014-15. However, only four waves of the IFLS were used in this thesis. The IFLS employed a multi-stage stratified systematic sampling design based on the stratification of provinces and urban/rural location. From 27 provinces, 13 of them containing 83% of the population were selected to maximise representation of the population, capture the cultural and socioeconomic diversity of Indonesia, and be a cost effective way to survey given the size and terrain of the country. It includes four provinces in Sumatra (North Sumatra, West Sumatra, South Sumatra, and Lampung), all five of the Javanese provinces (DKI Jakarta, West Java, Central Java, DI Yogyakarta, and East Java), and four provinces covering the remaining major island groups (Bali, West Nusa Tenggara, South Kalimantan, and South Sulawesi). Primary sampling units (PSUs) are enumeration areas (EAs), and urban/rural residence is used to identify stratum. EAs were randomly selected within each of the provinces. In total, 321 EAs were selected in the 13 provinces (Strauss et al., 2016).

The IFLS over-sampled households in urban EAs and EAs in smaller provinces – i.e. households in provinces other than Java – to facilitate urban and rural as well as Javanese and non-Javanese comparisons. Households were randomly selected within a selected EA. A household was defined as a “group of peoples whose members reside in the same dwelling and share food from the same cooking pot” (Strauss et al., 2009a, Strauss et al., 2016). From each urban EA, 20 households were selected, and from each rural EA 30 households were selected. A total of 7730 households were sampled for IFLS1 to obtain a final sample size goal of 7000 completed households. Even though the IFLS is a longitudinal survey, weights were constructed both at individual and household levels so that treats IFLS as cross-section. Accordingly, all individuals have been stratified by province and urban-rural, by sex and age. In addition, all the households were stratified by province and urban-rural sector (Strauss et al., 2009b). Because data are available for the same individuals from multiple points in time, IFLS offers an opportunity to understand the dynamics of behaviours, at the individual, household and family and community levels.

2.2.2. Variables

Data collection in IFLS consisted of two main parts: 1) Household Survey: detailed information both at individual- and household-levels, including individual’s physical health measurements by interviewing following household members: (i) household head and spouse,
(ii) two randomly selected children of head and spouse aged 0-14 (answered by child’s mother or female guardian, or the person who takes care of the child), (iii) an individual age 50 and above and their spouse, randomly selected from the remaining members, (iv) an individual aged 15 to 49 and their spouse, randomly selected from remaining members; 2) Community-Facility Survey: detailed information on the characteristics of the communities was collected from community leaders such as head of the village women group, as well as staff at schools and health facilities available to community residents. As shown in Figure 7, the following information was extracted from IFLS in this study.

Figure 7. The level of information in Indonesian Family Life Survey (IFLS) and the variables used in this study

Individual level variables used in this study were: (i) age (year), (ii) gender (men or women), (iii) weight (kg), (iv) height (cm), (v) education (no schooling, primary, secondary, or university), (vi) Occupation (worked or never worked), (vii) marital status (never married, married, separated, divorced or widow), (viii) place of residence (urban or rural), and (ix) per capita expenditure presented as quartiles of per capita expenditure (with the first quartile being considered as “lowest per capita expenditure”). Household per capita expenditure (total household expenditure divided by number of household members) was used as a proxy for a household’s living standard and contained information about households’ food expenditures and non-food consumption during one month measured in Indonesian Rupiah (Strauss et al., 2009b). In Indonesia, the majority of people are self-employed or have seasonal employment. Therefore, the individual measure of income is generally either not available or reliable. Per capita expenditure, though, is suggested to be a reliable approximation for permanent income due to its insensitivity to irregular income shock that is inherent in informal economy (Deaton and Zaidi, 2002, Howe et al., 2012).
Household level variables used in this study were: (i) men/women headed household (whether a household is headed by a man or a woman based on the IFLS survey by asking: “who is the head of this household?”), (ii) head of household's education (the highest level of education achieved by the head of household, i.e., no schooling, primary, secondary, university), (iii) households per capita expenditure, (iv) household size, (v) proportion of under 15 and over 60, (vi) place of residence (urban and rural), and (vii) households’ socioeconomic status quintiles (with the first quintile considered being poorest). Household socioeconomic status was calculated based on the household’s assets (e.g., TV, refrigerator, jewellery, vehicles, and savings certificates or disposal stocks) and infrastructure and housing characteristics (e.g., source of water, drainage, toilet, cooking, type of walls, roof, and floor) using Principle Component Analysis (PCA) (Vyas and Kumaranayake, 2006).

Community level variables used in this study were: place of residence (whether a community is located in the urban or rural area) and community social capital presented as tertiles (lowest, middle, or highest). The collective feature of social capital was measured based on the existence of programmes and activities in the community, such as village cooperatives, neighbourhood watch programmes, village improvements, child development, teen development, elderly programmes, youth and family groups, village loans, and health funds in the communities. The responses to each of these indicators were used and summarised with a PCA and the resulting index was divided into tertiles.

The BMI was calculated based on weight in kilograms divided by the square of height in meters (BMI = weight (kg)/height (cm)²). BMI was used to assess weight status in children and adolescents as well as adults. In adults the BMI cut-off points that define obesity and overweight are not linked to age and do not differ for men and women; in growing children BMI varies with age and sex (Must and Anderson, 2006). Furthermore, Height and weight are simple and universal measures that always formed the basis of growth monitoring. BMI will likely remain to be the foremost measure of weight status in children as it shows reasonably good correlations with more direct measures of adiposity and consistent linkages with adult overweight- and obesity-related comorbidities (Must and Anderson, 2006).

It is possible that the international BMI cut-offs used for categorising obesity and/or overweight underestimate the magnitude of the overnutrition problem in adults in Indonesia. It has been shown that, compared with Caucasians, Asian populations such as the Indonesians (Malays and Chinese ancestry), the Singaporean Chinese, the Malays and Indians, and the Hong Kong Chinese, have a higher percentage of body fat at a lower BMI that is predictive of chronic diseases (Deurenberg et al., 2002). In this study both international (WHO, 2000) and Asian (Deurenberg et al., 2002, WHO Expert Consultation, 2004) cut-off points were used to define overweight and obesity among adults. The international BMI cut-off values of 25 and 30 were used to define overweight and obesity. Using Asian cut-off points, BMI between 23 and 27.5 was defined here as preobese or
overweight, and BMI higher than 27.5 was defined as obese. Accordingly, a BMI of between 18.5 and 23 was identified as normal weight, and BMI of less than 18.5 was considered underweight (Table 1).

Table 1. Classification of adults based on Body Mass Index (BMI)

<table>
<thead>
<tr>
<th>Classification</th>
<th>International cut points</th>
<th>Asian cut points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;18.50</td>
<td>&lt;18.50</td>
</tr>
<tr>
<td>Normal weight</td>
<td>18.50 – 24.99</td>
<td>18.50 – 22.99</td>
</tr>
<tr>
<td>Overweight or preobese</td>
<td>25.00 – 29.99</td>
<td>23.00 – 27.49</td>
</tr>
<tr>
<td>Obese</td>
<td>≥ 30</td>
<td>≥ 27.50</td>
</tr>
</tbody>
</table>

For children and adolescents (age 2-18), underweight, overweight and obesity were calculated based on sex-age-specific cut-off points recommended by International Obesity Task Force (IOTF) (Cole et al., 2000, 2007). Among the entire reference standard available, IOTF is the only reference that provides a smooth transition from the child or adolescent to the adult definition of overweight and obesity. The IOTF reference has also been recommended for international use due to its unique strengths: (i) it is based on large data sets from six countries or regions (Brazil, Great Britain, Hong Kong, the Netherlands, Singapore, and the United States) and covers different races/ethnicities which are good for international comparisons; (ii) the BMI cut-offs are linked to adult cut-offs for overweight and obesity, which are good indicators of risks for adverse health outcomes (Wang, 2004).

A household with a double burden of malnutrition was identified as one where there was at least one underweight and one overweight member in the household. Households were excluded if there was only one member living in the household, or if BMI was available for only one member in the household, or there was no BMI available for any members in the household. Households were classified into four groups, including: (i) underweight households, with at least one underweight member, no overweight member, and variable number of normal weight; (ii) normal weight households, without any underweight or overweight members; (iii) overweight households, with at least one overweight, no underweight member, and variable number of normal weight; and (iv) double burden households with at least one underweight, one overweight member, and variable number of normal weight. In this study, we focused on comparing the “double burden households” with the other types of households combined.
2.2.3. Analysis

2.2.3.1. Graphical analysis of patterns of BMI distributional changes (P I)

Quantile-quantile (QQ) plot was used to examine patterns of distributional change in BMI (Wilk and Gnanadesikan, 1968). It was constructed by plotting percentiles of BMI from the most-recent study wave against percentiles of BMI from the baseline wave (IFLS1). If there were no change in distributions between the two survey years the points would lie on the line of the equality (y = x). Points above the line represented increases in BMI at the same percentile in the most recent year from baseline, whereas points below the line represented decreases in BMI at the same percentile. If the entire distribution were to experience an increase in BMI, the QQ plot would show a uniform upward shift of points from the line of equality. The QQ plot would also show deviations from the line of equality only in the lower and upper percentiles, if distributional changes were concentrated in these groups. Generally, QQ plots are effective in presenting changes at the tails of distributions. In addition, BMI was age-adjusted prior to analysis. Age adjustment was achieved by regressing BMI on age and quadratic age, followed by the addition of the grand mean to the residuals from this model.

2.2.3.2. Between-group and within-group differences in BMI mean and SD (P I)

Absolute difference, relative difference, and percentage change were calculated, in order to capture the between- and within-group differences in mean BMI and SD. Absolute difference was calculated by subtracting mean BMI among individuals with university degree from mean BMI among individuals with no schooling. For instance, relative difference was calculated by dividing mean BMI among individuals with university degree by mean BMI among individuals with no schooling. Percentage change was calculated based on the differences in mean BMI or SD between IFLS1 and IFLS4.

2.2.3.3. Variance differences in single level regression models (P I)

Percentage change in variance between two statistical models (i.e. model I and model II) was calculated based on the differences between models I and II. For instance, the variance in model I was subtracted by the variance in model II. The result was later divided by the variance in model I and multiplied by 100 (Merlo et al., 2006). This gives the percentage of the variance attenuated or explained by inclusion of all the socioeconomic factors for each study wave.
2.2.3.4. Multilevel (two-and three-level) statistical models and Intraclass correlation with linear outcome (P II)

In general, multilevel regression models assume that there is a hierarchal data set, with one single outcome or response variable that is measured at the lowest level, and explanatory variables at all existing levels. The details of these models can be found elsewhere (Diez Roux and Mair, 2010, Raudenbush and Bryk, 2002, Subramanian et al., 2003, Hox, 2010). A two-level multilevel data structure assumes observations are hierarchically nested, such that members of the lower level of individuals (i.e. level one) are nested in one and only one entity at the higher/household/district level (i.e. level two). Thus, the outcome (denoted y) for a person (denoted i) nested in a given household/district (denoted j) is modelled as:

\[ y_{ij} = \beta_0 + \beta_n x_{nij} + (u_{0j} + e_{0ij}) \]  

(1)

In Equation (1), the fixed effect parameter \( \beta_0 \) refers to the overall mean outcome \( y \) across all household/district and \( \beta_n x_{nij} \) refers to a vector of individual level covariates. The random effect parameter \( u_{0j} \) refers to the random effect for the household/district (assumed to be normally distributed with a mean of 0 and variance \( \sigma^2u_0 \)), and \( e_{0ij} \) refers to the random effect for the individual. In a three-level model the outcome (denoted i) simultaneously belong to two nested contexts, for instance household (denoted j) and district (denoted k). Thus our outcome (denoted \( y \)) for a person (i) nested in a household (j) and district (k) is modelled as:

\[ y_{ijk} = \beta_0 + \beta_n x_{nijk} + (v_{0k} + u_{0jk} + e_{0ijk}) \]  

(2)

In Equation (2), the fixed effect parameter \( \beta_0 \) refers to the overall mean outcome \( y \) across all households and districts; \( v_{0k} \) is the random effect at district level, and allowed to vary from the grand mean (variance between districts is assumed to be normally distributed with a mean of 0 and variance \( \sigma^2v_0 \)); \( u_{0jk} \) is the random effect at the household level, a departure from the household effect within the district level (variance between households is assumed to be normally distributed with a mean of 0 and variance \( \sigma^2u_0 \)); \( e_{0ijk} \) is the random effect at the individual level, a departure from the household effect within a district (variance between individuals is assumed to be normally distributed with a mean of 0 and variance \( \sigma^2e_0 \)).

