Poverty as an Individual Welfare

A quantitative study on the relationship between household poverty and individual poverty

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Abstract

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Household wealth is the gold standard of measuring poverty, however, poor individuals are not necessarily found in poor households. If household wealth is used in a context where the household members are not equally poor, poverty statistics measured on a household level might be wrong. This research aims to test the proposition 'poor individuals are mainly found in poor households'. The relationship between household wealth and individual poverty is studied using nutritional status as a proxy for individual poverty. The data is sourced from the National Institute for Population Research and Training and consists of a demographic health survey of Bangladesh, covering 17141 households. The analysis is performed through a chi-square test and correlation test. The result of the analysis shows that, of the people with individual poverty, 58% of females, 52.2% of males and 46-53 % of children are living in a household of the poorest 40% hence, the proposition holds. Using household wealth to find individual poverty is successful in so much as finding the majority of the population with individual poverty. However, since close to half of the group of people with individual poverty is not found in a poor household, using household wealth to find poor individuals would result in reduced uptake of the total share of individuals in poverty.

Keywords; Individual Poverty, Wealth Index, Body Mass Index, Stunting, Wasting

Introduction

A household measure of wealth has been the gold standard of measuring poverty. Research shows that the economically poorest households show a higher prevalence of various indicators of poverty. Poverty can be defined as more than monetary income. Poverty can also be defined as lack of social and human capital such as low participation in decision-making, limited access to basic services, social discrimination and exclusion, hunger and malnutrition (United Nation, 2019) It is argued that hunger and malnutrition is closely related to economic poverty. Poverty is known to be one of the main factors behind food insecurity and malnutrition, and food insecurity and malnutrition are common factors behind falling into poverty or increasing poverty if one is already poor (FAO et.al., 2019) A strand of research has shown the wealth effect on nutrition is large and poor household show a higher prevalence of hunger than non-poor households (FAO et.al.,2019; WHO, 2020; Wagstaff and Watanbe, 2000; Bredenkamp, Buisman and Van de Poel, 2014; Ravallion, 1992). It has been hypothesised that household wealth is a good predictor of individual poverty and development practitioners have therefore been using household wealth as the standard predictor of vulnerable individuals in various development programs (Coady et al., 2004; Del Ninno and Mills, 2015). Nevertheless, another strand of research has shown the contrary. Some researchers are recognising poverty as an individual welfare and have been researching poverty on an individual level rather than on a household level. They have shown that the wealth effect on nutrition is limited, undernourished individuals are not necessarily found in poor households moreover that members of a household are not necessarily equally poor as another (Behrman and B. Deoalikar, 1987; Brown, Ravallion and Walle,2017; De Vreyer and Lambert, 2016; Sahn and Younger, 2009), consequently arguing the hypothesis that household wealth is a good predictor of individual poverty, to be false. Several researchers argue that supporters of the hypothesis of household wealth as a good predictor of individual poverty, make three implicit assumptions 1) poor individuals are mainly found in poor households, 2) household wealth is a reliable indicator on individual poverty, and 3) resources are shared equally within households. This idea was made explicitly by Sahn and Younger although other

researchers have followed the idea (Brown, Ravallion and Walle, 2017; Sahn and Younger, 2009).

An individual is not necessarily as poor as the household measure and if members of a household are not equally poor, a household measure of poverty is a generalised measure. If a development program aims to identify poor individuals and the majority is found in the poorest household, targeting the poorest households will cover the majority of poor individuals. If, however, the majority of poor individuals are spread over the majority of the wealth groups, a targeting intervention will only cover some poor individuals and others are excluded even though they are also poor. Moreover, if this is the reality, and you measure poverty on a household level, you are at risk of miscalculating the level of poverty. When the household composition is complex and large, for example, in inter-generational household or where polygamy is practised, a household measure is a simplified measure of the poverty the household members are experiencing (De Vreyer and Lambert, 2016).

Hunger has been declining over the past decades but is now rising again. The latest measure shows the staggering numbers of 820 million people with hunger (FAO et.al., 2019). Due to the high prevalence of hunger and the development agenda, the research on hunger is immense. However, current research on hunger and economic poverty is primarily on a household level, and the research on the individual level is smaller and mainly on the African continent. Research in other areas is obtained but is limited. Of all hunger in the world, Asia accounts for close to two thirds. The prevalence of undernourishment (PoU) has been steadily increasing in almost all regions in Asia and Southern Asia has the highest prevalence of undernourishment in Asia (FAO et.al., 2019). Bangladesh is a highly and densely populated country in South Asia with 168.1 million peoples, and with a high prevalence of poverty and hunger. Close to a quarter of the population is still living in poverty and the share of the population in multidimensional poverty is 41.7% (UNDP, 2019). In 2016, the country had a prevalence of undernutrition of 14.7%, individuals living in moderate or severe food insecurity is 30.5%, and children under the age of 5 suffering from stunting was 36.2% (FAO et.al., 2019). Moreover, the country has a complex

household composition making household measures of poverty more complicated. There is an empirical gap in the geographical part of the analysis of the relationship between household wealth and individual poverty in terms of hunger. The purpose of this study is to broaden the geographical area of research on individual poverty, using individual nutrition status instead of household wealth to identify poor individuals. Contributing to the understanding of the relationship between household poverty and individual poverty empirically in Bangladesh is important for at least two reasons. First of all, by expanding the geography of the studies on household poverty and individual poverty in terms of hunger, this study will add to the discussion of the concepts of individual poverty in general terms. From greater knowledge of the relationship between household poverty and individual poverty, we can ask questions of how much influence geography has on concepts of individual poverty, the explanations behind the relationship and if individual targeting is morally good or better than targeting households when implementing anti-poverty programs. Secondly, given the pervasive hunger in Bangladesh, contributing to the understanding of the relationship between household poverty and individual hunger is valuable specifically in the discussion on how to find vulnerable individuals and to design effective anti-hunger programs in the country.

Research aim

This study aims to further contribute to our understanding of the relationship between household wealth and individual poverty. This study aims to test the traditionally held hypothesis; household wealth is a good predictor of individual poverty, which is argued to be based on three implicit premises;

1) poor individuals are mainly found in poor households
2) household poverty is a reliable indicator of individual poverty, and
3) resources are shared equally within households.

This study is concerned with the first premise. The premise will be tested using nutritional status as a proxy for individual poverty. This study aims, more specifically, to investigate the relationship between individuals nutritional status and household wealth. Unlike explanatory research that is designed to answer *why* a relationship between variables is observed, this study is

descriptive and exploratory. This study is designed to propose an answer to the ontological dimension of the relationship, ie. to *what* the relationship is (Bryman 2012, p.9) between various household wealth and individual nutritional status. Descriptive research is by some dismissed as a simple description of data. However, a good description of data is fundamental to research as descriptive research is contributing to our understanding of the shapes and nature of our society (De Vaus, 2011).

Disposition

The remaining part of this study is organised as follows: the next coming section is the literature review of which will be a presentation and discussion of previous research on the relationship between hunger on an individual level and on household poverty. The literature is followed by background with a presentation of the geographical context of Bangladesh, its characteristics and previous studies on the topic specifically in Bangladesh. Afterwards, the theory is made explicit, followed by methods and material and later methodology further setting the stage for the analysis. The result of the analysis is presented and discussed and the paper ends with a conclusion.

Literature Review

Household wealth has previously been used, and to this day is used, to tell us something about the relationship between hunger and economic inequality. What follows is a discussion of the major differences between previous research and their arguments for and against such a relationship.

The large economic effect on nutrition

It is well known that household wealth is correlating with various forms of malnutrition and poorer households show a higher prevalence of malnutrition, (FAO et.al., 2019; WHO, 2020). Researchers investigating the wealth effect on nutritional status have observed high responsiveness. One research on undernutrition and household wealth in Indonesia, using caloric

intake to measure undernutrition found that an increase in average household income has a positive effect on nutrition. Meaning, if your wealth increases, an increase in nutritional status will follow. This was true only if inequality does not increase and food staple prices remain stable (Ravallion 1990, 1992). Research on child malnutrition in the developing world using household consumption to measure living standards, wasting, stunting and underweight found that inequalities in malnutrition almost always disfavour the poor, both between countries and within countries. Moreover, the poorer households have a higher rate of malnutrition and malnutrition decreases with increasing living standards, however, not always monotonically (Wagstaff and Watanbe, 2000). Another study on child malnutrition, this one between 1990-2011 in 80 countries but mainly Africa was showing similar results. They researched inequalities between poorest and richest in stunting and underweight. They found that the prevalence of stunting and underweight was concentrated among the poor, majority of the countries had persistent inequalities, and countries with a higher prevalence of stunting and underweight in children have larger socioeconomic inequalities in stunting and underweight (Bredenkamp et al., 2014).

The limited economic effect on nutrition

Other research provides evidence for the contrary, that the wealth effect on nutritional status is limited. One early study in South India is arguing against the large wealth effect on nutrition status and provides evidence that an increase in income will not result in improvements in nutrient intakes (Behrman and B. Deoalikar, 1987). Another research was investigating how to find nutrition vulnerable individuals in sub-Saharan Africa using nutritional status as a proxy for individual poverty. They found that 75% of underweight women and undernourished children are not found in the poorest 20% households, and 50% was not found in the poorest 40% households. Moreover, they found that the probability of being an underweight woman and living in the poorest quintile was 3%. Moreover, countries with a high incidence of undernutrition tend to show a larger share of undernourished individuals in non-poor households (Brown, Ravallion and Walle, 2017). Another study in Senegal on poverty and inequality on a national level and within households, found that 15% of all inequality was found within

households, and 12.5% of poor individuals are living in non-poor households. Moreover, they estimate that by targeting poor households, over poor cells, 13-18% of the poor children would be missed in a program aiming to reduce child poverty. They further argue that due to the large and complex family structure such as polygamy and intergenerational households in the country, as well as in other sub-Saharan African countries, it is of great importance to reach a close measure of individual welfare when measuring poverty to obtain an adequate measure of poverty (De Vreyer and Lambert, 2016). There is another research on the relationship between inequality and wellbeing, in various less developed countries, mainly in Africa and South America and a few countries from the Middle East and Asia. They used BMI scores rather than income as an indicator of wellbeing, comparing inequality and wellbeing on the inter-country level and intra-household level. They found intra-household inequality to be increasing with higher household wellbeing. Moreover, they found close to 50% of inequality in BMI scores at the national level was found within households (Sahn and Younger 2009).