To partition variance in BMI, intraclass correlation (ICC) – the proportion of variation in the outcome that was due to differences across households and districts, rather that individuals – was estimated. It is an indication of the proportion of variance at the higher level, which can also be interpreted as the expected (population) correlation between two randomly chosen individuals within the same group. In a two-level model the ICC is calculated as follow:

\[ ICC_{(Household \ or \ District)} = \frac{\sigma^2u_0}{\sigma^2u_0 + \sigma^2e_0} \]  

(3)
In Equation (3), $\sigma^2_{u_0}$ refers to variance at the second level, divided by the total variance (variance at the first and second level). However, if we have a three-level model, for instance individuals nested within households, nested within districts, the ICC is calculated as follow:

$$ ICC_{(Household)} = \frac{\sigma^2_{u_0}}{\sigma^2_{u_0} + \sigma^2_{v_0} + \sigma^2_{e_0}} $$  \hspace{1cm} (4)$$

and:

$$ ICC_{(District)} = \frac{\sigma^2_{v_0}}{\sigma^2_{u_0} + \sigma^2_{v_0} + \sigma^2_{e_0}} $$  \hspace{1cm} (5)$$

In Equations (4) and (5), $\sigma^2_{u_0}$ and $\sigma^2_{v_0}$ refer to household-level and district-level variance respectively, which are divided by the total variance (variance at the first, second, and third level).

2.2.3.5. Multilevel (two-level) statistical model and ICC with logistic outcome (P III)

In logistic regression the aim is to predict the probability $\pi_i$ that a phenomenon occurs for the individual $i$ in function of a certain number of variables. Multilevel logistic regression considers that the individual probability is also statistically dependent on the area of residence (community) of the subjects.

$$ Logit (\pi_i) = \log odds = \log \left( \frac{\pi_i}{1-\pi_i} \right) = \beta_o + u_{0j} $$  \hspace{1cm} (6)$$

In equation (6), which is an empty model or random intercept model, the probability of being a double burden household is only function of the area in which the household is located. In this equation, $\beta_o$ refers overall mean probability (prevalence) express on the logistic scale; $u_{0j}$ refers to the area level residual. The area level residuals are on the logistic scale and normally distributed with mean 0 and variance $\sigma^2_{u_0}$. This model was later extended by including both individuals and community level characteristics.

In multilevel linear regression both the individual level and the area level variances are expressed on the same scale. Therefore, it is easy to partition the variance between different levels for detecting contextual phenomena. On the contrary, in multilevel logistic regression the area level residual variance is on the logistic scale and the individual level residual variance is on the probability scale, which are not directly comparable. On that basis, the ICC in multilevel logistic models is calculated as follow (Merlo et al., 2006):

$$ ICC_{(Community)} = \frac{\sigma^2_{u_0}}{\sigma^2_{u_0} + 3.29} $$  \hspace{1cm} (7)$$
2.2.3.6. Survey analysis procedure for the effect of study design used in P III

To account for the multistage/cluster sampling design, individual and household survey weights were used in the analysis. These survey functions enable inclusion of stratification identifier, primary sampling unit (clusters) and sampling weight. This was performed using the svyset and svy commands in Stata Software.

2.2.4. Software

STATA software version 13.1 and 14.2 were used for analysis in this thesis (StataCorp. 2013 and 2014. Stata: Release 13 and 14. Statistical Software. College Station, TX: StataCorp LP).

2.2.5. Ethical consideration

No consent was needed for the secondary data analysis. The RAND Corporation obtained ethical approval prior to fielding IFLS. The data are publically available upon registration on the website of the RAND Corporation.

2.3. Qualitative component

2.3.1. Study setting

Following our previous quantitative study on the double burden of malnutrition in Indonesia, two provinces were selected for the qualitative study – Central Java which was one of the provinces with the lowest proportion of double burden households (17%), and DKI Jakarta which had the highest proportion of double burden households (25%). As shown in Figure 8, both of these two provinces are located in the Java Island (Google, 2016). Java is home to 56.7% of the Indonesian population and is the most populous island in the world, with a population of over 141 million (the island itself) or 145 million (the administrative region) as of 2015 Census (City Population, 2015). Being the centre of powerful Hindu-Buddhist empires, the Islamic sultanates, the core of the colonial Dutch East Indies, and also the centre of the Indonesian struggle for independence during the 1930s and 1940s, much of Indonesian history happened on this Island. Java dominates Indonesia politically, economically and culturally.
2.3.1.1. Central Java – Purworejo district

Purworejo is a regency in the southern part of Central Java province in Indonesia and its capital is Purworejo. The total population is about 900,000 individuals who are mostly Javanese. This district is comprised of 16 sub-districts and 494 villages. Total area of Purworejo is 1034.82 square kilometres, which are inhabited by 729,825 persons (357,081 men and 372,744 women) mostly Javanese and most live in rural areas. The land contour of Purworejo is 2-325 metres above sea level so that some areas are considered mountainous. It has a tropical climate with rain falling between October and March, followed by a dry season from April to September. The Community Health and Nutrition Research Laboratory (CHN-RL) at Gadjah Mada University established a Health and Demographic Surveillance Site (HDSS) in 1994 for monitoring demographic and health events in Purworejo. Since 1999 the Purworejo HDSS is a member of the INDEPTH Network (http://indepth-network.org), which currently consists of 52 sites in Africa, Asia and Oceania.
2.3.1.2. Jakarta (DKI) – Jakarta

The Indonesian capital city, Jakarta, is located on western Java. Due to the economic growth, it has witnessed a great migration of people from all over Java and other Indonesian islands. Population of Greater Jakarta (Jabodetabek Region) was estimated to be 28.5 million in 2010 while it was recorded at 8.2 million in 1970. There is no rural area in the province of Jakarta. The 1990 Census declared this city as a fully urbanized area. As per data from Government sources, Greater Jakarta was home to 30,326,103 people in 2014 (Indonesia point). Greater Jakarta accounts for 11% of total population in Indonesia. Jakarta is administratively equal to a province with special status as the capital of Indonesia. It has a governor (instead of a mayor). As a province, the official name of Jakarta is Daerah Khusus Ibukota Jakarta ("Special Capital City District of Jakarta"), which in Indonesian is abbreviated to DKI Jakarta.
2.3.2. Informants and data collection

Using research infrastructure in Gadjah Mada University, we identified and informed the community leaders about the purpose of the study and characteristics of the participants. They were asked to identify and invite married adults living in households with more than two members, preferably from different socioeconomic backgrounds. A total of 123 community members (67 men and 56 women) participated in this study. Focus Group Discussions (FGDs) were conducted to explore participants' attitudes and perceptions about the double burden of malnutrition. Prior to the FGDs, participants were asked to fill in a small socio-demographic questionnaire. These socio-demographic information are presented in Table 2. The informants were mainly married adults (aged 27-67, except two adolescents and one divorced woman) living in households with more than one member. Most of the men had private jobs and women were housewives. A majority of both men and women had secondary education. Conducting several FGDs in different geographical places would provide us with broader understanding about the topic to explore men and women's different experiences and attitudes. All the FGDs were conducted separately among men and women. Based on our pre-understanding about the context, mixed FGDs would probably not have given us the information needed. Thus, a “pure” theoretical sampling (i.e. sampling is done stepwise based on emerging ideas from previous data collection) in accordance with grounded theory was not possible mainly due to practical fieldwork arrangements.
### Table 2. General characteristic of the study informants participating in qualitative focus group discussions (FGDs) on double burden of malnutrition in Indonesia, 2013

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Men group</th>
<th>Total Men</th>
<th>Women group</th>
<th>Total Women</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Groups</strong></td>
<td>1 2 3 4 5</td>
<td>6 7 8</td>
<td>1 2 3 4 5</td>
<td>6 7 8</td>
</tr>
<tr>
<td><strong>Central Java</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Jakarta</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td>1 2 3 4 5</td>
<td>6 7 8</td>
<td>1 2 3 4 5</td>
<td>6 7 8</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>36-51</td>
<td>34-40</td>
<td>36-37-43</td>
<td>28-38-17</td>
</tr>
<tr>
<td></td>
<td>51 53</td>
<td>48 64</td>
<td>52 65 65</td>
<td>61 65 47</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td>1 1 1 1</td>
<td>3 3 3 3</td>
<td>1 1 1 1</td>
<td>3 3 3 3</td>
</tr>
<tr>
<td><strong>Primary</strong></td>
<td>8 9 6 8</td>
<td>7 2 2 3</td>
<td>7 8 7 7</td>
<td>4 5 4 6</td>
</tr>
<tr>
<td><strong>Secondary</strong></td>
<td>1 1 1</td>
<td>3 4 1 8</td>
<td>2 2 1 1</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td><strong>University</strong></td>
<td>9 10 7 3 7</td>
<td>4 2 5 50</td>
<td>10 2 1</td>
<td>3 3 3 3</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td>1 1 1</td>
<td>3 4 1 8</td>
<td>2 2 1 1</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td><strong>Not working</strong></td>
<td>9 10 7 3 7</td>
<td>4 2 5 50</td>
<td>10 2 1</td>
<td>3 3 3 3</td>
</tr>
<tr>
<td><strong>Working</strong></td>
<td>1 1 1</td>
<td>3 4 1 8</td>
<td>2 2 1 1</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td><strong>Pension</strong></td>
<td>1 1 1</td>
<td>3 4 1 8</td>
<td>2 2 1 1</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td>1 1 1</td>
<td>3 3 3 3</td>
<td>1 1 1 1</td>
<td>3 3 3 3</td>
</tr>
<tr>
<td><strong>Never married</strong></td>
<td>10 9</td>
<td>8 7 5</td>
<td>8 9 8 6 5</td>
<td>6 5 6 5 9</td>
</tr>
<tr>
<td><strong>Married</strong></td>
<td>1 1 1</td>
<td>3 4 1 8</td>
<td>2 2 1 1</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td><strong>Widow</strong></td>
<td>1 1 1</td>
<td>3 4 1 8</td>
<td>2 2 1 1</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td><strong>Family size</strong></td>
<td>Range 2-6</td>
<td>3-6 2-6</td>
<td>3-6 2-6 4-6</td>
<td>3-6 2-6 4-6</td>
</tr>
<tr>
<td><strong>Household head</strong></td>
<td>Male</td>
<td>10 7 8 7 5 6</td>
<td>5 5 8 8</td>
<td>4 6 5 5 6 52</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>1 1 1</td>
<td>3 4 1 8</td>
<td>2 2 1 1</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td><strong>Place of residence</strong></td>
<td>Rural/suburban 1 8</td>
<td>7 5 30</td>
<td>3 3 3 3</td>
<td>6 36</td>
</tr>
<tr>
<td><strong>Urban/central</strong></td>
<td>10 10</td>
<td>8 5 6 29</td>
<td>8 8 9 6 6 6</td>
<td>28</td>
</tr>
<tr>
<td><strong>Province</strong></td>
<td>Central Java 10 10</td>
<td>8 5 6 29</td>
<td>8 8 9 6 6 6</td>
<td>28</td>
</tr>
<tr>
<td><strong>Jakarta</strong></td>
<td>10 10</td>
<td>8 5 6 29</td>
<td>8 8 9 6 6 6</td>
<td>28</td>
</tr>
</tbody>
</table>

**Note:** In total 10 missing values were detected in the variables age (1), education (1), occupation (3), marital status (1), family size (2), and household head (2).

In total, 16 FGDs were conducted among men and women separately during a period of eight weeks in 2013, from July 1st until August 24th (Figure 9). Although due to practical issues a fixed plan was adopted in conducting the FGDs, an emergent design was used over the course of the research (especially in week 3 and week 5) in response to what was learned in the earlier parts of the study. Eight FGDs were conducted in Central Java – Purworejo district (4 in urban and 4 in rural areas) and 8 FGDs were conducted in DKI Jakarta – Jakarta (4 in central and 4 in suburban areas). Since the intention was to collect data from different geographical areas among different groups of men and women, saturation point (the point in a qualitative study when there is enough data to ensure the research questions can be answered) was not considered. Dahlgren et al. defined a focus group as a small and relatively homogenous group of people who are brought together to explore attitudes and perceptions, feelings and ideas about a specific topic (Dahlgren et al., 2007). A FGD is not just an unsystematic talk and devising session among people who happened to be around; it is a well-planned endeavour moderated by trained and skilled interviewers to provide a structure within which participants may interact and articulate their thoughts and feelings (Stewart and Shamdasani, 2015). In order to create homogenous groups of participants, mainly married adults – men and women separately – living in households with more than two members were invited. In addition, to create an open atmosphere for discussion, we asked...
participants to sit around a table or in a circle on the ground. They were also asked to talk one by one and give other participants a chance to share their stories as well. We gently and politely asked those who intended to dominate the discussion to give others opportunities to share their stories. We insured participants that there was no right or wrong opinion and asked them to freely express their ideas in favour or against another fellow’s views. Each FGD lasted from 1 hour to 2.5 hours and were recorded, transcribed, and translated from Javanese and Bahasa Indonesia to English word by word.

Figure 9. Action plan for conducting Focus Group Discussions (FGDs) in Indonesia, 2013

MV participated in conducting all FGDs together with a local assistant. The local assistant moderated all the discussions and MV acted as a moderator’s assistant due to language barriers. The local assistant had a strong background in conducting qualitative interviews and was familiar with gender-related studies through several international collaborations – i.e. USAID – in Indonesia. She is Javanese and fully familiar with both English and Indonesian. It was important that the moderator was socially and culturally familiar with the context and understood the participants, which could enable her to act as a cultural interpreter, not only a linguistic translator. It also was essential that the local assistant was well informed about the scopes and objective of the study to be able to independently moderate the FGDs. Henceforth, several meetings between MV and the local assistant and among the research group were set up to discuss and review different aspects of the project before, if necessary within, and after each FGD.
Picture from a research group meeting for fieldwork preparation in the Department of Public Health, Gadjah Mada University in Yogjakarta city, 2013.

We conducted most of the FGDs in the community halls. In Jakarta, however some of the FGDs were done in community leaders’ or participants’ homes. We always arrived to the field one hour before to set up the room, prepare the nametags and informed consents, etc. We warmly welcomed the participants and gave them a short introduction about the whole process of the FGD.

Picture from a Focus Group Discussion (FGD) among women in rural Purworejo, Central Java, 2013.
We started the FGDs by presenting pictures and figures illustrating double burden households or overweight and underweight people living in the same household. We did this to stimulate a discussion around informants' opinions as an icebreaker at the beginning of the interviews to provide enough context and information for informants to have an understanding of the scenario being highlighted (Barter and Renold, 1999, Braun and Clarke, 2013). Then we used open-ended and non-judgmental questions so that the moderator could focus on the questions to invite detailed discussion of the topic (Charmaz, 2014a, Dahlgren et al., 2007). To accomplish a balance between making the interview open-ended and focusing on important statements depended on the combination of how the interviewer construct the question and conducted the interview. To encourage informants to have open exchanges and discussions, we developed three sets of questions (Appendix 1): (i) introductory or engaging questions (i.e. what is the typical food in this area? Or imagine a household with both underweight and overweight members, what could possibly contribute to this?), (ii) exploratory or linking questions (i.e. what are the characteristics of a household head and how relations within the households affects the household's health and nutrition), and (iii) closing questions (i.e. is there something else in this regards that you would like to talk about). Eventually, the question of focus was how gender relations influence the double burden of malnutrition within a household. All research group members participated in the design and construction of the FGD topic guide.

2.3.3. Steps of analysis

Data were primarily analysed in multiple phases, both during and after data collection. During data collection MV reviewed some of the FGDs and necessary revisions and preparations were done for the next FGDs. Initial notes and detailed summaries or memos were then discussed with other research members - MH and NN – for further investigations and emerging consensus to form. After data were collected, the analysis continued, whereby MV, AÖ, ME, and NN read the transcripts and made initial rounds of line-by-line open coding. This was conducted on a subset of FGDs by each member of the research team separately. Transferring data into codes was done by staying close to the data and trying to perceive the actions in the pieces of the data rather than applying pre-existing theories to data. The codes were discussed and compared in order to integrate different perspectives and achieve compromises among all research members. Furthermore, in vivo codes were identified to uncover participants' meaning and of their own views and actions in the coding itself. The data were coded following the steps suggested by Charmaz (2014): (i) open/initial coding, (ii) focused/selective coding, (iii) and theoretical coding. Afterwards, focused or selective coding was done by selecting and clustering the most frequent and significant initial codes as well as recoding the initial codes with a more specific focus to scrutinise and evaluate large sets of data (Charmaz, 2014b, Dahlgren et al., 2007). Eventually, theoretical coding was done in order to conceptualise how the substantive codes may relate to each other as hypotheses to be integrated into a model (Charmaz, 2014a). Theoretical coding can help
specifying possible relationships between categories developed through focused coding. These codes are meant to be integrative and help to tell an analytical story that is coherent (Charmaz, 2014b). The starting point for the analyses was mainly the collected data and not being too influenced by specific pre-determined theories. Still, in line with the principles of constructivist grounded theory – acknowledging that the result is an interpretation and depends on the researcher’s view – gender relations was used as sensitizing concepts to provide a starting point for building an analysis to produce a grounded theory. Sensitizing concepts do not enable the researchers to move directly to the instance which is related to a specific theory or idea and inspect its relevant content; instead, it gives a general sense of reference and guidance in approaching empirical instances and suggests directions along which to look (Blumer, 1954). Appendix 2 illustrates an audit trail example of how text was transferred to category. The program NVivo for Mac (Version 11.1.1 (1551)) was used to analyse the data.

2.3.4. Ethical consideration

The Medical and Health Research Ethic Committee (MHREC) at Faculty of Medicine, Gadjah Mada University approved the protocol of the study (Ref: KE/FK/458/EC). In addition, local permissions were obtained from each sub-district in order to recruit participants. Prior to the interview, participants were informed and assured verbally and in writing about their right to withdraw from the study at any time and that their information would be treated anonymously. Finally, written consent was obtained from all study informants.

2.4. Mixed component

Mixed method has been described as an approach combining both quantitative and qualitative methods – for instance research questions and hypothesis, data collections, analysis, and interpretations – to achieve a broad and in-depth understanding of a research area (Johnson et al., 2007). However, the definition of mixed method research further divides into two distinctive approaches. Firstly, "a mixed method study": this approach involves mixing both quantitative and qualitative methods within a single study. Secondly, "a mixed method program": which involves mixing both methods within a programme of research. Within this approach, mixing occurs across a close set of studies. The underlying assumption of mixed method research is that it can address some research questions more comprehensively than by using either method alone to harness the strengths of, and to compensate for the limitations of quantitative or qualitative methods. Dahlgren and colleagues proposed three different perspectives on whether quantitative or qualitative methods can be mixed: (i) purist perspective, (ii) situationalist perspective, and (iii) pragmatist perspective (Dahlgren et al., 2007). In sum, purist perspective holds that
quantitative and qualitative methods are incompatible and mixing them will result in less rigorous research. Situationalists choose to present quantitative and qualitative results separately while emphasising that these studies have complementary relationships. In contrast to the other perspectives, the pragmatists believe that it is possible to mix these two methods within one study or research programme to best address the question in focus. In this thesis, an exploratory sequential mixed method design was applied (Croswell and Plano Clark, 2011), where a qualitative method was used to answer "why" or "how" questions generated from preceding quantitative research (i.e., the protective effect of women-headed households or gender relations within households). Therefore, in terms of to what extend different methods can be mixed, this investigation lies somewhere between the situationalist and pragmatist perspective. In addition to that, although none of the four papers were considered as “a mixed method study”, the entire thesis can be regarded as “a mixed method program”. A summary of the PhD thesis is presented in Table 3.

**Table 3. Summary of the four papers**

<table>
<thead>
<tr>
<th>Paper</th>
<th>Research questions</th>
<th>Theoretical framework</th>
<th>Study design and sample</th>
<th>Analytical method</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>Inter-individual inequalities in BMI</td>
<td>Health inequality</td>
<td>Repeated cross-section of all IFLS waves. 20-50 year-olds</td>
<td>QQ plot Age adjusted BMI Linear regressions</td>
</tr>
<tr>
<td>II.</td>
<td>Households the omitted level in contextual analysis</td>
<td>Multilevel theory and omitted level</td>
<td>Repeated cross-section of all IFLS waves. 2-100 year-olds</td>
<td>Two- and three-level multiple multilevel linear regressions</td>
</tr>
<tr>
<td>III.</td>
<td>Dual burden of malnutrition: the effect of gender and social capital</td>
<td>Gender and social capital</td>
<td>Only one cross-section (IFLS4). 2-100 year-olds</td>
<td>Two level multiple multilevel logistic regressions</td>
</tr>
<tr>
<td>IV.</td>
<td>Generational gendered power relations and child malnutrition</td>
<td>Gender and generational relations</td>
<td>Grounded theory. Married household members</td>
<td>Constructivist grounded theory</td>
</tr>
</tbody>
</table>
3. RESULTS

This Results Section begins by presenting quotes from the FGDs in order to contextualize how participants perceived the study. Trends in overweight and obesity are reported, as are changes in the distribution of BMI, both overall and between and within socioeconomic groups. The results also show which context (i.e. household or district) had a greater effect on the variation of BMI and the prevalence of the double burden in households. The section concludes by presenting further quotes from the FGDs illustrating participants’ perceptions and attitudes towards the double burden of malnutrition.

3.1. Perceived changes in the patterns of diet and food consumption

The results from the FGDs in Central Java and Jakarta clearly showed that the issue of changing dietary patterns and eating habits was not just a problem for high socioeconomic status groups and urban dwellers. Individuals in all age groups, especially children, were frequently consuming junk foods, such as chicken nuggets and sweetened beverages, at streets stalls and in schools even in the rural areas in the Purworejo district. In addition to that there was an increasing pattern in the consumption of ready-made or manufactured foods such as instant noodles, rather than traditional foods like rice with vegetables, tofu or tempeh.

“But for fried chicken served like fast food products, there are the sellers here. There are many people buying this kind of food. When I want to buy in afternoon, they are sold out already. Consumption for instant sausage is also high. Children like this snack a lot, their favourite. Personally, I observe that overweight is influenced by your eating style.” A man in rural Purworejo

“My child does not like to eat and prefers beverages. I heard that drinks cause overweight. You know, you cannot forbid your children to buy food at their schools!” A man in rural Purworejo

The availability of junk foods and presence of street sellers, both in rural and urban areas, combined with a move away from locally sourced traditional foods, (e.g. steamed rice, tempeh, vegetables eggs) to energy-dense nutrient poor foods (e.g. noodles, fried chicken nuggets, salty and sugary fried puffs, sweetened beverages, processed foods) has become the
reality in Indonesia. Changes in the food environment and consumption patterns were impacting on household nutrition, and these effects were particularly evident in children.

“Our main food is rice and side dish can be tivul (local food made of cassava), vegetables (cassava leaves, kangkong leaves, spinach), tofu and tempeh at daily basis. Based on my observation, there are things triggering overweight such as instant noodle such as Indomie, Supermi, etc. The consumption rate is high. My younger child loves to eat instant noodle a lot, any brand that we can find. This is a concern but not so important. We are trying our best to switch into better menu, but we are busy and our kids want to eat foods like instant noodle, therefore, we have no choice.” A man in rural Purworejo

Although street sellers are ubiquitous and junk foods are easily accessible in bigger cities and urban settings, the availability of fast food restaurants triggers the worsening eating patterns of Indonesians. Children were “excited” about eating out in these restaurants and adults consumed their products on a regular basis.

“All my children like it, the three of them. If I take them to eat outside, the oldest one eats the most. The younger one eats a lot too. He is very excited about eating out.” A woman in suburban Jakarta

“My brother is overweight now because he eats food only in a fast food restaurant every day. He is already a member and he gets delivery service every day. Chicken means eating for him. One is not enough and he has to have two pieces every day.” A woman in suburban Jakarta

The emerging obesogenic environment described by participants was impacting across all age groups in the Indonesian population. Adults, particularly men, are more likely to eat out and buy food from street sellers. For instance, within this lifestyle there is too little time for cooking and individuals eating habits are transitioning mainly towards consumption of ready-made foods and noodles rather than traditional foods.

3.2. Trends in the prevalence of underweight, normal weight, overweight and obesity among adults

The prevalence of overweight and obesity continually increased from 22.8% and 6.4% respectively in IFLS1 (1993) to 28.5% and 12.6% respectively in IFLS4 (2007) for both 20-50-
year-olds men and women. The prevalence of normal weight men and women decreased from 58.0% in IFLS1 to 48.1% in IFLS4. Despite dramatic changes in the prevalence of normal weight, overweight and obesity, there has been a slight change in the prevalence of underweight over time. Underweight remained almost constant in IFLS1 (12.7%), IFLS2 (12.2%), and IFLS3 (13.1%), but decreased to 10.7% in IFLS4 (Figure 10). Obesity (12.6%) was more prevalent among the population than underweight (10.7%) in the last study wave.