Overweight and obesity

Hunger is once again increasing in the world, and so is obesity (FAO et.al., 2019). Socioeconomic inequality does not always make people thinner due to lack of food. Socioeconomic inequality can also lead to obesity as prices on nutritious food become inaccessible for poor individuals and they resort to cheap food of which tends to be energy-dense and low in nutrients (FAO et.al., 2019) One systematic review of obesity, found that in low-income countries an increase in wealth tends to correlate with an increase in obesity and this was true for both males and females. However, this cannot be said for middle-income countries where the association between obesity and wealth shows mixed results for males, and female obesity decreases with wealth (Dinsa, Goryakin, Fumagalli and Suhrcke, 2012). Moreover, in high-income countries overweight and obesity is more common in the lower socioeconomic population for females, however, this association is not found for males (Newton, Braithwaite and Akinyemiju, 2017).

Simple Schedule of the Literature

Income Effect	Year	Authors	Geography	Data	Population	Method	Methodology	Unit of Analysis	Indicator of Hunger	Indicator of Wealth
Limited										
	2017	Brown, Ravallion, Walle	Sub Saharan Africa	DHS, LSMS	Females, Children	Quant	Conditional Probabilities	Household vs. Individual	BMI; Stunting and Wasting;	Household Wealth
	2016	Vreyer, Lambert	Senegal	Household Survey	All household members	Quant.	Theil Index	Household vs. Individual	Individual food consumption	Household consumption
	2009	Sahn, Younger	Mainly Africa, South America	LSMS; DHS	All household members	Quant.	Theil Index, Kuznets Curve	Household vs. Individual vs. Inequality	BMI;	-
	1987	Behrman, Deolalikar	South India	Household Survey	Females, Males	Quanti.	Elasticity Estimates	Household vs. Individual	Food and nutrient expenditure	Income/ consumption
Large	2020	Who.int								
	2019	FAO et.al.								
	2014	Bredenkamp et al.	Mainly Africa	DHS	Children	Quant.	Corrected Concentration Index	Wealth Quintiles	Stunting, Underweight	Wealth Index
	2000	Wagstaff, Watanbe	Developing Countries	DHS	Children	Quant.	Achievement Index	Household	Underweight, Stunting, Wasting,	Household consume.
	1992	Ravallion	Indonesia	Household Survey	Do not specify	Quant	Dominance Test	Individual	Caloric intake	-

Insights from the literature

The majority of the researchers arguing for a limited wealth effect have all used individuals as the unit of analysis, as it is argued that it is not possible to measure individual poverty if the household is used as a unit of analysis or using population averages. Another discrepancy is the geography. The research using the individual as the unit of analysis is to a great extent conducted in Africa, to a lesser extent in South America and sparsely in Asia. Using Demographic Health Survey (DHS) as a data source is common in the study of wealth effects on nutrition, and this is not unexpected since many developing countries conduct DHS and share their data for research upon requests. Most DHS have also included indicators of hunger such as BMI, stunting, wasting, and underweight as well as estimated wealth index. For specific nutrient, caloric, and monetary consumption measurements, a smaller household survey has been the major data source. However, the sample size has been vastly different from using DHS. DHS is commonly covering whole countries, and the data sample is stratified according to geography, demographics and socioeconomic variables and thereby increasing the reliability of research and generalisation to the grand population. The methodology for measuring the wealth effect on nutrition are varying, and no pattern can be found to argue that one or another methodology

tends to generate any biased results due to methodology, other than the use of individual versus household as a unit of analysis.

Background

Geographical context

Bangladesh is a country in Southern Asia with the Ganges-Brahmaputra delta in the south, and India is surrounding its border except for a minor stretch in south-east bordering Myanmar. The culture of Bangladesh is influenced by the broader civilizational history of the Indian subcontinent. Bangladesh inhabits 168.1 million people, placing eight of the worlds most populated countries, in addition, Bangladesh is one of the world's most densely populated countries (UNDP Bangladesh, n.d.). In 2017 Bangladesh had a Gross Domestic Product (GDP) of 3879 (2011 US Dollar PPP) per capita, and from 2018 the country is considered a lower-middle-income country with a Human Development Index (HDI) score of 0.608 and placing at 136 of 189 countries. However, Bangladesh has a Gini index of 32.4, close to a quarter of the population is still living in poverty and the share of population in multidimensional poverty is 41.7%. Moreover, 21% of the national income is held by the poorest 40% of the country, and the richest 10% holds 26.8 % of the national income (UNDP 2019). Although considerable improvements over the years, the country is still troubled with poverty and inequality (UNDP Bangladesh, n.d.)

Household composition

A household in Bangladesh can come in different shapes and sizes. While polygamy is legal in the Muslim family laws ordinance (Ordinance NO. VIII Of 1961), it is only practised marginally, The exact percentage of polygamous marriages is not available to the public (RDP and BBS, 2018). A household in Bangladesh has on average 4.5 individuals. Households that have at least one individual below the age of 20 is 86%, and at least one individual over the age of 65 is 22%. Households with at least one individual below 20 and at least one over 65 is 17%, and female-headed households are 12.5%. (United Nations, 2019). Furthermore, individuals within a

household may move for various reasons, for example seasonal work, further complicating the measurement of the household composition. With a complex family structure such as polygamy and intergenerational households, it is of great importance to reach a close measure of individual welfare when measuring poverty to obtain an adequate measure of poverty (De Vreyer and Lambert, 2016).

Studies of Bangladesh

There is a study on the relationship between household wealth, individual welfare and inequality in rural Bangladesh. The study was looking at male-headed households in which the spouses are present using Bangladesh Integrated Household Survey (BIHS) of which is a smaller survey than the DHS. They also used nutrient and energy requirements to measure nutritional status levels for individuals and households and those who do not meet the requirements are considered undernourished. They found that male are consuming more and are less undernourished than females in the same household. The researchers emphasized the role of measurement in nutrients and calories as the data varies depending on who is recalling the numbers. Moreover, the definition of the household, as well as menu lists and recall period, produce different results (D'Souza and Tandon, 2019). This evidence of intra-household inequality points to uneven distribution of welfare within households and why households as a unit of analysis can mask individual poverty. A study on socioeconomic inequalities and dietary consumption changes between 1985 and 2010 used consumption patterns and could reveal that diets of the poorest quintile did not change although the purchasing power of the poorest quintiles did change. The national increase in poultry and beef was increasing and was restricted to the richer quintiles and did not increase in the poorest quintile. Furthermore, the researchers point out that the research did not study the distribution differences in the household due to lack of data (Waid et. al., 2018). Although this study looked at dietary changes and therefore nutrient intakes can be estimated, individual food requirements were not controlled for. Another study found that males were consuming more relative to women which reflects males' energy-intensive activities and not less poverty among males (Pitt, Rosenzweig and Hassan 1990). However, a metastudy on low- and middle-income countries of calorie intake show no intra-household inequality.

Although previous research has been done on nutrition inequalities and socioeconomic inequalities researchers have been using expenditure to measure inequality in the nutrition of which, as explained above, is in the large risk of measurement error. In addition, expenditure does not account for individual energy requirements and therefore discussing inequality in welfare in nutrition is problematic. This is further discussed in the material section of this paper and why alternative indicators of nutritional status is preferred.

Research on 0-5-year-olds nutritional status and socioeconomic inequalities have had considerable more attention. There is a large body of research on stunting, wasting and socioeconomic inequalities from around the globe including Bangladesh. One cross-sectional study 2007/2011 found children in the poorest household suffered more from undernutrition than children from the wealthiest households, and inequality was worse in rural areas (Pulok, Sabah, and Enemark, 2015) Another study on child malnutrition and wealth inequalities in the survey year of 2004 found that children in the poorest 20% were more than three times as likely to suffer from malnutrition than the wealthiest 20% (Hong, Banta and Betancourt, 2006). Another study on the survey year of 2014 found similar results, where children in poor households were four times as likely to be undernourished than children in wealthier households and the researchers was concluding poverty to be a significant predictor of stunting (Behowmik, Das 2017) The mentioned studies on child malnutrition and socioeconomic inequality did not include females and males. For comparison between adults and children and socioeconomic inequalities, moreover to test the hypothesis household poverty is a good indicator of individual poverty, also for children, children's nutritional status in relationship to household wealth is included in this study.

Theoretical Framework

Positivist/ post positivist worldview

The philosophical worldview, or the basic set of beliefs, that will guide this study is originating from a positivist/post positivist worldview. Such a worldview is deterministic meaning reality is

believed to be material and is ruled by cause and effect. Moreover, it is also reductionist in so much that ideas are reduced to a set of objects that is possible to test, further forming a hypothesis or research question. The acquired knowledge comes from careful observation and measurements of the material world. The theories that shape and form our society ought to be tested, verified and refined. The scientific method is in the core of the research where theory is tested against data and the theory is supported or refuted and thereafter revised and tested again against data. (Creswell, 2014)[1]

Human development approach

The human development approach is considered to be an alternative approach to development and is focused on building human capabilities (Potter, Binns, Elliott and Smith, 2008). This approach argues that, among other things, increasing human well-being and providing basic needs are some of the key drivers of development. In economics, poverty is classically measured in monetary terms on a household level. A human development approach will define poverty as more than a lack of economic capital (Potter, Binns, Elliott and Smith, 2008). Poverty can too be defined as lack of social capital and human capital such as low participation in decision-making, limited access to basic services, social discrimination and exclusion, hunger and malnutrition (United Nation, 2019). Poverty is traditionally measured on household level and large scale data on individual poverty is costly and rarely collected. The hunger and malnutrition dimension of poverty is however included in many developing countries DHS and living standards measurement study (LSMS). By using hunger as a proxy for individual poverty, the individual aspect of poverty can be studied. This has been done by researchers, however, the places of the research are limited, which brings us to the geographical approach of this study.