Figure 10. Prevalence of underweight, normal weight, overweight, and obesity among all 20-50 year-olds

Body Mass Index (BMI) was classified based on the Asian cut-offs: underweight <18, normal weight 18-22.9, overweight 23-27.49, and obese ≥27.50. IFLS: Indonesian Family Life Survey

The prevalence of underweight, normal weight, overweight and obesity was also reported separately for men and women. As shown in Figure 11, for both sexes, the prevalence of normal weight decreased, and the prevalence of overweight and obesity increased over time. However, a greater proportion of women were categorized as overweight and obese compared with men. In the last wave (IFLS4) 24.5% and 8.0% of men were overweight and obese respectively, while 32.2% and 16.8% of women were overweight and obese. Although the prevalence of underweight remained higher than the prevalence of obesity among men, it stayed constant across the survey waves, while the prevalence of obesity doubled from IFLS1 (3.8%) to IFLS4 (8%). Among women, the prevalence of underweight was higher than that of obesity in IFLS1 (13.3% compared with 8.5%) but by IFLS4 obesity prevalence was more prevalent than that of underweight (16.8% compared with 9.3%).
Figure 11. Prevalence of underweight, normal weight, overweight, and obesity among 20-50 year-olds men and women

Body Mass Index (BMI) was classified based on the Asian cut-offs: underweight <18, normal weight 18-22.9, overweight 23-27.49, and obese ≥27.50. IFLS: Indonesian Family Life Survey

3.3. Changes across the whole distribution of BMI

The asymmetric changes in BMI levels were evident in a QQ plot showing that much of the change in BMI over time occurred at higher percentiles of the BMI distribution. Figure 12 illustrates the QQ plot of BMI across different IFLS waves in men and women together. The distribution of BMI is closer to the baseline survey at lower percentiles of BMI and there is increasing positive deviation of BMI values from the line of equality at higher percentiles and above the overweight and obese cut-off points. The increasing divergence from the line of equality in the QQ plot over the survey years shows growing inequalities in weight gain over time.
Figure 12. Quantile-Quantile (QQ) plot of BMI by comparing the baseline with the subsequent study waves. X-axis shows the BMI at the baseline survey. Y-axis shows the BMI at the following survey waves. The diagonal line $y = x$ is the line of equality between baseline survey and subsequent survey. Vertical reference lines (dash) represent the 5th, 50th, and 95th percentiles, with the value of BMI at the baseline survey. *IFLS: Indonesian Family Life Survey*

### 3.4. Between- and within-group inequalities in BMI distribution

In order to identify inequalities in mean BMI within socioeconomic groups by men and women, absolute and relative differences are presented by first comparing individuals with no schooling and university level education separately in IFLS1 and IFLS4, and second, by comparing individuals with lowest and highest per capita expenditure separately in IFLS1 and IFLS4. The percentage change between IFLS1 and IFLS4 in these estimates is also shown for men and women. Table 4 shows that all absolute and relative values are positive. This indicates that individuals with a university degree and the highest per capita expenditure had higher mean BMI, compared with individuals with no schooling and lowest per capita expenditure. These patterns were consistent for both men and women. The percentage changes from IFLS1 to IFLS4 for the absolute and relative estimates indicate that between-group inequalities were decreasing over time for both these socioeconomic groups, with the exception of the absolute difference between the lowest and highest per capita expenditure in men.
Table 4. Between-group differences in the mean BMI over time for education (no schooling and university) and per capita expenditure quartiles (lowest and highest)

| All individuals | Education | Per capita expenditure | Mean differences (University vs. No schooling) | | | | Absolute | Relative | Mean BMI | Mean BMI | Absolute | Relative |
|-----------------|-----------|------------------------|-----------------------------------------------|--------|------|--------|--------|--------|--------|--------|--------|
|                 | No schooling | University | Mean BMI | Mean BMI | Absolute | Relative | Mean BMI | Mean BMI | Absolute | Relative |
| IFLS1           | 21.09      | 22.85      | 1.76     | 1.08     | 20.87    | 22.75    | 1.88     | 1.09     |          |          |
| IFLS4           | 22.34      | 23.36      | 1.02     | 1.05     | 21.98    | 23.58    | 1.59     | 1.07     |          |          |
| % Change        |            |            | -42.1%   | -3.5%    |          |          | -15.3%   | -1.6%    |          |          |
| Men             |            |            |          |          |          |          |          |          |          |          |
| IFLS1           | 20.52      | 22.74      | 2.22     | 1.11     | 20.55    | 22.36    | 1.81     | 1.09     |          |          |
| IFLS4           | 21.34      | 23.37      | 2.03     | 1.09     | 21.14    | 22.98    | 1.84     | 1.09     |          |          |
| % Change        |            |            | -8.7%    | -1.2%    |          |          | 1.6%     | -0.1%    |          |          |
| Women           |            |            |          |          |          |          |          |          |          |          |
| IFLS1           | 21.31      | 23.05      | 1.74     | 1.08     | 21.10    | 23.07    | 1.97     | 1.09     |          |          |
| IFLS4           | 22.73      | 23.35      | 0.62     | 1.03     | 22.73    | 24.12    | 1.39     | 1.06     |          |          |
| % Change        |            |            | -64.2%   | -5.0%    |          |          | -29.4%   | -2.9%    |          |          |

Percentage change was calculated based on the differences between IFLS1 and IFLS4. IFLS: Indonesian Family Life Survey

The SD measures dispersion in a distribution. This provides a proxy measure of inequalities in mean BMI within socioeconomic groups. While between socioeconomic group differences decreased over time (Table 4), within group inequalities increased (Table 5). All percentage changes in SDs from IFLS1 to IFLS4 were positive suggesting increasing dispersion. The percentage change for all individuals was higher among the no schooling group (26.2%) compared to the university group (18.3%) and for the lowest per capita expenditure (37.4%) compared to the highest per capita expenditure (18.1%).

Table 5. Within group differences in the standard deviation (SD) of BMI over time for education (no schooling and university) and per capita expenditure quartiles (lowest and highest)

<table>
<thead>
<tr>
<th>All individuals</th>
<th>Education</th>
<th>Per capita expenditure</th>
<th>SD of BMI</th>
<th>SD of BMI</th>
<th>SD of BMI</th>
<th>SD of BMI</th>
<th>SD of BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No schooling</td>
<td>University</td>
<td>Lowest</td>
<td>Highest</td>
<td>Lowest</td>
<td>Highest</td>
<td></td>
</tr>
<tr>
<td>IFLS1</td>
<td>3.1</td>
<td>3.6</td>
<td>2.7</td>
<td>3.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IFLS4</td>
<td>3.9</td>
<td>4.2</td>
<td>3.7</td>
<td>4.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Change</td>
<td>26.2%</td>
<td>18.3%</td>
<td>37.4%</td>
<td>18.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>2.3</td>
<td>3.4</td>
<td>2.3</td>
<td>3.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IFLS1</td>
<td>2.8</td>
<td>4.0</td>
<td>3.1</td>
<td>4.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IFLS4</td>
<td>22.1%</td>
<td>20.1%</td>
<td>34.9%</td>
<td>20.8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Change</td>
<td>3.3</td>
<td>4.0</td>
<td>3.0</td>
<td>3.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>4.2</td>
<td>4.4</td>
<td>4.1</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IFLS1</td>
<td>26.0%</td>
<td>12.0%</td>
<td>37.5%</td>
<td>16.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Percentage change was calculated based on the differences between IFLS1 and IFLS4. IFLS: Indonesian Family Life Survey

Table 6 illustrates the variance and standard error (SE) from multiple linear regressions computed for each study wave using two multiple linear models. Model I was adjusted for age and gender only, and model II was further adjusted for occupation, education, per capita
expenditure, and place of residence. The percentage change in variance was calculated as the difference between model I and model II. The variance in model I was subtracted by the variance in model II and the result was divided by the variance in model I and multiplied by 100. This gives the percentage of the variance attenuated or explained by inclusion of all the socioeconomic factors for each study wave. As shown in the column “% change in variance” in Table 6, the effect of the same socioeconomic variables on the variation of BMI was reduced over time, after controlling for individuals’ age and gender.

Table 6. Multiple linear regressions on BMI across four different models

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model I</td>
<td>Model II</td>
<td>% Change in variance</td>
</tr>
<tr>
<td></td>
<td>Variance (SE)</td>
<td>Variance (SE)</td>
<td></td>
</tr>
<tr>
<td>IFLS1</td>
<td>10.41 (0.16)</td>
<td>9.68 (0.15)</td>
<td>7.0%</td>
</tr>
<tr>
<td>IFLS2</td>
<td>11.24 (0.15)</td>
<td>10.76 (0.15)</td>
<td>4.3%</td>
</tr>
<tr>
<td>IFLS3</td>
<td>11.96 (0.13)</td>
<td>11.56 (0.13)</td>
<td>3.3%</td>
</tr>
<tr>
<td>IFLS4</td>
<td>15.06 (0.15)</td>
<td>14.61 (0.15)</td>
<td>3.0%</td>
</tr>
<tr>
<td>IFLS1</td>
<td>7.87 (0.19)</td>
<td>7.17 (0.17)</td>
<td>8.9%</td>
</tr>
<tr>
<td>IFLS2</td>
<td>8.39 (0.17)</td>
<td>7.76 (0.16)</td>
<td>7.5%</td>
</tr>
<tr>
<td>IFLS3</td>
<td>9.53 (0.16)</td>
<td>8.94 (0.15)</td>
<td>6.2%</td>
</tr>
<tr>
<td>IFLS4</td>
<td>12.28 (0.18)</td>
<td>11.55 (0.17)</td>
<td>5.9%</td>
</tr>
</tbody>
</table>

Model I: \[ b_{0} + \beta_{1} (\text{Age})_{i} + \beta_{2} (\text{Gender})_{i} + e_{0i} \]
Model II: \[ b_{0} + \beta_{1} (\text{Age})_{i} + \beta_{2} (\text{Gender})_{i} + \beta_{3} (\text{Occupation})_{3i} + \beta_{4} (\text{Education})_{4i} + \beta_{5} (\text{Per Capita Expenditure})_{5i} + \beta_{6} (\text{Place of residence})_{6i} + e_{0i} \]

IFLS: Indonesian Family Life Survey.

3.5. Contextual variations in mean BMI at household and district level over time

Understanding variations in BMI in different social contexts is important for setting policies and developing interventions aimed at reducing inequalities and promoting health. Figure 13 demonstrates the distribution of predicted mean household BMI for each IFLS study cycle. Based on their predicted mean BMIs, these households were ranked from the lowest to the highest. The number of households increased from IFLS1 in 1993 to IFLS4 in 2007 because new split-off households were also followed. As shown in Figure 13, the distribution of BMI was not uniform and the variation in predicted mean household BMI increased over time. This suggests that households became more variable over time.
Figure 13. Distribution of predicted mean household BMI: IFLS: Indonesian Family Life Survey.
Note. Dots represent the household BMI mean. Households are sorted from left to right based on the household mean BMIs.

Figure 14 shows the distribution of predicted mean district BMI for each IFLS wave. Based on their predicted mean BMI, districts were ranked from those with the lowest to the highest BMIs. The number of districts increased from IFLS1 in 1993 to IFLS4 in 2007, since new split-off households were also followed. As demonstrated in Figure 14, there are variations in mean BMI across districts, however, these variations in districts mean BMI decreased over time and districts became more similar in the last wave. Although between district variations decreased, within district variations increased over time. The 95% bars in IFLS4 are wider than those in IFLS1.

Figure 14. Distribution of predicted mean district BMI: IFLS: Indonesian Family Life Survey.
Note. Dots represent the district BMI mean. Ninety-five percent bound around the means (based on the standard deviations of BMI mean). Districts are sorted from left to right based on the district mean BMIs.
Figure 15 presents ICCs from 36 multilevel analyses to illustrate how much of the variation in BMI is attributable to households and districts in each wave. These values were derived from three different multilevel analyses: (i) only household (two-level), where individuals are nested within households, and district levels were ignored; (ii) only district (two-level) where individuals are nested within districts, and households were ignored; and (iii) household and district (three-level), where individuals are nested within households and districts. Three models were applied for each analysis: Model I was adjusted for age and gender; Model II, was also adjusted for education, marital status, and occupation; and Model III further adjusted for household per capita expenditure, households size, and urban/rural residence. In general, the ICC of households fell slightly between IFLS1 to IFLS3, but increased sharply in IFLS4 (15% in model III in the three-level analysis). On the contrary, the ICC of districts deceased sharply from IFLS1 to IFLS2 and remained constant until IFLS4 (1.6% in model III, in three-level analysis). The results from Figure 15, also show that when household level is ignored i.e. individuals nested within districts, the effect of or the variation in higher level (districts) remains the same, as shown by the two lines (only district – two level and district – three level) that overlapped in all three models. This results in an overestimation of the individual level effect. However if the district level is ignored i.e. individuals nested within households, it results in an overestimation of the intermediary level (household), because part of this variation belongs to the higher level (district). This can be seen by comparing only household (two-level) and households (three-level) lines in Figure 15.
Figure 15. Intraclass correlation of Body Mass Index (BMI) over time. IFLS: Indonesian Family Life Survey. Note: District (three-level) and Only district (two level) are overlapped.
3.6. **Double burden of malnutrition at household level across provinces in 2007**

Initially households were classified into four distinctive groups: underweight, normal weight, overweight, and the double burden of malnutrition. Figure 16 illustrates the prevalence of each household type in Indonesia. The prevalence of overweight households was highest (32%) in Indonesia, followed by underweight households (28%). Only 21% of all households were classified as normal weight. Almost one in five households (19%) in Indonesia had at least one underweight and one overweight member in the same household.

**Figure 16.** The prevalence of underweight, normal weight, overweight, and double burden of malnutrition households in Indonesia in 2007

**Figure 17** presents the prevalence of double burden of malnutrition among households (coexistence of both underweight and overweight individual in the same household) across thirteen provinces in Indonesia. Provinces were ranked by the Human Development Index with Jakarta having the highest and West Nusa Tenggara having the lowest. There was no clear pattern in the distribution of double burden households across the provinces based on this ranking. Jakarta, South Sulawesi, and Lampung had the highest proportion of double burden households at 25%, 23%, and 22%, respectively. North Sumatra (15%) had the lowest proportion of double burden households and the second lowest were Central Java, Yogyakarta, and Bali each had 17% of double burden households. Overall, 19% of all households in Indonesia had at least one underweight and one overweight member. In other word, almost one in five households in Indonesia experienced a double burden of malnutrition.
**Figure 17.** Prevalence of the double burden of malnutrition across 13 provinces in Indonesia in 2007, sorted on their human development index.

**Figure 18** illustrates the prevalence of the double burden of malnutrition among households stratified by the gender of the head of households across thirteen provinces in Indonesia. In Jakarta 25% of both men-headed and women-headed households were classified as having double burden of malnutrition. In Yogyakarta, North Sumatra, and West Sumatra double burden households were more prevalent among women-headed households, while in all the other provinces men-headed households were more likely to be double burden households. In total, the prevalence of double burden of malnutrition was 20% among men-headed households and 15% in women-headed households and it was statistically significant ($p<0.001$).

**Figure 18.** Prevalence of the double burden of malnutrition across 13 provinces in Indonesia in 2007, sorted based on their human development index, and stratified based on the gender of the household head.
Figure 19 shows the prevalence of the double burden of malnutrition among households stratified by communities’ social capital across the thirteen provinces in Indonesia. In Yogyakarta the prevalence of double burden households was the same in communities with the lowest and highest social capital (18%). In West Java, East Java, and Lampung provinces double burden were marginally more prevalent in communities with lowest social capital, while in all other provinces it was more prevalent in communities with highest social capital. Overall, the double burden of malnutrition among households was more prevalent in communities with highest social capital compared with communities with the lowest social capital, however, these differences were not statistically significant (p=0.178).

![Figure 19](image.png)

Figure 19. Prevalence of the double burden of malnutrition across 13 provinces in Indonesia in 2007, sorted based on their human development index, and stratified based on community social capital.

Figure 20 shows the prevalence of the double burden of malnutrition among households stratified by place of residence across the thirteen provinces in Indonesia. As Jakarta was defined as a fully urbanized area in the 1990 Indonesian Census, and no information is available for the rural areas. Urban areas in Lampung (29%) and South Sulawesi (28%) had the highest prevalence of double burden households across all the provinces. In total the double burden of malnutrition was higher in urban areas compared with rural areas (23% vs. 17%) and these differences were statistically significant (p<0.001).

![Figure 20](image.png)
Table 7 presents the results from multilevel logistic modelling for measures of association between households and area characteristics and the outcome, as well as measures of variation and clustering in the double burden of malnutrition among households in Indonesia. The null or empty model presents only the community level variance (0.092) and the standard error (0.024) around the intercept or grand mean. Intraclass correlation in the null model shows that 2.8% of the variation in the double burden among households is attributable to the community level; therefore the remaining 97.2% is attributable to the household level. In model I, household level variables (gender of the head of the household and household’s socioeconomic status, which are shown in the table as well as the education level of the head of the household and percentage of under-15 and over-60 year-olds in the household, which are not shown in the table) were included. The fixed part of model I shows that women-headed households had protective effect on double burden of malnutrition (OR = 0.75, 95% CI: 0.63 to 0.89). Model I also shows that there is a gradient in the association between double burden and households’ socioeconomic status of households, meaning that the odds of double burden increased as the households’ socioeconomic status increases. Highest socioeconomic status households had the highest odds of double burden compared to the lowest socioeconomic status households (OR = 1.85, 95% CI: 1.51 to 2.25). In the random part, the intraclass correlation in model I decreased to 2.2%. After inclusion of household level variables in model I, the community level variance attenuated to 0.074 from 0.092 in the null model. Accordingly, it can be said that 10% of the area level variation in double burden is explained by the household level characteristics. Community level variables (social capital and urban/rural area) were included in the model II. Women-headed households still had a protective effect on double burden (OR = 0.74, 95% CI: 0.62 to 0.88); however, the gradient in the association between double burden and households’ socioeconomic status was disappeared.
Table 7. Multilevel logistic modelling for measure of association between households, and area characteristics and the outcome as well as measures of variation and clustering in double burden of malnutrition among households in Indonesia in 2007

<table>
<thead>
<tr>
<th>Household characteristics</th>
<th>Multilevel multiple logistic regression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Null model</td>
</tr>
<tr>
<td><strong>MEASURE OF ASSOCIATION (OR, 95% CI)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>OR FIXED PART</strong></td>
<td></td>
</tr>
<tr>
<td>Household level variables</td>
<td></td>
</tr>
<tr>
<td>Household head</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>-----</td>
</tr>
<tr>
<td>Women</td>
<td>-----</td>
</tr>
<tr>
<td>Household socioeconomic status</td>
<td></td>
</tr>
<tr>
<td>1 poorest</td>
<td>-----</td>
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<tr>
<td>2</td>
<td>-----</td>
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<tr>
<td>3</td>
<td>-----</td>
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<tr>
<td>4</td>
<td>-----</td>
</tr>
<tr>
<td>5 richest</td>
<td>-----</td>
</tr>
<tr>
<td>Community level variables</td>
<td></td>
</tr>
<tr>
<td>Community social capital</td>
<td></td>
</tr>
<tr>
<td>1 Lowest</td>
<td>-----</td>
</tr>
<tr>
<td>2 Middle</td>
<td>-----</td>
</tr>
<tr>
<td>3 Highest</td>
<td>-----</td>
</tr>
<tr>
<td>Community</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>-----</td>
</tr>
<tr>
<td>Rural</td>
<td>-----</td>
</tr>
<tr>
<td><strong>MEASURE OF VARIATION OR CLUSTERING</strong></td>
<td></td>
</tr>
<tr>
<td><strong>OR RANDOM PART</strong></td>
<td></td>
</tr>
<tr>
<td>Community level variance (SE)</td>
<td>0.092 (0.024)</td>
</tr>
<tr>
<td>Intraclass correlation (%)</td>
<td>2.8%</td>
</tr>
<tr>
<td>Proportional change in variance (PCV)</td>
<td>Reference</td>
</tr>
<tr>
<td>Median Odds Ratio (MOR) for place of residence</td>
<td></td>
</tr>
</tbody>
</table>

Note: Model I and II were also controlled for percentage of under-15 and over-60 year-olds in the household, which are not shown in the table.

There was no significant association between community social capital and double burden, but communities in rural areas had protective effect on double burden (OR = 0.77, 95% CI: 0.60 to 0.88). Intraclass correlation reduced to 1.8% in model II, indicating that only 1.8% of the total community level variation in double burden is attributable to the community level. Community level variance also decreased to 0.061 from 0.092 in the null model meaning 34% of the community level variation in null model is explained by these household and community characteristics. The cross-level interactions between households socioeconomic status and community characteristics were also estimated but the associations were not
statistically significant (is not shown). The MOR is defined as the median value of the odds ratio between the area at highest and lowest risk when randomly picking out two areas. There would be no differences between areas in the probability of double burden households, if the MOR is equal to one. The MOR estimates in this analysis was 1.26. It means that the area of residence would be relevant for understanding variations of double burden households.

Table 8. The association between household socioeconomic status and double burden of malnutrition stratified by gender of household head, community social capital and place of residence

<table>
<thead>
<tr>
<th>Household socioeconomic status</th>
<th>Gender of household head</th>
<th>Community social capital</th>
<th>Place of residence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women-headed household</td>
<td>Men-headed households</td>
<td>The lowest</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>community social capital</td>
</tr>
<tr>
<td>1 poorest</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>0.93 (0.54-1.60)</td>
<td>1.36 (1.12-1.66)</td>
<td>1.26 (0.93-1.69)</td>
</tr>
<tr>
<td>3</td>
<td>1.09 (0.65-1.82)</td>
<td>1.70 (1.40-2.07)</td>
<td>1.78 (1.32-2.40)</td>
</tr>
<tr>
<td>4</td>
<td>1.48 (0.88-2.50)</td>
<td>1.68 (1.37-2.06)</td>
<td>1.85 (1.35-2.54)</td>
</tr>
<tr>
<td>5 richest</td>
<td>1.28 (0.71-2.33)</td>
<td>1.68 (1.34-2.09)</td>
<td>2.07 (1.45-2.96)</td>
</tr>
</tbody>
</table>

Note: These models were controlled for household level characteristics (gender of the head of the household, household’s socioeconomic status, education level of the head of the household, and percentage of under-15 and over-60 year-olds in the household) and community level characteristics (social capital and urban/rural area).

The results in Table 8 show that there was no association between household socioeconomic status and the double burden of malnutrition among woman-headed households or if the household was located in a community with the highest social capital. In communities with the highest social capital, the odds of double burden were very close to each other across the different socioeconomic status strata - although not statistically significant. This suggests that inequalities in the double burden of malnutrition were smaller across the socioeconomic status strata among households located in communities with the highest social capital. However among men-headed households, households with higher socioeconomic status had higher odds of double burden compared to lowest socioeconomic status households, but there was no clear gradient across the different socioeconomic status groups. In the communities with the lowest social capital there was a clear gradient in double burden and household socioeconomic status. Households with the highest socioeconomic status had the highest odds of double burden in communities with lowest social capital (OR = 2.07, 95% CI: 1.45 to 2.96). Additionally the odds of double burden were significantly higher among households with higher socioeconomic status in both urban and rural areas.
3.7. Perceptions and attitudes towards the double burden of malnutrition

In total 16 FGDs were conducted among 59 men and 64 women in urban and rural areas in Central Java as well as central and suburban areas in Jakarta (Table 9).

Table 9. Geographical locations and number of the study participants in qualitative Focus group discussions (FGDs) in Indonesia, 2013

<table>
<thead>
<tr>
<th>Geographical location</th>
<th>Groups</th>
<th>Informants</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Jakarta</td>
<td>4</td>
<td>23</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Suburban Jakarta</td>
<td>4</td>
<td>27</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Urban Purworejo</td>
<td>4</td>
<td>34</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Rural Purworejo</td>
<td>4</td>
<td>39</td>
<td>18</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>123</td>
<td>59</td>
<td>64</td>
</tr>
</tbody>
</table>

Grounded theory was used to construct three categories, which captured the significance of gendered power relations, the emerging obesogenic environment, and generational relations for child malnutrition. These new categories are labelled: (i) women at the end of family hierarchy; (ii) the environment makes the unhealthy choice, the easy choice; and (iii) parents are concerned but not able to control children’s eating habits. A closer description of the three categories follows.

3.8. Women at the end of family hierarchy

Women generally were at the end of the family hierarchy. The gender arrangements and power relations were mentioned to be rooted in the culture – Javanese culture – as well as religion – Islam.

"From Javanese culture, from our religion stating that male is an imam (leader).” A woman in central Jakarta.

Children had the priority in receiving food first because they were perceived to be in a growing period and developing a healthy condition. Both boys and girls within the families were equally fed and treated, and gender preferences were not given. Nonetheless, in adults priority goes to fathers.
Almost all men and women still posit a strong sense of compliance to the institutionalized beliefs and values in gender relations. However, there have been some indications and manifestations of transitions occurring in the practices or doing of gender within the context of households and its members.

"In my family, we put our children first because they are still young. When they are grown-up already, perhaps the priority will turn to the father. It does not go to the mother because generally in our traditional community, a wife will put her husband first. They take the second turn." A man in urban Purworejo

3.9. The environment makes the unhealthy food choice, the easy choice

Inside and outside schools’ environments, particularly the availability of junk foods was considered as an influencing factor deteriorating children’s nutritional status. Foods sold at schools were considered “dangerous” for children’s health and schooling period was known as a period when a big shift happens in the children’s nutritional status and eating behaviour.

"For me and my husband, decision-making is balanced. No one is more than the other. Just take turns which one is better. Does not have to be my husband’s always, or mine always." A woman in urban Purworejo

"I have 3 children, the oldest one was small before he/she entered elementary school, did not want to eat. My brother’s child is also like that, when he/she was younger, he/she was small and after 3rd or 4th grade of elementary school he/she got fat. So all of them are fat now.” A woman in rural Purworejo

The outside school environment also plays an important role stimulating unhealthy eating behaviour. This is depicted as a place jammed with street sellers offering snacks, instant noodles, fried chicken and nuggets to schoolchildren.
Both men and women shared the same story in addressing this issue and no differences were observed in terms of place of residence i.e. between urban and rural in Purworejo or between central and suburban areas in Jakarta. However, in Jakarta, work offices were considered as environments that promote unhealthy eating habits and described as places where foods and snacks were frequently consumed. In some cases even changing a job was seen as a factor contributing to weight gain.

3.10. Parents are concerned but not able to control children’s eating habits

Both men and women are “concerned” about the eating habits of their children and are aware of the consequences of unhealthy eating. However in spite of their parents’ resistance and disapproval, children have the power to do and to eat whatever they wish for and this means frequently consumption of junk foods. They maintain this behaviour by any means i.e. “crying”, “fighting”, “insisting”, “being upset”, “becoming mad”, etc. Parents, on the other hand, are incapable of preventing these habits and eventually acquiesce.