Geographical approach

Studies on individual poverty and differences between individuals hunger are mainly conducted in African countries, meaning the discourse is mainly of the African continent and with smaller

[1] This e-book contains no page numbers.

inputs of other places. People and communities are diverse and ever-changing entities and so are peoples and communities' needs and their poverty (Potter, Binns, Elliott and Smith, 2008). Researching mainly one geographical place is producing a discourse of mainly one place. By expanding and diversifying the geographical context to a different place, in this case, Bangladesh, with different people and communities may produce research with different results. Findings from other geographical regions may tweak the discourse of individual poverty and individual differences in hunger or support a general theory of individual poverty.

Geography of malnutrition

Geography is an interdisciplinary approach studying complex interaction and multiscalar issues. Nutritional geography can be defined as research using geographic frameworks or methods that examine issues of nutrition, regardless of discipline. Geography of malnutrition is specifically concerned with the negative outcomes of poor nutrition and the causes of poor nutrition (Beal and Ervin, 2017). Poverty, food security and nutrition does not move in unison. Poverty is both a determinant and an outcome of food insecurity and malnutrition (FAO et.al., 2019). Poverty is known to be one of the main factors behind food insecurity and malnutrition, and food insecurity and malnutrition are common factors behind falling into poverty or increasing poverty if one is already poor (FAO et.al., 2019). A geographical approach can aid our understanding of the complex interaction of poverty and hunger and understanding hunger on different geographical scales, such as country level, household level and individual level, as well as horizontally such as interpersonal differences in hunger within a socioeconomic group or household. If the geography is ignored, people and communities are at risk of being portrayed as homogeneous when in fact people's and communities' needs are diverse (Potter, Binns, Elliott and Smith, 2008).

Methods and Material

Research design

With post positivist assumptions, the research design takes the form of a quantitative design. This research is nonexperimental and has the form of a correlation design. A correlation design

allows for the use of correlation statistics to describe and measure if and to what extent there is a relationship between individual poverty and household poverty (Creswell, 2014). This study is descriptive and exploratory and the objective is to describe the relationship between household wealth and individual poverty using a set of variables in a novel context. With a theory-testing approach, normally held propositions on the relationship between household wealth and individual poverty can be tested (Creswell, 2014). The data used in this study is originating from a survey which takes a quantitative form.

Material

Data source

The material used in this research is collected by the National Institute of Population Research and Training (NIPORT) by the DHS Program (NIPORT, 2005, 2009, 2013, 2016) and consists of several DHS from various years of Bangladesh. The types of datasets generated for each survey vary by survey design. All DHS data is distributed in several separate datasets, called recode files, of which are households (HR), household members (PR), women's (IR), births (BR), children under five (KR), men's (MR), and couples (CR) files. The only survey year which includes nutritional status for males, as well as females, is DHS VII and this survey was collected 2011. This research will use the DHS VII because it includes the required variables and the households (PR) file because it contains the largest population sample for males and females.

Data quality

Official statistical data from government departments are, for the most cases, of high-quality data. This type of data is provided without costs which saves time and funding in comparison to collecting own data. The most important limitation of using statistics collected by others is the lack of familiarity with the data when working with and analyzing the data. Nuances and structures may go missing, nevertheless, it is feasible to learn more of the data by studying how the data has been collected and how the variables have been coded. (Bryman, 2012). The metadata that describes data design, sampling, errors, and estimations of quality and more of the dataset is available. The metadata is not only aiding the researcher to gain familiarity with the

data but also to scrutinise and reveal biases in the data. Another limitation is the volume and complexity of the data sets of which can problematise the handling of the data. (Bryman, 2012). Regarding the source of the data sets, although the data is most likely of high-quality, due to the size of the data it may include guess-work and other inadequate measures, meaning all data may not be an exact representation but rather a calculated estimation (Klocke, 14 Nov 2019). Moreover, government official data may also be subjects of manipulation to persuade the public of improved conditions (Klocke, 14 Nov 2019). The problems of manipulations will be taken into consideration and any findings of estimated/ missing data or false data will be disclosed. Moreover, this data is accessible by request, and other researchers have previously used the data for analysis, however, it is uncommon for data sets to be exhausted of new findings (Bryman, 2012).

Variables

Nutritional status

Poverty is classically measured in monetary terms on a household level. When poverty is defined as more than in monetary terms as in the Human Development Approach, at least one poverty dimension on an individual level is available in most DHS surveys and that is nutritional status. Nutritional status is an indicator of hunger. However, hunger is conceptualised and measured in various ways. FAO defines hunger as lack of dietary energy, and the main indicator of hunger is the prevalence of undernutrition (PoU). PoU is calculated using aggregated country-level data on food that is available for human consumption, and to a lesser extent from data on food consumption collected through surveys. Furthermore, daily dietary energy consumption, dietary energy needs, and the proportion of population lacking adequate dietary energy consumption are estimated from the average population. (FAO et.al., 2018). Food insecurity experience scale (FIES) is an alternative method to measure hunger by the FAO emphasising the subjective experience of food insecurity. Moreover, development practitioners have also used the Body Mass Index (BMI) to measure the prevalence of hunger, and many DHS surveys in developing countries include BMI as a variable. Previous researchers have used BMI as a way to study

poverty on an individual level (Sahn and Younger, 2009; Brown, Ravallion and Walle 2017). This study will use BMI to measure nutritional status.

BMI, also known as the Quetelet Index, is a measure of acute nutritional status. It is based on the Fogarty Metropolitan Life tables of ideal weight for height. BMI as a measure of hunger is prefered for following reasons: anthropometric data is collected in many household surveys, researchers have used BMI due to its ability to measure well-being on an individual level rather than the household level, BMI can be standardized, it reflects command over food, it reflects health status, it accounts for dietary energy consumption relative to needs, anthropometric variables data is easy to measure, and measurement error is likely to be random (Sahn and Younger, 2009; FAO et.al., 2018) in comparison to calorie or nutrient recall that holds the risk of false reporting as previously discussed in studies of Bangladesh (D'Souza and Tandon 2019). However, there are a few problems with the use of BMI. First, BMI only captures one dimension of hunger ie. dietary energy consumption and expenditure and not micronutrient deficiencies and is therefore not a measure of malnutrition. Moreover, the use of BMI has utility limitations, higher BMI does not always mean higher well-being (Sahn and Younger, 2009). Lastly, BMI may not hold in a context where the household wealth is higher and where individuals have the luxury to make calculated decisions to deprive themselves to live up to beauty standards. Nevertheless, BMI can still be an adequate measure of at least one dimension of hunger. BMI still measures dietary energy consumption relative to needs and resources allocation within households relative to needs, which suit the purpose of this research. Moreover, BMI is an indicator which satisfies two out of the three main reasons for measuring a concept (Bryman 2012). First, BMI allows for a consistent device to be used over time and by other researchers since data on height and weight is commonly gathered in most DHS and population consensus and is easy to measure. As researchers on the topic of individual poverty have previously used BMI (Sahn and Younger, 2009; Brown, Ravallion and Walle 2017), using BMI in this research will be consistent with previous research on individual poverty. Secondly, BMI allows for statistical analysis with more precise estimates of the degree of relationship between concepts (Bryman 2012, p.164), in this case between individual nutritional status and household wealth. In conclusion, BMI makes a good indicator of nutritional status and thereby of individual poverty

which allows for testing the hypothesis household wealth is a good indicator of individual poverty.

BMI is calculated as weight in kilograms divided by the square of height in meters, BMI = kg/m^2. The denominator is the number of men or women aged 15–49 with a valid BMI of which is considered to be between 12-60. BMI by category, are equal to the category numerators divided by the denominator and multiplied by 100. The mean BMI is equal to the numerator divided by the denominator. Unlike the female BMI, the male BMI is not an existing variable in any other survey recode file except from the survey year of 2011.

BMI for women is covering non-pregnant, non-postpartum women age 15–49 current status at the time of the survey. While pregnant women and women two months postpartum are weighed and measured, they are excluded from the report tabulations because of weight gain during pregnancy. Women whose calculated BMI is below 12.0 or above 60.0 are flagged as out of range and are excluded from both the denominator and the numerators. A woman is suffering from hunger if and only if BMI < Normal ie. < 18.5 of which is categorised as underweight according to WHO health standards (WHO, 2020). Numerators: Number of women with a body mass index (BMI) with the following values:

- Moderately and Severely thin: less than 17.00
- Mildly thin: 17.00 to 18.49
- Normal: 18.50 to 24.99
- Overweight: 25.00 to 29.99
- Obese: 30.00 or more

The threshold for females was originally coded differently with moderately and severely thin in different groups. For coherence with other variables and analytical purpose of comparison between genders, moderately and severely thin groups were merged into one group and new cutoff points are in hundredths decimals instead of previously tenths decimal points. The upper threshold for moderately thin remained, and instead of the lower threshold for moderately thin,

the final group has the lower threshold of previously severely thin. The recoding of females BMI follows the thresholds according to WHO standards.

BMI for men is covering all men of the age 15-49 for current status at the time of the survey. Men whose calculated BMI is below 12.0 or above 60.0 are flagged as out of range and are excluded from both the denominator and the numerators. A man is suffering from hunger if and only if BMI < Normal ie. < 18.5 according to WHO health standards (WHO, 2020). Numerators: Number of men at the age 15-49 with a body mass index (BMI) with the following values:

- ➢ Moderately and Severely thin: less than 17.00
- ➢ Mildly thin: 17.00 to 18.49
- ➢ Normal: 18.50 to 24.99
- ➢ Overweight: 25.00 to 29.99
- ➢ Obese: 30.0 or more

Nutrition status for children differs from adults. To measure hunger among children, this research will follow the methodology of WHO who uses stunting and wasting as indicators of children's nutrition status (FAO et.al., 2018) Children are defined as aged 0-59 months. Stunting is defined as low height-for-age, it is responsive to prolonged undernutrition. Stunting reflects micronutrient and caloric deficiencies long term and is a measure of chronic undernutrition. Wasting reflects acute caloric deficiency but does not measure micronutrient deficiencies. Wasting and stunting are calculated using z-score. Z-score is the observed value minus the median value of the reference value divided by the standard deviation of the reference population, $z = (x-\mu)/\sigma$. The threshold for stunting is minus two standard deviations below the WHO Child Growth Standard median. Wasting is defined as low weight-for-height. The threshold for wasting is two standard deviations below the WHO Child Growth Standards median. (WHO, 2020). A child is wasted if and only if wasting $\leq -2\sigma$ and a child is stunted if and only if stunting $\leq -2\sigma$. Numerators Stunting:

- ➢ Severely stunted: Number of children whose height-for-age z-score is below minus 3 (-3.0) standard deviations below the mean on the WHO Child Growth Standards

- ➢ Moderately or Severely stunted: Number of children whose height-for-age z-score is below minus 2 (-2.0) standard deviations below the mean on the WHO Child Growth Standards
- ➢ Mean z-score for height-for-age: Sum of the z-scores of children with a non-flagged height for age score (∑ hc70/100, if hc70 < 9990)

Numerators Wasting:

- ➢ Severely wasted: Number of children whose weight-for-height z-score is below minus 3 (-3.0) standard deviations below the mean on the WHO Child Growth Standards
- ➢ Moderately or Severely wasted: Number of children whose weight-for-height z-score is below minus 2 (-2.0) standard deviations below the mean on the WHO Child Growth Standards
- ➢ Mean z-score for the weight for height: Sum of the z-scores of children with a non-flagged weight for height score (∑ hc72/100, if hc72 < 9990)

Denominators: Number of de facto living children between ages 0 and 59 months before the survey who have stunting: valid non-flagged height for age z-scores (hc70 < 9990): Wasting: valid non-flagged weight for height z-scores (hc72 < 9990) (NIPORT, 2011).