“When our children ask for snacks and if we don’t buy the snacks for them, they can get upset. We don’t want them to be upset so we prefer giving them what they want.” A man in rural Purworejo

Between parents, women seem to be more concerned and more responsible for this issue, while men tend to provide children with junk foods by taking them out to eat or buying takeaway foods rather than cooking at home. However this can be because of men’s lack of cooking skills. This might also reflect the fact that the domestic responsibilities have not been transferred to men despite women’s greater involvement in paid work outside the household.

“Honestly, I cannot cook. I can only cook Indomie (instant noodle) and fried rice. A man in suburban Jakarta
Given such an unequal labour division within the households, it seems that men took a responsive approach had a tendency to “go with the flow” regarding the modern obesogenic environment, when charged with taking care of children. This reflects the fact that the domestic responsibilities were not fully transferred to men despite women’s increasing participation in paid work outside the home. On the contrary, women struggled with these changes and tried to prevent their children from consuming unhealthy foods. They were, however, generally not successful due to their lack of power within the family hierarchy.

“When fathers take the children to go out, they tend to give children things or food that mothers forbid. They often say to the children that it is OK to take that food because mother is not with them. I protested my husband for doing that but my husband said that it was OK for children to have that food occasionally. That makes us having different way of giving rules to the children and it is not good for the children.” A woman in central Jakarta
4. DISCUSSION

4.1. Summary of the main findings

The BMI has been increasing in the Indonesian population over the last few decades. Participants in this study perceived that this was mainly due to changes in patterns of diet and eating habits. However, changes in the mean BMI over time were not equally distributed. Population at higher baseline percentiles of BMI gained more weight relative to the population segment at lower baseline percentiles. Despite the socioeconomic group inequalities (in terms of education and household per capita expenditure strata) observed in the population weight gain, the findings showed that merely focusing on between-group inequalities may mask increasing inequality or dispersion occurring among individuals within socioeconomic groups. These findings suggest there are other under-recognized compositional and contextual characteristics in the population affecting BMI rather than conventional socioeconomic factors. Contextual effects were observed by addressing the relative contribution of households and districts on the variation of BMI over the last two decades. Variations between households increased dramatically in the last wave of IFLS in 2007, while the variation of BMI attributable to the districts decreased during 1993-2007. These findings suggest the importance of laying out strategies that respond to the differential needs of individuals within the same households. The double burden of malnutrition was examined by identifying both underweight and overweight individuals in the same household. Almost one in five households in Indonesia were classed here as having a double burden of malnutrition, with significant differences in the prevalence across provinces. There was a gradient in the association between the double burden and households' socioeconomic status. However, no association was observed between socioeconomic quintiles when households were headed by a woman or located in a community with highest social capital. The highest prevalence was observed among households with the highest socioeconomic status located in the communities with the lowest social capital. These findings suggest that empowering women and improving community social capital could well be a useful tool for narrowing the gap across socioeconomic strata, and addressing the double burden of malnutrition within households. Finally as perceived by the FGD participants, a transition to unhealthy eating patterns – especially among children – together with an increasing weight gain by adult household members, dominated the issue of double burden of malnutrition. The qualitative findings also showed that gendered power relations within the household, the emerging obesogenic environment, the availability of junk food both inside and outside schools, coupled with an intersection of gender and generations in which parents were not able to control children’s eating habits, were the major contributors to malnutrition in children.
4.2. Indonesia – a society in transition

In all aspects of this study transition was a single overarching theme. Transition from undernutrition and underweight towards over nutrition and overweight in the population, transition from consumption of traditional and nutrient foods towards energy-dense and nutrient-poor fast foods, and gradual transition in gender roles and relations within the households and in society are some examples of Indonesia undergoing a transition to a post-traditional society. Giddens claims “modernity is post-tradition” (Giddens, 1994). He argues societies can’t be completely modern if attitudes, actions, or institutes are considerably persuaded by tradition that is contradictory to “modern reflexivity”. In a traditional society like Indonesia that has long stood at the crossroads of culture and developmental paths, there are increasing efforts being made by women in their seeking a more gender equal life. This is particularly evident among younger generations. One may argue that connecting the increase in reflexivity among younger generations to Giddens’s claim of “de-traditionalization” in the Western countries does not fit to Indonesian population, where still strong ties to family and tradition exist (Smith-Hefner, 2005). However, the expansion of potential life trajectories and lifestyle choices through education and work have shaped different sort of youth compared to previous older generations (Parker and Nilan, 2013). Women are increasingly getting involved in higher education, in generating or earning income outside the home, in contributing to their household’s economy, and in participating in community activities. This “reflexivity” can provide women with more authority and can boost their position in the family hierarchy, if it is supported by stronger gender sensitive legislation and regulations at the institutional and national level. This thesis provides an overall picture of the multidimensional aspects of malnutrition in Indonesia because it addresses malnutrition from a number of perspectives and at different levels of the population.

4.3. A population perspective

In order to improve the health of populations it is necessary to move beyond a focus on clinical interventions that target high-risk groups. This concept was best articulated by Geoffrey Rose in 1992, who noted, “medical thinking has been largely concerned with the needs of sick individuals” (Rose, 1992). Despite the importance of this articulation for medicine and health care, it does little to prevent people from becoming sick in the first place, and it typically has overlooked issues related to disparities in access to and quality of preventive and treatment services (Committee on Assuring the Health of the Public in the 21st Century, 2003). Personal health care is only one, and perhaps the least prevailing, of several types of determinants of health, which include genetic, behavioural, social, and environmental factors (Mcginnis and Foege, 1993, Institute of Medicine, 2000). To amend these restraints, the intersectoral public health system must recognize and exploit the full potential of new opportunities and strategies for health policy and action (Committee on
Assuring the Health of the Public in the 21st Century, 2003). Thus, providing evidence on new health challenges at different levels of the population and within and between socioeconomic groups can assist in the implementation of policies aimed at reducing variation in health and promoting population health.

### 4.4. Change in the distribution of BMI

In the past understanding weight gain at the population level has focused on the proportion of the population above thresholds (e.g. overweight or obese), or on increases in mean BMI (Finucane et al., 2011, Jones-Smith et al., 2011). In many such descriptions it is assumed that the distribution of BMI or the dispersion in the population remains constant, while the entire distribution moves to the right, allowing summaries of population change by examining a single parameter (Rose et al., 2008). In contrast, this thesis provides a comprehensive examination of changes in the distribution of BMI rather than sole estimation of limited parameters such as the mean level of BMI or prevalence of overweight and obesity, by examining the entire distribution of BMI. The findings imply that the concept of "average weight gain" in a population where variance is rapidly rising fails to give a true estimation of how these changes are distributed. This finding has implication for the population approach to prevention since promoting a change in mean BMI can impact on people who are underweight and overweight in many very different ways. A population-based strategy solely relying on changes in the overall mean BMI in a population would fail to accomplish this dual benefit – to reduce weight in high BMI segments of the population and to increase weight in the low BMI segment (Razak et al., 2013). Findings in this thesis result from four repeated cross-sectional analysis of IFLS data in order to capture the population change. However, population changes in the BMI distribution may differ from actual individual-level changes in BMI as for example, BMI might also change within individuals with different baseline BMI classifications. Further work can address this issue by utilizing IFLS panel data for individuals who participated in all four waves of surveys.

### 4.5. Health inequalities

Explanations for the increasing dispersion in the BMI distribution are multifactorial. Growing inter-individual inequalities within the groups confirm that increasing inequality in the population is not merely attributed to socioeconomic factors. In comparing regression models with and without socioeconomic factors in IFLS1 and IFLS4, we found that the contribution these factors made to explain the variation of BMI decreased over time, especially among women (Table 6). This result suggests that there are additional unmeasured social, physiological and genetic factors that might possibly explain the rising inter-individual inequalities. In epidemiological studies exposures and outcomes are measured at the group level and inferences are mainly made in relation to groups rather than
individuals (Morris, 1957). For instance even we are analysing individual-level data, we still compare groups of individuals (i.e. smokers and non-smokers or overweight and not overweight). Therefore, accounting for incidence is different to understanding a specific incidence. This is reflected in Geoffrey Rose’s contribution to the theoretical basis for population health arguing that determinants of incident rates experienced by a population may explain very little of the variation in risk between individuals within the population (Rose et al., 2008).

George Davey Smith refers to this issue as the “gloomy prospect” of epidemiology and public health. He reasons that a major component of inter-individual differences in risk of disease is accounted for by events that are not epidemiologically detectable. Even identification of these stochastic events, ranging from biographical to the sub-cellular level and their interaction with the environment have no implications for disease prevention, as they do not generally provide targets for intervention. However, chance processes or highly stochastic nature of disease causation at an individual level, together with almost fully explainable group level differences, are not paradoxical and can even be expected. Davey Smith continues by saying that fully personalized medicine is an unlikely solution as well, yet suggests the importance of group differences and identification of “the smallest coherent group for which reliable treatment effects can be estimated” (Smith, 2011). Furthermore, back to what Murray and others proposed, both health inequalities and social group differences are important for measuring population health and we cannot simply focus on average level of health while encountering extreme variation in health within population. This has fuelled a rich debate on the advantages and disadvantages of various summary indicators used to describe the distribution of health in populations (Murray et al., 1999). In addition, Murray et al. also proposed “Community location” or contextual effect as one particular approach that can be used for defining social groups. Although largely unutilized in research on inequalities in population health, the approach could uncover even larger health inequalities than previously acknowledged (Murray et al., 1999).

4.6. Contextual effects

Indonesia has been through different economic stages: economic growth (prior to 1996), economic crisis (1997-98), economic recovery (2000-2005) and economic improvement (2006 onwards). Indonesian underwent a radical decentralization in 2001, which has brought political freedom to the districts by giving local citizens the right to select their mayor and parliament through direct elections. This means that they now have greater authority to deliver public services, as most of the responsibility for managing these services has been transferred to district governments. This was supported by substantial financial transfer that devolved around 30% of total national expenditure to districts (World Bank, 2008). Subsequently, district councils became more independent allowing them to initiate policies to meet the demands of local citizens. Decentralization aims at making health care closer to
“population needs” (Mills et al., 1990). Therefore, locally controlled politics better reflect the political will of citizens and better fit their health needs. The increased inequality in BMI between households observed in this thesis could be due to different impacts of the nutrition transition on different age groups, thus affecting the nutritional status of children and adults differently within a household. In contrast, lifestyle and dietary changes combined with limited nutrition and health knowledge; coupled with rapid social, economic and technological changes, appear similarly shared within the districts among individuals after decentralization and during the phase of economic improvement. Therefore, this secular trend might be explained by sharing the same obesogenic environment at the district level. These findings do not oppose the view that place matters (Dorling, 2001). They, however, confirm that the variance in BMI within districts (between individuals and households) is much greater than the variance between districts. Nonetheless, a very low district ICC (1.6%) in IFLS4 in 2007 or more generally even the absence of statistically area effect does not mean that district-based initiatives are unlikely to be effective (Joshi, 2001, Smith, 2001). These findings are among the first to consider households as a distinct intermediate level between individual and area. Recognition of increased variation in BMI at household level is important for developing strategies that respond to the differential needs of individuals within the same household. Otherwise, there is a risk that misguided policies and interventions will be implemented in contexts that may not be capable of having a significant effect on reducing health risk and promoting population health outcomes.

4.7. Double burden among households and the effect of women-headed households

A protective effect of women-headed households on the double burden of malnutrition was evident in the findings in this thesis. According to the Indonesian Bureau of Statistics approximately 9 million (14.63%) of Indonesia’s 65 million households were headed by women in 2015 (Statistic Indonesia, 2017). However Indonesian marriage law No. 1/1974 (State Secretariat of the Republic of Indonesia, 1974) dictates that only a man or a husband can legally be a household head. The identity of household members (including head status) is recorded in family cards, which are required by law for proof of residency status. According to the women-headed household empowerment program (PEKKA) women who are heads of household are those who undertake their roles and responsibilities as wage earners, household managers, “sustainers” of the family, and decision makers (PEKKA, 2000). The PEKKA, which began in 2001, is operating in 19 provinces in Indonesia and has benefitted around 20,000 women and approximately 52,000 family members by improving their livelihood and well-being. Proportions of women-headed households across IFLS provinces in 2007 are presented in Figure 21. Women-headed household generally occupy a marginal position in all aspects of life and are denied opportunities. PEKKA works with poor women heads of households who have been abandoned by their husbands or who are widowed, divorced or unmarried, it also supports women who are married to a disabled husband.
Assuming that women-headed households are primarily poor and subordinated, it can be argued that the protective effect of women-headed households on the double burden of malnutrition observed in this thesis is due to their substantially lower socioeconomic status and not therefore necessarily because of their positive influence on household health and nutrition. Figure 22 illustrates the proportion of men- and women-headed households across quintiles of households’ socioeconomic status. Although the proportion of women-headed households is slightly lower in the highest socioeconomic stratum (11%) compared to all the other socioeconomic strata (13%), they are not concentrated in the lower strata. Therefore the observed protective effect of women-headed household could be because of the positive role and influence of women on households rather than lack of resources and poor condition.