Household wealth index

To measure a household's wealth can look different around the world due to the size and the more or less and complexity of the household. In the DHS data on Bangladesh, a household is defined in two ways, each with a unique set of data. The first definition is the sum of individuals who currently reside in the household at the time of data collection. The second definition is the sum of individuals who usually reside in the household but do not necessarily currently reside in the household at the point of data collection. A household is here defined as the former. The DHS survey data do not collect data on consumption or income, however, the DHS survey contains details of household characteristics and access to a variety of consumer goods and services and assets. Examples of such are televisions and bicycles; materials used for housing construction; and types of water access and sanitation facilities, of which in combination are

used as a measure of a household's living status. The threshold for poverty is calculated using different combinations of criteria such as absolute and relative poverty and associated national and international criteria for poverty (Rutstein, 2008). The wealth index is generated with principal components analysis. The resulting wealth index is an indicator of the level of wealth of which is argued to be consistent with expenditure and income measures and was constructed to compare the influence of wealth on population groups, health and nutrition indicators (NIPORT, 2013) The DHS survey data contain two variables for economic status 'Wealth index combined' and 'Wealth index factor score combined'. Due to lack of information regarding the first and continuous variable of wealth, the latter and discrete variable 'Wealth index factor score combined' will be used in this research for economic status. The variable is grouped by traditional wealth quintiles and a household is poor if and only if, wealth status < middle income. The wealth quintiles are poorest, poorer, middle, richer and richest. In the analysis over time, the DHS household wealth index is further complemented with GDP per capita (2011 US dollar PPP) from 2004 to 2014. GDP is defined as the Gross Domestic Product from a particular period divided by the total population in the same period. The data over GDP is sourced from The World Bank (World Bank, 2019).

Data preparation

The requested data for this study came recoded, with each survey year containing various recode files. Each survey year from 2004 to 2014 and respectively recode file was explored to find a suitable survey year containing the variables of nutritional status for females, males and children. There were differences in the amount of missing data in the different survey year and recode files, moreover, indexes are calculated differently in various survey years. The preferred survey year and recode file further needed work before pursuing any type of analysis. The BMI variable was recoded into the different ranges of the index according to UN standards. Values that are flagged out or range are excluded. BMI was further recoded producing an additional variable dividing BMI into two groups. Group one contains BMI values of which are considered thinning and living with poverty and the rest forming group two of which are considered equal to or more than normal according to UN standards and is not considered to live in poverty. Stunting and

wasting was recorded according to the index of severely (-3) , moderately (-2), and normal (> -2). First two groups are classified as poor and the last group as non-poor. Syntax of the recoding is expressed below.

Recode BMI;

RECODE HB40$1 (1200 thru 1699=1) (1700 thru 1849=2) (1850 thru 2499=3) (2500 thru 2999=4) (3000 thru 6000=5) INTO BMIGPM. VARIABLE LABELS BMIGPM 'BMI Group Male'.

RECODE HA40$1 (1200 thru 1699=1) (1700 thru 1849=2) (1850 thru 2499=3) (2500 thru 2999=4) (3000 thru 6000=5) INTO BMIGPF. VARIABLE LABELS BMIGPF 'BMI Group Female'.

RECODE HA40$1 HB40$1 (1200 thru 1849=1) (1850 thru 6000=2) INTO BMIFTG BMIMTG. VARIABLE LABELS BMIFTG 'BMI Female Two Group' /BMIMTG 'BMI Male Two Group'.

Recode Stunting and Wasting;

RECODE HC70$1 HC72$1 (Lowest thru -300=2) (-299 thru -200=1) (-201 thru Highest=0) INTO SG WG. VARIABLE LABELS SG 'Stunting Groups' /WG 'Wasting Groups'.

Recode Wealth Index to Poor and Non-Poor;

RECODE HV270 (3 thru Highest=2) (Lowest thru 2=1) INTO WealthIndex2.
VARIABLE LABELS WealthIndex2 'Wealth Index two groups'.

The types of datasets generated for each survey vary by survey design. Except for varying names of original variables in the data, the recoding syntax above was also used for the survey year of 2004, 2007, 2011 and 2014 when preparing the data for analysis over time. However, each variable itself might contain different dimensions, of which is complicating the analysis over various survey years. This type of limitation and others is further discussed below.

Limitations

The DHS survey data distributed in separate recode files; for households (HR), household members (PR), women's (IR), births (BR), children under five (KR), men's (MR), and couples(CR) files. Nutritional status for women and children and household wealth are found in most files. It is only in the year of 2011 that household members file include men as well as women, and children's nutritional status and household wealth. Moreover, there may exist zero or several Woman's or Man's Questionnaires for each household complicating analysis of intra-household inequality. Other than the DHS survey year of 2011, surveys from other years exclude males nutritional status of which unfortunately limits the analysis over time to women and children. To analyse variance between households in years more than 2011, and to look at patterns over time regarding the relationship between household wealth and nutritional status, it is first necessary to match and merge separate datasets using the cluster, household and line numbers. Moreover, women in phases of the DHS survey before DHS-IV of 2008, only interviewed mothers of children under 5 years were weighed and measured or in some surveys only a subsample of these women were selected for anthropometry. All comparisons between surveys over time should take into account the possible differences in the defined population base. Regarding economic status, the method of calculating the wealth quintiles has been changing over the years. Initially, the national wealth index score was calculated using a single principal components analysis (Rutstein and Johnson, 2004). In 2008 the calculation method was changed to produce separate urban and rural wealth scores and then use a regression equation to map these to a combined national wealth index score (Rutstein, 2008). This too ought to be taken into consideration when analysing household wealth variables in relation to rural/urban variables over time if samples from before and after 2008 are included. Concerning males BMI, a large portion of the survey responses is coded with 'missing value'. A missing value in this DHS is a variable that should have a response but does not have a response. NIPORT argues there are two explanations behind missing values, it can be the case that the question was never asked because of error by the interviewer or it may be because the respondent did not want to answer. NIPORT has a general rule that under no circumstances in survey data

processions should an answer be made up, and instead, the value is assigned a missing value. Moreover, the handling of missing data varies. A table presenting a percent distribution that sums to 100%, missing values are only shown if the missing values account for at least 1% of cases in any row. If the missing values account less than 1%, it is the decision of the author to show it or not. Concerning tables showing individual cell percentages of respondents, missing values in rows are not shown (NIPORT, 2013). At last, this research uses BMI as a measure of hunger and thereby a measure of individual poverty, however hunger is only one dimension of poverty. Similar studies of individual poverty could be made with for example individual education, individual bargaining power within households and other individual indicators of poverty.

Methodology

The correlation design allows for statistical tests. The tests performed in the analysis are first univariate analysis to present the characteristics of the objects studied. Secondly, and most importantly, are two bivariate analysis. Bivariate analysis has the purpose of analysing two variables to determine the empirical association between the variables.

Chi-Square test

The first premise behind the hypothesis of household poverty as a good predictor of individual poverty, ie. poor individuals are mainly found in poor households, is the focus of the study. The wealth index is a discrete variable, however BMI is a continuous variable and can be recoded into a discrete variable. The chosen methodology for testing the premise is the Chi-Square test. If individual poverty is mainly found in poor households, we can expect low BMI to correlate with low household wealth more often than with high household wealth, and high BMI to correlate with high household wealth more often than with low household wealth. The data contain a BMI variable and is categorised into five groups according to index levels varying from severely thin to obese. The household wealth variable is also also categorised into five groups, varying from poorest to richest. To analyse the relationship between two categorical variables, cross-tabulation

and chi-square test will be used. Cross tabulation is a contingency table generating patterns of association and likeliness (Bryman, 2012). Chi-square tests (x^2) is a test for statistical significance, in other words, the confidence level for a probability sample to be generalised to population (Bryman, 2012). Chi-square tests can tell us how confident we can be of the relationship between household wealth and nutritional status levels in the population. The logic of the test is calculating expected frequency (or value) ie. what would occur randomly for each cell in the table. The chi-square value equals the differences between actual and expected values for each cell and summing those differences. The chi-square value is interpreted with the set level of statistical significance (Bryman, 2012). The statistical significance will in this test be set to 0.05 in other words 95% confidence interval. In other words, there are 5 chances out of 100 that a statistical significant result is false. To determine statistical significance depends not only on the magnitude but also on the number of categories being analysed governed by 'the degrees of freedom' associated with the table. This means, the chi-square value is also calculated taking into account the size of the table to decide if the chi-square value is statistically significant or not (Bryman, 2012).

The individual welfare for individuals in our case BMI are denoted b, and the economic wealth of the household the individual resides in is denoted wi. We assume b to be normalised by the threshold for when BMI is considered to be classified as normal according to WHO health standards and wi are normalised by the threshold for middle income. Thereby, a person is suffering from poverty if and only if $b<1$, and a household is poor if and only if, $wi<1$. For children's welfare, we replace BMI with stunting and wasting. Stunting is defined as low height-for-age and wasting is defined as low weight-for-height. Stunting and wasting are denoted s and wa. We assume s and wa to be normalised by the threshold for when children's anthropometric ratios are considered unhealthy. A child is wasted if and only if $wa \leq -2\sigma$ and a child is stunted if and only if $s \leq -2\sigma$, a child is normal if and only if, $s,wa > -2\sigma$.