Figure 21. Proportion of women-headed households across provinces in Indonesia in 2007 (IFLS4)

Figure 22. Proportion of men-headed and women-headed households across quintiles of households’ socioeconomic status in Indonesia in 2007 (IFLS4)
Authors of other studies have also concluded that the protective effect of women-headed households is because they are better with money, take a better care of their household's financial arrangements, and particularly pay better attention to their children's health and nutritional status (Cunningham et al., 2015, Quisumbing and Maluccio, 1999, Rae, 1999, Roemling and Qaim, 2013, Rogers, 1996, Thomas, 1990). This was also supported by the results from FGDs (a man in rural Purworejo) said: "in general, the situation is better when women are in charge".

4.8. Double burden among households and the effect of community social capital

A vast body of literature has been published on neighbourhood or community effects on individuals' outcomes including schooling, housing, and health (Ellen and Turner, 1997, Dietz, 2002, Durlauf, 2004, Eriksson, 2010). The neighbourhood effect resembles the idea that living in deprived neighbourhoods had a negative effect on residents' life chance over and above the effect of their individual characteristics (Van Ham and Manley, 2010). A growing body of literature, especially within the disciplines of public health and social epidemiology, has identified two neighbourhood attributes that are theoretically relevant for individual health: physical/environmental deprivation of the neighbourhood (i.e. unmet need due to lack of resources in a neighbourhood that can contribute to good health and well-being) and neighbourhood social capital (Tampubolon, 2012). At the community level, the influence of social capital – contextual social capital or the social space – could have an effect on health in addition to the effect of individual social capital (Lochner et al., 1999). Collective social capital is often identified through aggregated measures of trust and social participation that do not obviously relate to the physical living area. Some argue the need for clearer place related measures (Poortinga, 2006b, Poortinga, 2006a, Harpham et al., 2002). On the other hand, the contextual or structural measures of social capital, such as availability of community programs and activities within an area, pose some measurement difficulties. These community level characteristics fail to address individual differences that enable participation in activities and organizations. Accordingly, contextual or community social capital could have different effects on the health and wellbeing of individuals and groups with different socioeconomic status. Despite the wealth of evidence that affirms the relationship between social capital and health, and also evidence that social capital mediates the relationship between income inequality and health (Kawachi et al., 1997), the relationship between social capital and socioeconomic inequalities in health remains unclear. A systematic review of the relationship between social capital and socioeconomic inequalities in health reported both a buffer effect (both low socioeconomic status and high socioeconomic status groups benefit from high social capital) and a dependency effect (only those with high socioeconomic status benefit from high social capital) of social capital on socioeconomic inequalities in health (Uphoff et al., 2013). In addition to that, the relationship between the double burden of malnutrition and income has attracted a particular interest in the literature. For instance, in
Indonesia and China, double burden and overweight households were more likely to be richer, while in Brazil and Russia, the double burden households tended to have lower than average incomes (Doak et al., 2005).

The relationship between household socioeconomic status, community social capital and the double burden of malnutrition was presented in Table 8. The analysis was stratified by low and high community social capital. No significant association was found between household socioeconomic status and the double burden of malnutrition in communities with highest social capital. In addition, the gradients across socioeconomic status strata disappeared and the odds of double burden were similar, indicating decreasing household socioeconomic inequalities. However by contrast, in communities with the lowest social capital, gradients across socioeconomic status strata remained, and the odds of double burden were highest among rich people in the poor settings. This finding is in accordance with the concept of double burden of malnutrition happening in poor settings (i.e. LMICs), where economic situation of the population is increasing. It can be argued that rich people may live in areas with low community activities or programs. On the contrary, Figure 23 shows that the majority of high socioeconomic status households were in communities with highest social capital and low socioeconomic status households were living in lowest community social capital. Therefore, it is unlikely the higher odds of double burden households in communities with lowest social capital is because a greater number of households with high socioeconomic status are living in areas with low community social capital.

Figure 23. Proportion of households with different socioeconomic status only in communities with the lowest and the highest social capital in Indonesia in 2007 (IFLS4)
4.9. Gender as a category in quantitative data analysis

A large gender gap was identified in the variation of BMI. Although there were substantial differences between men and women in each study wave, the results from regression analysis also showed that the variance of BMI in men in IFLS4 was almost equal to the variance of BMI in women in IFLS1. This finding suggests that the dispersion of BMI in men in 2007 was very similar to that in women in 1993. Additionally, the same sets of socioeconomic factors explained less variation in BMI among women compared with men. The variability among men and women could imply either that the same variables have very different effects on the two groups or that there are two completely different sets of exposures that drive these differences in BMI between the sexes. Another possibility is that the differences are random or stochastic in one group and not in the other and are therefore not predicted precisely. This may remind us that research on the social determinants of health in men and women involves complex causal relationships beyond simple confounding and if inequality is not uniformly distributed in a population – as we found in this study –, we need to find what the other indications from variation about social and environmental determinants are. The analyses in paper I did not go beyond the disaggregation of the data by men and women, therefore, our ability in explaining the differences is limited. Future work should adopt a more gender-oriented or gender-sensitive analysis (Morgan et al., 2016) to describe the economic and social differences in BMI of women and men in the same population. For example, differences may be driven by the impact of maternity, body image, relative allocation of resources or gender relations within households. In paper III, however, gender of the household head was used as proxy to study the effect of gender relations (men-headed households vs. women-headed households) on double burden of malnutrition in the household.

4.10. Gendered power relations, obesogenic environment, and childhood malnutrition

As perceived by the participants in FGDs, the presence of street sellers and availability of junk foods accompanied by increasing transition in food habits, i.e. moving away from consuming local and traditional foods such as steamed rice, tempeh, vegetables, vegetables soups, and eggs towards more energy-dense but nutrient poor foods such as instant noodles, fried chicken nuggets, salty and sugary fried puffs, and sweetened beverages, processed foods etc. is the reality of the Indonesia’s emerging obesogenic environment affecting households’ nutrition, especially children’s nutrition. For food and beverage industries, Indonesia represents one of the fast-growing parts of the global opportunity with the world’s fourth largest population with more than 240 million people. Investment in Indonesia’s processed food and beverage industry is expected to increase again by 16% in 2016 compare to 2015 and surpass the IDR 50 trillion level (approximately USD $3.9 billion) from IDR 43 trillion in 2015 (Lukman, 2016). In addition, by 2020 the global nonalcoholic ready-to-drink beverage
category is expected to grow in retail value by approximately $300 billion globally, and Indonesia represents a large emerging middle class with underdeveloped consumption rates of nonalcoholic ready-to-drink beverages (The Coca-Cola Company, 2015).

However, based on the qualitative findings, the way households’ responded to this observed reality is gendered. Fathers did not consider themselves responsible for children’s eating behavior and food consumption, as they believed that it is always mothers’ “role” to be the primary care provider for their children. Being occasionally concerned about children’s nutritional habits, fathers were part of the emerging obesogenic environment by taking children out to fast food restaurants or purchased food from out rather that cooking at home, when mothers were not available or not able to cook for the family. Mothers instead were concerned and conscious about children’s unhealthy eating patterns and strived to act against this behaviour but they did not possess enough power against the children’s will. The intersection between gender and generation requires a more complex and holistic picture of within households’ relationships in which the interplay of gender (parents, especially mothers) and generation (children) creates differential patterns of susceptibility, differential needs, and differential obligations for individuals within a household. Intersectionality is defined as a theoretical and methodological tool to analyze how historically specific kind of power differentials and/or constraining normativities, based on discursively, institutionally and/or structurally constructed socio-cultural categories such as gender, ethnicity, race, class, sexuality, age/generation, dis/ability, nationality, mother tongue, interact and produces different kind of societal inequalities and unjust social relations (Lykke, 2010). Initially the intention was not to study intersections of gender and generation. However, the analyses resulted in identifying generation as a significant power dimension intersecting with gender. The power structure of intersection between gender (parents, especially mothers) and generation (children) might be an answer to why mothers are incapable of controlling their children’s eating behavior. In 1961 Geertz, recognized mothers and children relationship within the Javanese context as a strong and secure relationship that will last a lifetime (Geertz, 1961). He continues, children do respect their mothers, however, they never address them in the formal style of speech used in the Javanese language as they address their fathers. Such generational power relations within households might be because of gendered division of labor and gendered power relation between men and women, reinforced by institutionalized national ideology of gender reflected in a nationwide organization called Dharma Wanita (Women's Dedication) considering marriage and motherhood as the final destinies for women. This hegemonic gender ideology simultaneously emphasizes women's importance and downgrades them to second-class. Thus despite being highly active in generating income and households financial managements, women lack significant real power both in the society and in their households (Kusuiarti and Tickamyer, 2012, Manderson, 1983, Mather, 1982, Sullivan, 1994).
Several methods have been suggested to explore structures and processes in which the subordination of women takes place; in a given point in time (Mitchell, 1971), within a structure that proclaims patriarchy (Walby, 1990), or how gender works within distinct societal institutions (Lorber, 1994). These approaches, nevertheless, avoid the flowing and dynamic social processes; as Connell points out that in a real life context, the different dimensions of gender constantly interweave and condition each other (Connell, 2009). Chandra Talpade Mohanty, though, critiqued the political project of western feminism for construction of the category of the “Third World women” as a homogenous and oppressed stereotype that should be saved by Western feminists in her essay, “Under Western Eyes: Feminist Scholarship and Colonial Discourses” (Mohanty, 1984). Hence, she argued that there should be a new feminist scholarship that moves away from the Western understanding of feminism, and recognizes the power relationships of the feminist discourse construction, and focuses on the micro-politics of context as well as the macro-politics of global political systems. Likewise, to understand gender on a world scale, Connell emphasizes moving the analysis beyond local arenas by adopting a relational approach (Connell, 2012). Indeed, applying the relational theory of gender was a useful tool guiding understanding of the different roles women and men play in the same context as well as their interweaving relationships of economic arrangements, emotional, and power relations and also the impact of these differences on their own and their children’s nutritional status. These gender roles and relations, values and attitudes are transitioned and repeated from one generation to the next, resulting in intergenerational power relations. Interrelationship, among the three categories and their characteristics are illustrated in Figure 24.

Figure 24. The interrelations between obesogenic environment, gendered power relations and generational relation in child overweight and obesity among households. Source: the author’s own figure
4.II. Methodological considerations

4.II.1. Strengths

The use of mixed method approach – applying both quantitative and qualitative studies – was a major strength of this body of work. The quantitative studies provided a broad picture of the detailed and complex relationships and associations between different forms of malnutrition and relevant social and contextual factors. The quantitative studies also helped to identify places and informants with highest and lowest burden of malnutrition for further explorations in the qualitative study. The qualitative study, delivered deeper insights of how changes in population’s nutritional status are occurring within households and affected by social, cultural, and institutional norm and practices. Additionally, the qualitative study not only helped the interpretation of the statistical findings, but also guided the exploration of new and unknown phenomena. Despite different definitions of ways of undertaking mixed method research (Johnson et al., 2007), applying a sequential procedure within the mixed method approach allowed the current thesis to pursue convergence of results collected by different methods to improve understanding of the research problem from different perspectives.

Another strength of this thesis was the use of both mean-centric measures of associations and measures of variance. The mean-centric measures are mainly concerned with changes in risk factors among groups and generate contradictory situation for instance by solely focusing on increasing the (mean) health of the population, while the goal should also focus in understanding and decreasing inappropriate health and healthcare inequalities (variance). Thus, the variance approach that cannot be interpreted in mean-centric terms, allows perspective to be expanded in contextual analysis (Merlo et al., 2009).

The use of multilevel analysis is also another strengths of the current thesis. Despite the fact that health and disease occur in social context, research on the determinants of health has generally been depicted by individualization of disease, for instance by explaining individual-level outcomes in terms of individual-level independent factors assuming that the causes of diseases are best conceptualized and best measured at the individual-level (Diez-Roux, 2000). Multilevel analysis allows the simultaneous examination of the effect of individual-level and group-level predictors and variations as well as the contribution of individual-level and group-level variables in explaining those variations.

Adopting the relational theory of gender proposed by Connell was also a strength allowing exploration of the structure and process of gender relation (Connell, 2012). This theoretical tool helped to better conceptualize gender as a multidimensional experience in which beliefs and practices are constantly interrelated. It also helps to better understand how the gendered power relations within households influence household nutrition and in particular the nutrition of children.
In order to increase the trustworthiness, and more specifically the credibility of the qualitative study, triangulation of researchers, peer debriefing, and prolonged engagement; techniques described by Lincoln and Guba (Lincoln and Guba, 1985) and Dahlgren et al (Dahlgren et al., 2007) were used. Firstly regarding triangulation, the research team comprised four researchers with disciplinary backgrounds in nutrition, public health, and gender studies. These different areas of expertise were used when planning the data collection and interview guide, in the process of analysis, and in the final drafting of the results in which the emerging categories with theories of gender, intersectionality, food and health were mirrored. The qualitative result is a negotiated outcome resulting from a triangulating process. Secondly, one of the researchers (NN) has prolonged engagement and deep knowledge about the Javanese society and the field assistant was a native Javanese experienced in fieldwork and qualitative studies. This was extremely beneficial in ensuring cultural sensitivity during data collection and analysis. Thirdly, peer-debriefing sessions with colleagues were undertaken in order to obtain input during the different steps within the analysis.