Correlation

The purpose of the simple correlation analysis in this study is to measure the relationship between BMI, wasting, stunting and household wealth index over time, and to study patterns. The algebraic form of a correlation is known as the Pearson product-moment correlation coefficient and it is symbolised as r. Pearson's r ranges from -1.00 to +1.00. The closer r is to 1 positively or negative, the variables vary together. In other words the co-vary, or share a common variance. Pearson r squared equates to a numerical estimate of the proportion of the variance in one variable that can be accounted for by the other variable, or more precisely, the variance in one variable which is held common with the other (Punch, 2014). A correlation analysis is not a test of cause and effect and merely a test of association. Although this test will answer questions concerning the distribution of individual poverty in various wealth indexes, the test can provide other valuable information concerning the discussion of individual and household poverty. To analyse the relationship between BMI and wealth index over time brings a broader perspective of the relationship between the variables, in comparison to solely measuring one point in time. The perspective of differences over time can thereby bring context to the study of one point in time, and guide interpretation of the data in that one specific point in time. The purpose of the correlation analysis in this study is thereby to study the pattern of association between wealth and BMI, and wealth and wasting and stunting of which will further give perspective to the analysis of the 2011 survey year data.

Analysis

The analysis consists of three sections, first of which is a chi-square test of the relationship between nutritional status for females and males respectively and household wealth index studying both poor households as a group and levels of poverty. The second analysis is a chi-square test of the relationship between children's nutritional status and wealth. In the final section contain correlation tests of the relationship of wealth and nutritional status over various survey years.

Description of data

More than half of the total female population sample had a normal weight, this is true also for the male population sample. The amount of the population sample being mildly thin and overweight is almost equal for females, with slightly more people being overweight than mildly thin. Unlike the female population, males have three times as many people being mildly thin than overweight. Regarding the ends of the spectrum, there are close to three times as many females that are moderately or severely thin than obese. Only a very small minority of the male population is obese, and almost ten times as many moderately and severely thin males than obese males. In more general terms, 22.6% of females and 26.3% males were considered underweight, and 18.2% females and 7.4% of males were considered overweight or obese. Household wealth sample was stratified from each socioeconomic group and each one representing approximately 20% of the population sample. At the time of data collection, it was far more common for a household not to be living in poverty, and around ⅘ of the population sample is living in poverty. The head of the household is most often a male, representing the head of household 88.9% of all households. Concerning the relationship structure, it is most commonly (52.9%) three or more related adults in one household. Second most common (38.9%) is two adults of the opposite sex. The remaining four groups of other relationship structures make up between 0.0% to 4.7% of all households. Moreover, the majority (91%) of all adults are currently married. Anthropometric data of the population is overwhelmingly represented by females, due to the great amount of missing anthropometric data of the male population. As a consequence of a large amount of missing data of the male population, the number of males being analysed is, therefore, smaller than the female population in this analysis.

Poor and non-poor individuals and households

The first analysis is looking at the relationship between poor and non-poor households and individuals.

Poor and Non-Poor, Females

			BMI Female Two Group		
			Poor	Non-Poor	Total
Wealth Index two groups	Poor	Count	1900	3707	5607
		% of Total	13,1%	25,6%	38,7%
	Non-Poor	Count	1378	7510	8888
		% of Total	9,5%	51,8%	61,3%
Total		Count	3278	11217	14495
		% of Total	22,6%	77,4%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	663,835[a]	1	,000		
Continuity Correction[b]	662,785	1	,000		
Likelihood Ratio	649,615	1	,000		
Fisher's Exact Test				,000	,000
Linear-by-Linear Association	663,790	1	,000		
N of Valid Cases	14495				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 1268,01.
b. Computed only for a 2x2 table

Pearson Chi-Square 0.000 ie. < 0.05 ie. The relationship between household wealth and individual poverty groups is significant to the 1% level. There is a significant difference between poor and non-poor households to individual poverty and no individual poverty among females. We can be confident the observed relationship between household wealth and females individual poverty levels in this sample test can be generalised to the female population.

Poor and Non-Poor, Males

			BMI Male Two Group		
			Poor	Non-Poor	Total
Wealth Index two groups	Poor	Count	188	356	544
		% of Total	13,9%	26,4%	40,3%
	Non-Poor	Count	168	637	805
		% of Total	12,5%	47,2%	59,7%
Total		Count	356	993	1349
		% of Total	26,4%	73,6%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	31,316[a]	1	,000		
Continuity Correction[b]	30,615	1	,000		
Likelihood Ratio	30,921	1	,000		
Fisher's Exact Test				,000	,000
Linear-by-Linear Association	31,293	1	,000		
N of Valid Cases	1349				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 143,56.
b. Computed only for a 2x2 table

Pearson Chi-Square 0.000 ie. < 0.05 ie. meaning the relationship between household wealth and individual poverty groups is significant to the 1% level. There is a significant difference between poor and non-poor households concerning males individual poverty and no individual poverty. We can be confident the observed relationship between poor and non-poor households and individuals with poverty and with no poverty in this sample test can be generalised to the male population.

When calculating the relationship between BMI categories and wealth categories, for both sexes around half of the total population sample was not living in a poor household and was not poor. Around a quarter of the total population were living in poor households while not living with poverty. Between thirteen and fourteen per cent of the total population were both living in poor households and with poverty. Close to 1/10 of the total female population, and ⅛ of the total male population were living with poverty but not in a poor household. The main differences between the sexes are seen in slightly more men living with poverty and not in poor households and slightly fewer males living in non-poor households and with no poverty. Noteworthy is the very small difference in males with poverty in poor and in non-poor households, 13.9% and 12.5%. In summary, more males are living with poverty, and more males are living with poverty but not in a poor household, in comparison to females. This means males are more likely to be in an economically privileged position but still living in poverty compared to the same situation for females. We can observe a positive trend between no individual poverty and household wealth,

and a negative trend between individual poverty and household wealth. In other words, a wealthier household is more likely to have household members who are not living in poverty.

BMI by wealth groups

The second analysis below goes beyond the poor and non-poor households and looks more in detail into the relationship between various household wealth indexes and individual poverty. This analysis paints a more nuanced story of which wealth group poor individuals are living in.

BMI Groups by Wealth Groups, Females

			Wealth index					Total
			Poorest	Poorer	Middle	Richer	Richest	
BMI Group Female	Moderately and Severely thin	Count	473	327	263	169	79	1311
		% of Total	3,3%	2,3%	1,8%	1,2%	0,5%	9,0%
	Mildly thin	Count	613	487	372	341	154	1967
		% of Total	4,2%	3,4%	2,6%	2,4%	1,1%	13,6%
	Normal	Count	1570	1786	1761	1807	1649	8573
		% of Total	10,8%	12,3%	12,1%	12,5%	11,4%	59,1%
	Overweight	Count	135	188	319	543	978	2163
		% of Total	0,9%	1,3%	2,2%	3,7%	6,7%	14,9%
	Obese	Count	11	17	35	101	317	481
		% of Total	0,1%	0,1%	0,2%	0,7%	2,2%	3,3%
Total		Count	2802	2805	2750	2961	3177	14495
		% of Total	19,3%	19,4%	19,0%	20,4%	21,9%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2306,350[a]	16	,000
Likelihood Ratio	2281,387	16	,000
Linear-by-Linear Association	1842,732	1	,000
N of Valid Cases	14495		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 91,26.

Pearson Chi-Square is 0.000 ie. <0.05 meaning the observed relationship is significant to the 1% level, in other words, there is a significant difference between wealth index groups in respect to

females BMI. We can be confident the observed relationship between household wealth and females BMI levels in this sample test can be generalised to the female population. Concerning the female population sample, the number of mildly to severely underweight females decrease as wealth increases, and the number of overweight and obese females increases as wealth increases. We can observe the number of females with a normal weight increases with wealth up to a richer wealth status and then drops in the richest wealth status group. Moreover, we can observe overweight and obesity are increasing as wealth increases. The richest wealth status groups also have considerably more overweight and obesity than the other wealth groups. Of all the females with moderately and severe hunger as a group, 58 % are living in the poorest 40%, as we could find in the previous test as well. What was not found in the previous test is that every fifth female with moderate or severe hunger is living in a household that is not considered poor but middle wealth and 7.1 % is living in a household that is considered richer.

BMI Groups by Wealth Groups, Males

			Wealth index					
			Poorest	Poorer	Middle	Richer	Richest	Total
BMI Group Male	Moderately and Severely thin	Count	24	19	27	15	6	91
		% of Total	1,8%	1,4%	2,0%	1,1%	0,4%	6,7%
	Mildly thin	Count	66	79	49	45	26	265
		% of Total	4,9%	5,9%	3,6%	3,3%	1,9%	19,6%
	Normal	Count	174	173	174	199	174	894
		% of Total	12,9%	12,8%	12,9%	14,8%	12,9%	66,3%
	Overweight	Count	1	5	8	25	51	90
		% of Total	0,1%	0,4%	0,6%	1,9%	3,8%	6,7%
	Obese	Count	1	2	0	2	4	9
		% of Total	0,1%	0,1%	0,0%	0,1%	0,3%	0,7%
Total		Count	266	278	258	286	261	1349
		% of Total	19,7%	20,6%	19,1%	21,2%	19,3%	100,0%