Unlike quantitative studies, qualitative studies are not intended to obtain statistical generalizations as they often deal with a small number of participants with the aim of in-depth study a phenomenon. Instead the sample selection in qualitative studies is carried out to achieve an analytical generalization and participants are selected in order to contribute to the theory that is being developed (Dahlgren et al., 2007). Therefore although knowledge gained from this study is not statistically generalizable to a target population from a statistical point of view, this may well be transferable beyond the study sample to other similar social contexts from a theoretical point of view.

4.11.2. Limitations

There are also some limitations that must be acknowledged. All the analyses in the quantitative part were based on the IFLS repeated cross-sectional data and therefore our ability to make inference regarding causation or changes within individual is limited. For instance, we cannot fully determine the weight changes within an individual over time. However, because the main aim was to examine the changes at the population level, repeated cross-sectional data allowed us to make inferences at the population level or for segments of the population.

In addition, the dietary pattern of households or the physical activity level of individuals were not included into the analysis, which might better explain the variation in BMI in the quantitative data analysis. Although these factors were addressed in the qualitative part of the thesis, modelling the association between physical activity and elevated BMI would have required a complex feedback mechanism that was beyond the scope of this thesis. For instance, obesity-related mechanical dysfunctions such as joint pain or reduced range of motions, and medical co-morbidities make physical activity more difficult. In addition,
obesity-related psychological dysfunctions, such as depression, anxiety or binge eating correlated with low socioeconomic status and poor diet, are barriers to a healthy lifestyle. These multifactorial effects were modelled as “the runaway weight gain train” which could trigger a vicious self-reinforcing cycle of even more weight gain (Swinburn and Egger, 2004). Such complex feedback mechanisms was supported by a recent Mendelian randomization study, which demonstrated that elevated BMI can result in lower physical activity (Richmond et al., 2014). This finding, however, does not exclude lower physical activity that can also lead to increased adiposity among children, i.e., bidirectional causation.

The global epidemic of overweight and obesity is rapidly becoming a major public health concern. The WHO has long ago sought to provide guidance on the appropriate use of interpretation of anthropometric indices throughout the individuals’ life cycle for assessing health, nutrition, and social and economic circumstances of populations (WHO, 1986, Jelliffe, 1966, Waterlow et al., 1977, WHO, 1976). As an external measurement of the human body and recommended by a WHO Expert Committee, anthropometry is “the single most portable, universally applicable, inexpensive, and noninvasive method available to assess the proportions, size, and composition of the human body”. It reflects both health and nutrition and predicts performance, health and survival. For that reason it is used for selecting individuals and populations for health and nutrition interventions as well as for monitoring their health and nutrition (De Onis and Habicht, 1996). It should be mentioned that there are limitations in using BMI to identify body fat and obesity; yet it is the most widely used indicator of nutritional status and the only one for which comparable data are usually available (Must and Anderson, 2006, WHO, 2000).

The other limitation of this thesis could be the arbitrary categorization of double burden households. For example, households with only one overweight or underweight members were categorized overweight or underweight households if the other members were of normal weight. The number of overweight or underweight individuals in a household was not counted, therefore heterogeneity exists between certain weight groups within households. For example a household with one overweight, one normal weight, and three underweight individuals was considered to be a double burden household at the same time as a household with three overweight, one normal weight, and one underweight individuals. In addition, double burden households were contrasted against all the other households together. Applying multinomial regression analysis could have been one way to address this issue. However, the findings in this thesis were consistent with similar study in Indonesia (Roemling and Qaim, 2013) that also compared double burden households with all the other types of households separately.

Due to practical issues it was not possible to fully control the process of sampling of informants in the qualitative study, and it was left to community leaders to randomly select and invite household members with different socioeconomic backgrounds from different
parts of the villages. In addition, in some of the focus groups the majority of the participants were from the same organization (i.e. village hall) or neighborhood, and this may have influenced their willingness to openly share their thoughts and experiences. However, as we conducted several FGDs in different settings, among many different men and women from different backgrounds, it is unlikely that our findings are projecting the view of a very specific group of the individuals. In addition, the design of the FGD study still provided opportunities for emergent ideas from one discussion to be further elaborated and carried forward in subsequent discussions.

The fact that MV did not have a prolonged engagement in the Javanese society and does not speak the language, and therefore did not moderate the FGDs, could be considered a limitation of the study. However the field assistant was trained and competent in moderating the discussions. The field assistant was also fully informed and aware of the purpose of the study and took an active role in the summary discussions directly after each FGD session. However, despite this drawback, the combination of an “insiders perspective” (permit access, cultural sensitivity and understanding) and an “outsiders perspective” in the research team (detect patterns that may be hidden by the blinder of familiarity) can be regarded as a productive factor for the different steps of analysis.
5. CONCLUSION

This body of works describes the social and contextual distribution of malnutrition in Indonesia. Specifically the study investigates and explains increases and variation in BMI at the population level, across different socioeconomic groups, in different contexts and among households, and further explores how gender relations within the household can impact on childhood nutritional status.

At the population level, greater increases in within-group dispersion compared with between-group differences imply that growing inequalities in BMI were not merely driven by socioeconomic factors; other under-recognized social and contextual factors may have greater effect on the variation in BMI.

At the contextual level, households were identified as an important social context in which the variation of BMI increased over time. Recognition of this increased variation is important for laying out strategies that respond to the differential needs of individuals within the same household.

At the household level, women empowerment and community social capital reduced inequalities in the double burden of malnutrition across different socioeconomic groups. And finally, gendered power relations within the household and its intersection with generational relations coupled with an emerging obesogenic environment were main contributors to overweight and obesity in Indonesian children.
5.1. Future Directions

Future studies using the longitudinal IFLS data are needed to identify who in BMI distribution groups is gaining weight and to aid further exploration of under-recognized characteristics of population-level weight change in and across different age groups. This helps to capture the long arc of weight gain that starts during adolescence and carries over into late middle age. The impact of such research on the “population approach” to obesity prevention is an important question that requires further investigation.

To help guide the investment of limited public health resources, much more work is needed to demonstrate and to evaluate the role of social contexts on the variation of BMI by targeting specific age groups and also by examining the double burden of malnutrition across the life course. Otherwise, implementation of misguided policies and interventions in contexts that may not have a significant effect on reducing health risk and promoting population health outcomes will always be a risk.

Gender empowerment can only happen if the context allow and gender relations are restructured and disputed in a variety of institutional arenas. Thus, community social capital should be encouraged and community health and nutrition programs should adopt more gender sensitive interventions and help both men and women to acknowledge and respect women’s status by raising awareness, promoting discourses and providing educations, and more importantly to hold men also accountable for children’s nutritional habits. Therefore, gender empowerment can be shaped by constant participation of household members in constructing new gender norms.

Finally, in Indonesia much work has been done to reduce stunting and wasting among children. However, less attention has been paid to the public health problem of overweight and obesity in adolescents and children. It is increasingly crucial to recognize the implication of the availability and accessibility of junk foods especially among school-aged children in Indonesia. Schools have a very important role in preventing obesity by providing more nutritious food, offering greater opportunities for physical activity, and providing obesity-related health services. The circumstances in which people live are often beyond their control. Therefore, multisectoral and multilevel contributions are vital to tackle double burden of malnutrition ranging from setting up national level policies to controlling the food system and creating supportive and healthy communities as well as encouraging all individuals within households to change their nutritional/dietary behaviours.
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APPENDIXES

Appendix 1. Questions for the Focus Group Discussion

Question (1) OVERWEIGHT AND UNDERWEIGHT

- **Engagement questions:**
  What is the typical food in this area?
  Imagine a household like this (a picture showing an overweight mother and a skinny child), what do you think about that?

- **Exploration questions, followed by emergent design:**
  What could contribute to such a problem?
  Is there any social and cultural factors influencing the nutrition and physical activities of different age/gender groups?

- **Exit question:**
  Is there anything else you would like to say about households with both overweight and underweight members and the related factors?

Question (2) WOMEN- AND MEN-HEADED HOUSEHOLDS

- **Engagement questions:**
  What do you think about or how do you define the head of a household?
  Does it have to be a man or a woman? And what are the benefits or drawbacks of having man or women as the head of a household?

- **Exploration questions:**
  Is there any difference in households' health, food allocation, distribution of the resources, decision-making, etc. if the head is a man or a woman and why?
  What could be done and how to promote equality between men and women in regards to issues discussed previously?

- **Exit question:**
  Is there anything else you would like to add regarding the head of a household?

Question (3) SOCIAL CAPITAL

- **Engagement questions:**
  Are there any group activities in your neighbourhood/community?
  What do they do in these group activities and do people trust them?

- **Exploring questions:**
  What do you think about involvement into these activities and are you involved in any?
  Could you please give a list of these activities?
  Who do you think is more involved into these activities, men, women, rich people, poor people, etc.?

- **Exit question:**
  Is there anything you would like to add regarding these activities?
Appendix 2. Illustration of the analysis process

<table>
<thead>
<tr>
<th>Text</th>
<th>Open codes</th>
<th>Clusters</th>
<th>Categories</th>
</tr>
</thead>
</table>
| From Javanese culture, from our religion stating that male is an imam (leader). A male is a leader, we as women are companions. If something is wrong, we remind him, we talk to him. Still it is the man who leads. | Household head is a man  
Culture and religion consider men as leader  
Men lead the household  
Women are companion for men | Being head of a household |                                    |
| The first one is make a living, educate wife-children, keep family's dignity, keep communication and socialization with neighbours and relatives. A wife is also a household leader. She keeps her husband's wealth. If a husband is not at home, she can be his representative. However, all of these responsibilities are at husbands. Yet a wife also plays some roles. If the pilot is not good, the house will be broken. I ever saw a successful religious leader. His wife said that we would see if I gave the children to him. When he needed to write his speech, his children would disturb so he couldn’t do his job. On the following day, he could not deliver his speech. That is the role of a wife. She is not a household leader but she is great. Once the religious leader’s wife tells him to take care of their children, and the wife delegates just one of her small roles, he won’t be successful on the eyes of the community. So, a wife’s support is amazing | Men should make a living  
Men should educate wife and children  
Men should keep family’s dignity  
Men should keep communication and socialization with neighbors and relatives  
Wives keep husbands wealth  
Men wouldn’t be successful without their wives support  
Wives support is amazing | Being a companion for men | Gendered power relations |
| Our main food is rice and side dish can be tiwul (local food made of cassava), vegetables (cassava leaves, kangkong leaves, spinach), tofu and tempeh at daily basis. Based on my observation, there are things triggering overweight such as instant noodle such as Indomie, Supermi, etc. The consumption rate is high. My younger child loves to eat instant noodle a lot, any brand that we can find. There is a concern but it is not much. We are trying our best to switch into better menu, but if we are not busy and our kids want to eat other meals but instant noodle, we have no choice | Main food is rice, cassava, and vegetables  
Daily foods are tofu and tempeh  
Meet is eaten only on certain occasions  
High consumption of instant noodle triggers overweight  
Younger child have the same weight as older because of too much instant noodle  
Too busy to have healthy foods  
Children love to eat noodles and we have no choice | Changing Food patterns and eating habits | Obesogenic environment |
| He/She does not like to eat and prefers cold beverages. I heard that cold drinks caused fat. But it is not. You know that you cannot forbid your children to buy food at their schools. Nowadays, at schools, that kind of food (junk foods) is what children have for their snacks. No fried cassava anymore no fried banana anymore. That’s why I said that I'm very concerned about present children development. | Can not forbid children buying food at school  
Availability of junk foods at schools  
Being concern about children development | Schools, and Street sellers |                                    |
| Yes, we practice what we’ve got in Posyandu such as not eating food with too much preservative because it can cause problem at our tonsils. Sometimes we remember to practice but most of the time we forget. When our children ask for snacks and if we don’t buy the snacks for them, they can get upset. We don’t want them to be upset so we prefer giving them what they want | Food advices (preservatives) are practiced at home  
Preservatives are bad for health  
Children get upset if they are not provided by snacks  
Children get (snacks) whatever they want | Feeding children | Generational relations |
| In my family, we put our children first because they are still young. When they are grown up already, perhaps the priority will turn into the father. It does not go to the mother because generally in our traditional community, a wife will put her husband first. They take the second turn. | Young children has priority if food is limited  
When children are grown up priority goes to father  
Women take the second turn | Gender order and women’s status |                                    |

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