Chi-Square Tests

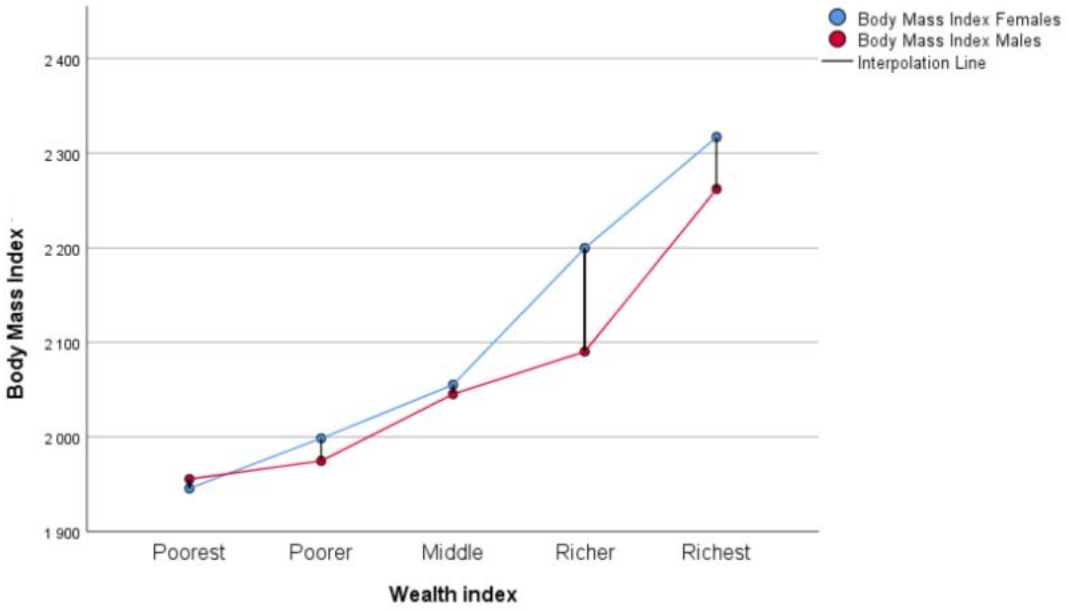
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	148,692[a]	16	,000
Likelihood Ratio	147,522	16	,000
Linear-by-Linear Association	79,799	1	,000
N of Valid Cases	1349		

a. 5 cells (20,0%) have expected count less than 5. The minimum expected count is 1,72.

Pearson Chi-Square is 0.000, r <0.05 meaning the observed relationship is significant to the 1% level, in other words, there is a significant difference between wealth index groups in respect to males BMI. We can be confident the observed relationship between household wealth and males BMI levels in this sample test can be generalised to the male population.

The variable relationship for the male population differs slightly from the female population, which was also true in previous tests. However, the percentages of males being severely underweight are concentrated in the poorest and middle wealth index, and the percentages of males being mildly thin are concentrated in poorest and poorer, with more mildly thin males in poorer than in the poorest of which is expected if wealth and higher nutrition status move in unison. As wealth increases, the number of mildly underweight first increases and then decreases, and the number of moderately and severely underweight first drops, then increases followed by a larger decrease. This wave pattern, but yet increasing trend has also been found in a previous studies of developing countries but mainly countries of Africa, and they argue this pattern shows that the focus should not be where poorest individuals are but that the rate decreases as wealth increases (Wagstaff and Watanbe, 2000) Similar to the female population, the number of normal weight males is highest among the richer wealth status group of which stands out from the average of 174 normal weight males in the rest of the wealth status group. This means, there are as many normal weight males in the poorest as it is in the richest wealth status group which can be expected since the normal weight group contains more than half of the population sample. In a similar fashion as the female population, the number of overweight males increases as wealth increases and it increases around a twofold between each wealth status group. However, with increases in wealth, the number of obese males first increase, drop in the

middle wealth status group followed again by an increase. Of men with moderate to severe hunger as a group, 52.8% is living in the poorest 40%. Close to ⅕ is not living in a household considered poor but middle wealth, and 9% in richer households. For a male with moderate to severe hunger, it is more likely to be living in a middle wealth household than living in a poorer household.



Simple scatter of BMI for females and males respectively, by Wealth Index

In contrast to the trend when looking at poor/non-poor wealth groups, looking into the relationship between wealth status and average BMI levels in the graph above we can observe a more accurate relationship. On average, a wealthier household has a population with higher mean BMI and this is true for both men and women. However, this relationship is different for men than for women. Females have on average a higher BMI, and they have a larger increase in mean BMI between middle to richer wealth indexes, than males for the same wealth indexes groups. Males have a larger increase between richer and richest wealth indexes than females but still not large enough to score as high mean BMI as the female population.

Discussion

Using the human development approach and including hunger in the definition of Poverty, the first premise 'poor individuals are mainly found in poor households' is supported by the test results as females and males with moderate to severe hunger as a group, 58 % and 52.8% respectively, are living in the poorest 40% households, ie. poor household. In other words, if vulnerable individuals are the target of the development program and household wealth is used to find vulnerable individuals, the percentages of females and males that will be accurately selected for the development program is close to the percentages of females and males that would by mistake not be included in the development program. Given that almost half of poor individuals will not be included, a broad reaching intervention to fight poverty, and in particular hunger, is implied. This test result is further showing that increased human well-being is associated with higher wealth, this test result is in line with the researchers arguing for a positive wealth effect on nutrition, and the human development approach of human well-being leads to development. However, since this test result is only an association and not a causation, the results from this study cannot argue that wealth has a positive effect on nutrition but only that the variables are associated.

The focus of this study is the first premise; poor individuals are mainly found in poor households. Other researchers have asked questions in a similar phrasing to; are poor individuals mainly found in poor households? Although this question was not of their main concern, their findings are interestingly similar to this study. In this study, of all the females with moderately and severe hunger as a group, 58 % are living in the poorest 40% in other words households normally classified simply as poor. Of men with moderate to severe hunger as a group, 52.8% is living in the poorest 40% households, ie. poor households. A study on thirty countries in Sub Saharan Africa found that around half of the underweight women were found in the poorest 40%. This is in line with the findings in this study of males, however, this study found relatively more females in poor households (Brown, Ravallion and Walle 2017) Another study in Africa, in Senegal, found 47.8% of poor individuals living in poor households. Although this study used

consumption to measure individual poverty, the results of poor individuals in poor households are similar (De Vreyer and Lambert, 2016). The study by D'Souza, Tandon (2019) of rural Bangladesh found that 9-55% of undernourished individuals live in inadequately nourished households. This study was also using consumption to measure undernourishment. Of the previous research which also found poor individuals in non-poor households, or poor individuals while remaining household members are not poor, argue that intra-household inequality is a factor (De Vreyer and Lambert, 2016; Brown, Ravallion and Walle 2017). De Vreyer and Lambert (2016) further suggest that the poverty that goes unnoticed are more likely to be among the least poor of the poor. Although the findings in this study cannot speak of intra-house inequality, considering all individuals with moderate to severe hunger, every fifth female and male is living in a household considered middle wealth, and the differences between males and females in terms of individuals with moderate to severe hunger in the middle wealth quintile, it would be of interest to study the level of intra-house inequality in the middle wealth households in particular. Previous research has shown no clear gender difference in terms of vulnerability to individual poverty (Sahn and Younger 2009) and other find female-headed households have less individual poverty (De Vreyer and Lambert, 2016), while a large body of research argues females are more often than males in a less privileged situation concerning intra-household food allocation (Chinyophiro, 2017), this study shows that females have a larger increase in individual wealth than males and males are more likely than females to be poor while not living in a poor household. A study from Nairobi slum found similar results and they found a larger increase in women's BMI in comparison to males (Haregu et al., 2018). Possible causes of their findings were not discussed.

As Bangladesh was a lower-middle-income country by the time of the survey, the obesity results found in this research is in line with the findings in the study by (Dinsa, Goryakin, Fumagalli and Suhrcke (2012) they found that in low-income countries an increase in wealth tends to correlate with an increase in obesity and this was true for both males and females. This is also true in this study where female obesity is increasing as wealth increases. The richest wealth status groups also have considerably more overweight and obesity than the other wealth groups. In a similar

fashion as the female population, the number of overweight males increases as wealth increases and it increases around a twofold between each wealth status group. However, with increases in wealth, the number of obese males first increase, drop in the middle wealth status group followed again by an increase. Although overweight and obesity were increasing as wealth increased, also shown in the study by Dinsa, Goryakin, Fumagalli and Suhrcke (2012), this test result was not fully expected. Food and Agriculture Organization and others (2019) argued that socioeconomic inequality can lead to obesity due to high food prices. This means, there might be two forces driving the BMI in our test results, lack of food leading to inadequate calories and thinning and lack of nutrient-rich food and mostly consuming nutrient-poor and calorie-dense food leading to overweight. If poverty was driving obesity in this data sample, obesity would have been found mainly in poor households, of which was not the case as obesity is primarily found in the richest wealth group for females and males. The national economy has been rising in Bangladesh, and in 2018 graduated to a lower-middle-income country. It would be of interest to perform the same tests as in this research on the data from the survey year of 2017 or later when that data is released. As further shown in the study by Dinsa, Goryakin, Fumagalli and Suhrcke (2012) for middle-income countries the association between obesity and wealth showed mixed results for males, and female obesity decreases with wealth (Dinsa, Goryakin, Fumagalli and Suhrcke, 2012). If Bangladesh is following the trend of other countries, the test results on survey years post 2018 may come out differently than from this research. Simultaneously, research has shown that increases in income will not lead to improvements in nutrient intakes. Food expenditure will increase proportionally to income but marginal increments will not be devoted to obtaining more nutrients (Behrman and B. Deoalikar, 1987). In other words, there are other mechanisms than wealth at play in increasing the amount of nutritious food, thus, if a household becomes less poor does not necessarily mean the household will consume more nutritious food.

Stunting and wasting by wealth groups

The nutrition status for children is measured in the number of observable cases of stunting and wasting. The children's measurements are classified according to moderately, severely stunted or

wasting, or normal values in the relationship between age, height and weight according to WHO standards (WHO, 2020).

Stunting

Stunting by Wealth Groups

			Wealth index					
			Poorest	Poorer	Middle	Richer	Richest	Total
Stunting Groups	,00	Count	838	834	913	1024	1174	4783
		% of Total	11,3%	11,3%	12,3%	13,8%	15,8%	64,5%
	1,00	Count	410	378	337	285	231	1641
		% of Total	5,5%	5,1%	4,5%	3,8%	3,1%	22,1%
	2,00	Count	368	230	168	138	85	989
		% of Total	5,0%	3,1%	2,3%	1,9%	1,1%	13,3%
Total		Count	1616	1442	1418	1447	1490	7413
		% of Total	21,8%	19,5%	19,1%	19,5%	20,1%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	357,907[a]	8	,000
Likelihood Ratio	360,852	8	,000
Linear-by-Linear Association	342,739	1	,000
N of Valid Cases	7413		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 189,18.

Pearson Chi-Square is 0.000, meaning the observed relationship is significant to the 1% level, in other words, there is a significant difference between wealth index groups in respect to stunting in children under the age of five. We can be confident the observed relationship between household wealth and stunting levels in this sample test can be generalised to the population of children.

Of all children in the sample under the age of five, 22.1 % was moderately stunting, and 13.3 % was severely stunting and remaining 64.5% was within normal standard deviations from what is considered healthy according to UN standards. As wealth increases, the share of normal values increases, the share of moderately stunting decreases, and so is the share of severely stunting.

Noticeable is the small difference between wealth indexes is respect to moderately stunting. In respect to all children under the age of five in the sample, 5.5% of moderately stunting is found in the poorest and 3.1 percent of moderately stunting is found in the richest. If you only look at the group of moderately stunting children, one quarter is found in the poorest household and around one-sixth is found in the richest households. Of all stunting children as a group, both moderately and severely stunting, 53% is found within the poorest 40%. In a similar fashion as the prevalence of moderately and severely thinning females and males, the difference in the prevalence of stunting between the various wealth indexes is relatively small.

Wasting

Wasting by Wealth Groups

			Wealth index					
			Poorest	Poorer	Middle	Richer	Richest	Total
Wasting Groups	,00	Count	1374	1229	1200	1284	1336	6423
		% of Total	18,5%	16,6%	16,2%	17,3%	18,0%	86,6%
	1,00	Count	182	167	171	133	106	759
		% of Total	2,5%	2,3%	2,3%	1,8%	1,4%	10,2%
	2,00	Count	60	46	47	30	48	231
		% of Total	0,8%	0,6%	0,6%	0,4%	0,6%	3,1%
Total		Count	1616	1442	1418	1447	1490	7413
		% of Total	21,8%	19,5%	19,1%	19,5%	20,1%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	35,482[a]	8	,000
Likelihood Ratio	37,405	8	,000
Linear-by-Linear Association	16,591	1	,000
N of Valid Cases	7413		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 44,19.

Pearson Chi-Square is 0.000 and The observed relationship is significant to the 1% level, meaning there is a significant difference between wealth index groups in respect to wasting in children under the age of five. We can be confident the observed relationship between household wealth and wasting levels in this sample test can be generalised to the population of children.

Of all children in the sample under the age of five, 10.2 % was moderately wasting, and 3.1 % was severely wasting. As wealth increases, the share of normal values increases with a minor dip in the middle wealth group, the share of moderately stunting decreases, and so does the share of severely stunting except a minor increase in the richest wealth group. Noticeable is the small difference between wealth indexes is respect to moderately wasting. Moreover, there is almost the same number of moderately and severely wasted children in the middle wealth group as in the poorer wealth group, and in the richest wealth group in respect to severely wasting. Of all wasting children as a group, both moderately and severely wasting, 46% is found in the poorest 40%, meaning more than half of the share of children who are wasting is not living in a poor household.

Discussion

Using the human development approach and including hunger in the definition of poverty, the first premise 'poor individuals are mainly found in poor households' the test results of children stunting supports the premise as 53% of children stunting as a group is found in the poor household. However, as the majority of children wasting as a group, 46% is not found in poor households. The test results of children wasting express the need for further testing to support a new proposition: poor individuals are not mainly found in poor households. If development practitioners were to target vulnerable children, working after wealth indexes would arguably be an ineffective method to find vulnerable children as the majority of wasting children and almost half of the children stunting, is not found in the poor households. Moreover, this test result is showing that an increase in wealth is associated with a decrease in stunting and wasting, except for a minor increase in wasting in the richest wealth group from the rich wealth group. As previously discussed, wasting and stunting measures different dimensions of children's nutritional status, acute and chronic undernutrition respectively. This study found evidence of the premise poor individuals are mainly found in poor households, to be false using wasting and the opposite using stunting. The test results thereby highlight the importance of using different indicators, for example wasting and stunting, of the same concept in this case undernutrition as

the choice of method influences the result. Moreover, there is a possibility that the results of wasting is only a small anomaly in the long run since wasting responds quickly to hunger.

The test results in this study on wasting and stunting children are similar to the test results as in a few previous research and yet different. For example, in Sub Saharan Africa (Brown, Ravallion and Walle 2017), wasting is less common than stunting and the prevalence of wasting is more or less similar over the wealth indexes. Moreover, they also found that around half of the children stunting, wasting was found in the poorest 40%. Hong, Banta and Betancourt (2006) found that children in the poorest 20% of households are more than three times as likely to suffer from adverse growth rate stunting as children from the wealthiest 20% of households. This test result is greater than the test result in this study, the similar difference can only be found in the severely stunting children as a severely stunting child is around 2.5 times likely to live in the poorest 20% than in the richest 20%. The greatest inequality is found in the study by Behowmik and Das (2017) who found children in the poorest 20% are four times as likely to be stunted as the children from the richest 20% households. Bredenkamp and others (2014) found the majority of the prevalence of stunting and underweight to be found among the poor, as did this study in regards to stunting. Wagstaff and Watanbe (2000) Found that inequality in stunting tends to be larger than inequality in wasting and inequality in malnutrition almost always disfavour the poor. Although this relationship is evident in wasting it is less clear than in wasting and underweight. A similar trend can be found in this research, although the level of inequality between wealth groups is not tested, the difference between the wealth group in respect to prevalence in stunting is larger than the difference between wealth groups in respect to prevalence in wasting. Moreover, the test results for stunting show that the majority of stunting is found in the poor households, but the non-poor are not disfavored in terms of the prevalence of wasting as the majority is not found in the poor households. Moreover, a study on the wealth effect on children's nutrition of 12 developing countries with data dating from 1970 until now, show increases in income at the household and national levels using GDP have similar rates of reduction in malnutrition. The researchers argue sustained household income growth leads to a sizable reduction in children's malnutrition. The researchers conclude that a reduction in

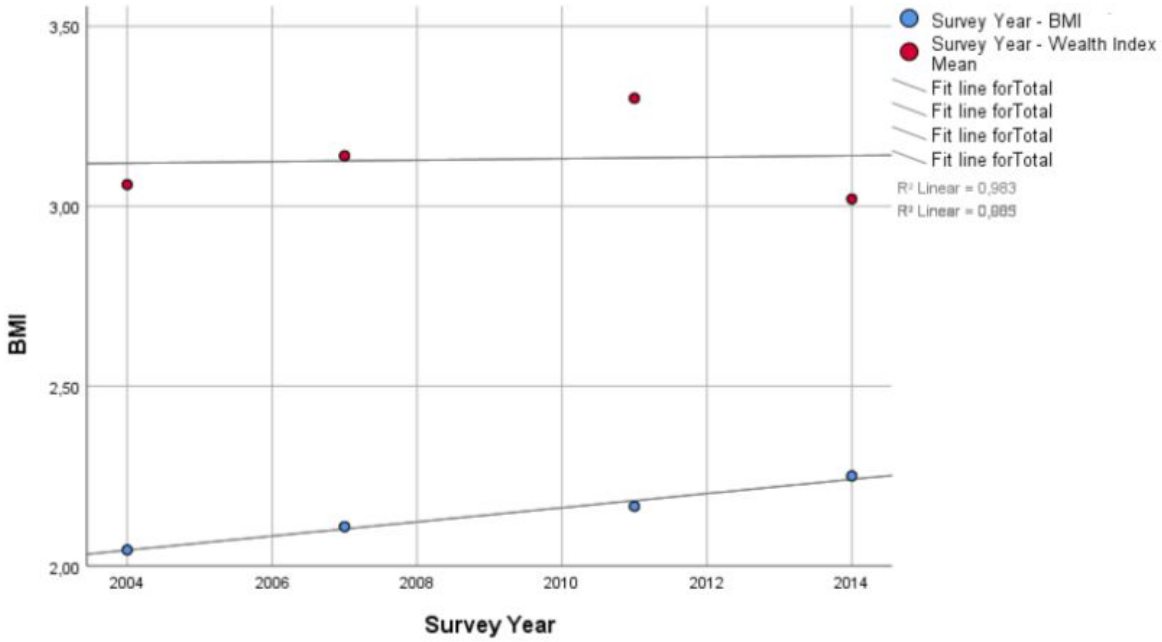
children's malnutrition is unlikely to be met through income growth alone, and investment in more direct interventions is likely to further reduce the reduction of children's malnutrition. (Haddad, 2003). Previous research is showing that the use of household wealth to identify poor children can in some countries be argued to be an effective method if you work after the greatest prevalence of malnourished children as the greatest prevalence of children's malnutrition is found in the poor households. Nevertheless, close to half of the prevalence of malnourished children is not found in poor households and previous research has also shown households income growth alone is not effective. Using household wealth can be argued not to be the most effective method to find individual poor children and implies a broad-reaching intervention targeting malnutrition is necessary to reduce children malnourishment.

Trends over time

The purpose of the simple correlation analysis in this study is to measure the relationship between nutritional status and wealth index over time, and to study patterns.

Correlations BMI and Wealth Index

		BMI	Wealth Index Mean
BMI	Pearson Correlation	1	-,042
	Sig. (2-tailed)		,958
	N	4	4
Wealth Index Mean	Pearson Correlation	-,042	1
	Sig. (2-tailed)	,958	
	N	4	4



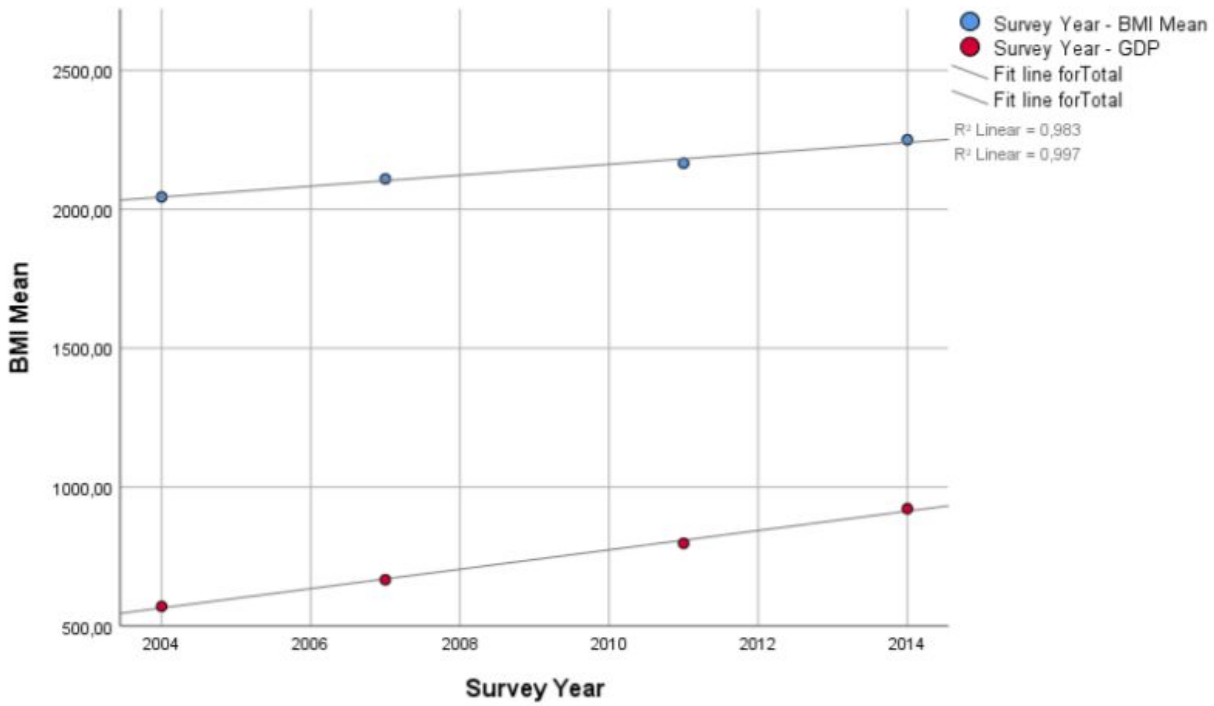
Simple scatter of mean BMI and mean Wealth Index by Survey Year

The graph above visualises the relationship between mean BMI and means wealth index from the survey year of 2004 to 2014. The correlation test was performed to measure the relationship between mean BMI and household wealth index over time and to study patterns. The correlation coefficient Pearson's r was -0,42 meaning there is a very weak and negative relationship, moreover, the correlation is not significant. We cannot be confident the observed relationship between mean wealth index and females mean BMI in this sample test can be generalised to the population, and the relationship is likely to be random. The BMI is converted to single units to match the wealth index, the value of r will not be affected by the conversion of the unit of measurements of either variable. To read the mean BMI value, multiply with ten. Concerning the wealth index, as previously discussed under material and limitation, the method of calculating the wealth quintiles has been changing over the years. One important change which is relevant to this analysis over time, is the change in the defined population base of females 2008, in surveys before 2008, only mothers of children under 5 years were weighed and measured and only a subsample of these women was selected for anthropometry. Comparisons between surveys over time and in this analysis the discrepancies between 2004, 2007 and 2011 and 2014 is complicated. The years of 2004 and 2007 are expected to have a higher BMI due to weight gains

associated with pregnancies. However, this simplified expectation cannot be observed in the test result. An explanation could be too small of a difference in the sampled population between each survey year. Another explanation behind the result could be a simultaneous and counteractive force of the higher prevalence of hunger in earlier survey years. Considering that very large and small values can distort the result, with the fact that Bangladesh's economy has been on the rise, the mean value of household wealth in 2014 may be an outlier. Given that Bangladesh has a large agricultural sector, the drop in mean value of household wealth could also be due to the global food price drop in the middle of 2014 to the middle of 2015. However, there may be too few measurements to draw any conclusions, and the test would have benefited from multiple measurements from each survey year and/or including more survey year measurements. Unfortunately, surveys from the years of 2004-2014 are the only available data for this research. Although the relationship between BMI and wealth index over time is not significant, and no conclusion can be made about the relationship between BMI and wealth index, the mean BMI for females has been increasing with time. A correlation test was performed to measure the relationship between the share of children stunting and wasting of the total population of children under the age of five and over time (not presented here). Equivalent limitations apply to this test as the former correlation test on mean BMI and mean wealth index. Although the trend is not statistically significant, stunting is decreasing more steadily and wasting is decreasing with more fluctuations. This result is as expected since stunting is more responsive to prolonged undernutrition and is a measure of chronic undernutrition and therefore takes longer time to shift. Wasting is more responsive to periodic undernutrition and is a measure of acute undernutrition and therefore fluctuates more than stunting. Answering a few of the limitations with the use and handling of wealth index in this study, another analysis was performed and replacing household wealth index with national GDP per capita and tested against the mean BMI from the various survey years.

Correlations BMI and GDP

		BMI Mean	GDP
BMI Mean	Pearson Correlation	1	,996**
	Sig. (2-tailed)		,004
	N	4	4
GDP	Pearson Correlation	,996**	1
	Sig. (2-tailed)	,004	
	N	4	4



Simple scatter of mean BMI and GDP by Survey Year

The graph above visualises the relationship between mean BMI and GDP from the survey year of 2004 to 2014. The correlation coefficient Pearson's r was 0.996 meaning there is a very strong and positive relationship between mean BMI and GDP, moreover, the correlation is significant. We can be confident the observed relationship between GDP and females mean BMI in this sample test can be generalised to the population. Equivalent limitation as in the correlation test over time as using wealth index and BMI also applies in this test using GDP and BMI. Concerning the changed population base of females in 2008, the mean BMI levels from the 2004

and 2007 survey year are expected to be higher than in 2011 and 2014 due to weight gain associated with pregnancies. One can speculate and suspect that the rate of increase in BMI would be larger if the same population base was used throughout all survey years and consequently the correlation could have been different. The relationship between increased wealth and individual poverty appears to be strong, which is in line with the studies on the wealth effect on nutrition that argues for a large wealth effect. Previous findings in this research show a positive trend between no poverty and wealth, and a negative trend between poverty and wealth. In other words, a wealthier household is more likely to have household members who are not living with hunger. In combination, the results are in line with but does not confirm the researchers adopting the view of a large wealth effect on nutrition. However, a great wealth effect on nutrition does not rule out socioeconomic inequality and the wealth effect over time might favour individuals in some households more than others.

Conclusion

The strength of this study can be argued to be the large and diverse population sample which further increases the reliability and thereby confidence to infer findings back to the population. In addition, the use of BMI instead of wealth as a measure of individual welfare made it possible to study individual poverty. BMI measures more aspects of nutritional status than food consumption reports, and food consumption reports have higher risks of error. BMI has, therefore, higher validity than food consumption as a measure of nutritional status. However, BMI has its weaknesses. BMI is not a direct measure of nutritional facts in contrast to food consumption reports. Anaemia levels were included in some surveys of Bangladesh and could be used in combination to BMI to test for nutrients. The BMI results in this study showed a low prevalence of overweight and minimal prevalence of obesity, moreover, overweight and obesity were concentrated in the richest households. The risk of high BMI masking poverty in terms of inaccessibility to nutrient-rich foods in this study is therefore low. Concerning the use of BMI as a proxy for individual poverty, although BMI is a suitable variable to measure individual hunger and thereby poverty, there are of course other ways of measuring individual poverty beside hunger. When poverty is defined as more than economic wealth, any other indicator of poverty

could, and perhaps ought to, be studied to cover the full spectrum of individual poverty. More weaknesses of the study are the large share of missing data for males, moreover, males anthropometric data were not collected in any surveys except from the 2011 survey year. Consequently, males test results have lower reliability than females, moreover, no analysis overtime was possible for males. Even with these limitations, this study has provided a few interesting findings. More males are living with poverty, and more males are living with poverty but not in a poor household, in comparison to females. This means males are more likely to be in an economically privileged position but still living in poverty compared to females. Moreover, individual poverty is decreasing with wealth and this is true for both adults and children. Also, of all poor adults, the majority is living in a poor household. This is also true for children using stunting. However, the majority of wasting children is not found in poor households. The discrepancy in the results of children's hunger due to difference in indicators accentuates the importance of the methodology, and hunger takes various forms. Other interesting findings is the very strong and positive relationship between mean BMI and GDP in addition to the positive association between BMI and household wealth. These findings support the idea of a close relationship between poverty and hunger on the national level. Furthermore, this study shows similar results to several other studies. Research shows that around half of all poor individuals live in poor households, except for the study by D'Souza, Tandon (2019) that show 9-55% of undernourished individuals live in inadequately nourished households. Research shows varying gender bias in terms of individual poverty. Males are less privileged in this study and this was also found in a study in Nairobi slums using BMI, while in other research males are in the privileged position. Moreover, in low-income countries, including Bangladesh from this study, an increase in wealth tends to correlate with an increase in obesity. Furthermore, the test results in this study on wasting and stunting children are similar to the test results as in a few previous research and yet different. Earlier studies of Bangladesh showed a greater difference in stunting and wasting in the poorest wealth group than this study. This study is, however, similar to research in Africa showing that around half of the children with stunting and wasting found in poor households. It would be difficult to argue for or against the impact of geography on the concept of individual poverty. Using geography and the human development approach and the

test results in comparison to other studies on individual poverty in terms of hunger, individual poverty could be argued to be universal in its difference from household poverty in so much that around half of the group with individual poverty is living in poor households. Using the hypothesis by Sahn and Younger (2009), statistically, poor individuals are mainly found in poor households. It remains to test the other two premises to accept the idea of household wealth as a good predictor of individual poverty. Moreover, the term 'good' is used arbitrarily and is contextual. If we ask how 'good' household wealth is as a predictor of individual poverty for the purpose of finding poor individuals for an anti-poverty intervention, are we asking how good the method is to cover as many poor individuals as possible? What degree of inclusion is acceptable? Using the human development approach and including hunger in the definition of poverty, the first premise 'poor individuals are mainly found in poor households' is supported by the findings of this study in regards to adults. However, the premise in regards to children's poverty needs further testing to reject the premise that poor individuals are mainly found in poor households. Of the people with individual poverty, 58 % of females, 52.2% of males, 53% or 46% of children are living in the poorest 40%. Using household wealth to find individual poverty is successful in so much as finding the majority of the population with individual poverty. However, since close to half of the group of people with individual poverty is not found in a poor household, using household wealth to find poor individuals would result in a lower uptake of the total share of individuals in poverty.

Conflict of Interest

The author has no conflict of interest.

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