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Family structure, gender and childhood obesity: A case study in Peru

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Abstract

This thesis examines relationships between gender, family structure and childhood overweight and obesity. Children in developing and developed countries are more overweight and obese than ever. Previous literature has mainly focused on children I developed countries, but this thesis focuses on developing countries where research literature is scarce. Data used in this research is from Young lives and focuses on 8 years old children from Peru. Peru is a country that has gone through rapid industrialization and urbanization which has changed nutrition and feeding habits. Altogether 714 children were included in the multiple regression analysis and also used in descriptive analysis. Dependent variable BMI-for-age, independent variable gender and six family structure variables were used and associations analysed. Descriptive findings indicated that boys are more overweight or obese in Peru than girls. Firstborn children and children from small- or medium-sized families are more overweight than other children. Also children with sisters and brothers, which have only few siblings or who live in an urban surroundings are more overweight or obese. Explanatory results from multiple regression analysis indicate that 4 out of 7 independent variables had positive associations with children's BMI's. Gender, number of siblings and gender composition of siblings had negative associations. Grandparent in family, birth order, living location and marital status had positive associations. Birth order, number of siblings, living location and gender composition of siblings were statistically significant with p-values < 0.05. Family size was eliminated from analysis due to multicollinearity concerns. Limitation for this study was the use of BMI measurement tool on children which cannot be completely trusted in accuracy.

Keywords: Childhood overweight, gender, family structure, Peru

Table of Contents

Table of Figures

1. INTRODUCTION

1.1 Problem statement and societal relevance

Children in the world are more overweight and obese than ever. World Health Organization estimates that 42 million children under 5 years old are overweight and 31 million of these children are residing in developing countries (WHO, 2016). According to the State of Obesity (2016), childhood obesity rates have tripled since 1980 in developed countries such as the United States. Obesity rates for 6- and 11-years olds have doubled, and obesity rates for teens have quadrupled. Developing countries are experiencing even more rapid increases in obesity and overweight rates. According to WHO (2016) majority of obese and overweight children live in developing countries and these countries have experienced 30% higher rate increases in overweight or obesity than developed countries. Without effective interventions and policies, obese children and infants will likely develop a lifelong overweight problem that will cause problems later in life. Consequences may affect not only individuals, families but society as a whole and cause economic disadvantages.

In adults, overweight and obesity are defined to be abnormal conditions where fat is excessively accumulated on the person's body. This is, at least partly caused by impaired calorie consumption and decreased physical activity (WHO, 2016). Short-term and long-term health consequences can be serious both for adults and children. Childhood obesity is associated with several high-risk non-communicable diseases such as cardiovascular diseases, diabetes, musculoskeletal disorders[1] and some cancers. According to WHO (2016), 2.8 million people die of overweight and estimated 35.8 million (2.3%) of global DALY's (disability-adjusted life years) are due to overweight and obesity. Obesity is not just a physical condition, but it affects emotional well-being of individuals as well. For example, girls can suffer from low self-esteem and behavioral problems (Stewart, 2010). Obesity and overweight can, for example, create an unintentional wall between intimate transactions in relationships (Williams & Merten, 2013).

Overweight and obesity are increasing concern among school-aged children in several developed and developing countries. Childhood obesity is widely acknowledged to be a chronic disease and not just a physical handicap. Few reasons can explain why increasing childhood obesity levels are a serious health concern. First of all, children are in increasing amounts diagnosed with life-threatening conditions such as high blood pressure, cardiovascular diseases; high cholesterol, high blood sugar or diabetes (WHO, 2016; Chan, 2016). In the past, these conditions were only met in adults (OFI, 2016). Secondly, childhood obesity can have long lasting consequences to adulthood. Obesity in childhood is associated with premature death, disability in adulthood and increased the risk to be obese as an adult (WHO, 2016).

Childhood obesity is a complex and problematic issue especially in the context of developing countries. According to World of Obesity (2016), childhood obesity is no

[1] Damage, injury or disorder of the joints or tissues in the upper or lower back and limbs (HSE, 2016).

longer an isolated problem of the high-income countries but is rapidly spreading to lower- and middle-income countries. Middle-income countries are supporting 5 billion people out of 7 billion in the world, and 73% of these people are considered poor. Middle-income countries are major players in the global growth since they count for one-third of global GDP's and are a versatile group of countries by population, size and income level (World Bank, 2016). At the same time, these countries are dealing with population health problems such as infectious disease, malnutrition, and undernutrition, so rapid increase in obesity and overweight only adds to the double burden of disease.

According to Kolčić (2012) low and, middle-income countries are also affected by the double burden of malnutrition which can be identified as an undernutrition problem among children and overnutrition problem among adults. The mechanism behind this phenomenon is rapid economic growth, urbanization, globalization, and nutrition transition. According to WHO (2016) it is not uncommon to find obesity and undernutrition in the same country, community or household. Children in low- and middle-income countries are especially vulnerable to undernutrition and obesity, because of challenging socio-economic situation of families and rapidly increasing adoption of the Western lifestyle. Children might at the same time experience nutrient deficiencies, undernutrition, and obesity and be exposed to plenty of manufactured foods that are high in fat, sugar, and salt. In other words to foods that don't meet the dietary requirements and are low in micronutrients (WHO, 2016).

In the developing countries being an individual with a particular gender may determine how a person's life unfolds and what kind opportunities or challenges they will face. Men, women, girls and boys face different types of problems and opportunities early in their life. Gender influences education, health, personal autonomy and many other aspects of the life course. Gender inequality is very present, especially in poor and less developed countries (Jayachandran, 2014). One reason for such a noticeable gender gap is cultural norms that favor males. Developing countries, where the sex ratio is skewed towards males, are described to be very patrilocal[2], and purity of women is promoted. Another aspect of gender is that women's decision-making power inside a marriage has been proven to be a major factor for the well-being of her children and herself. Children with a mother that has been empowered have improved health outcomes. This is especially important in the context of developing countries since the poorer the country is, the less likely women are allowed to take part in spending decisions of the household (Jayachandran, 2014).

Gender may play a part in childhood obesity since girls and boys are affected differently. In a worldwide scale, girls are more often overweight or obese than boys (World of obesity, 2016). Overweight and obesity might also affect girls and boys differently depending on several family structure factors such as gender composition of siblings, sibship size, birth order or family size. For example in Peru, 32% of boys and 23.5% of girls are overweight and obese (see **Figure 1** and **Figure 2** below) (World of obesity, 2016). Reasons, why childhood obesity affects genders differently, are not well

[2] Marriage pattern where woman moves and lives with the husband's family (Dictionary.com, 2016).

understood in the context of developing countries and mechanisms working behind are yet largely unexplored.

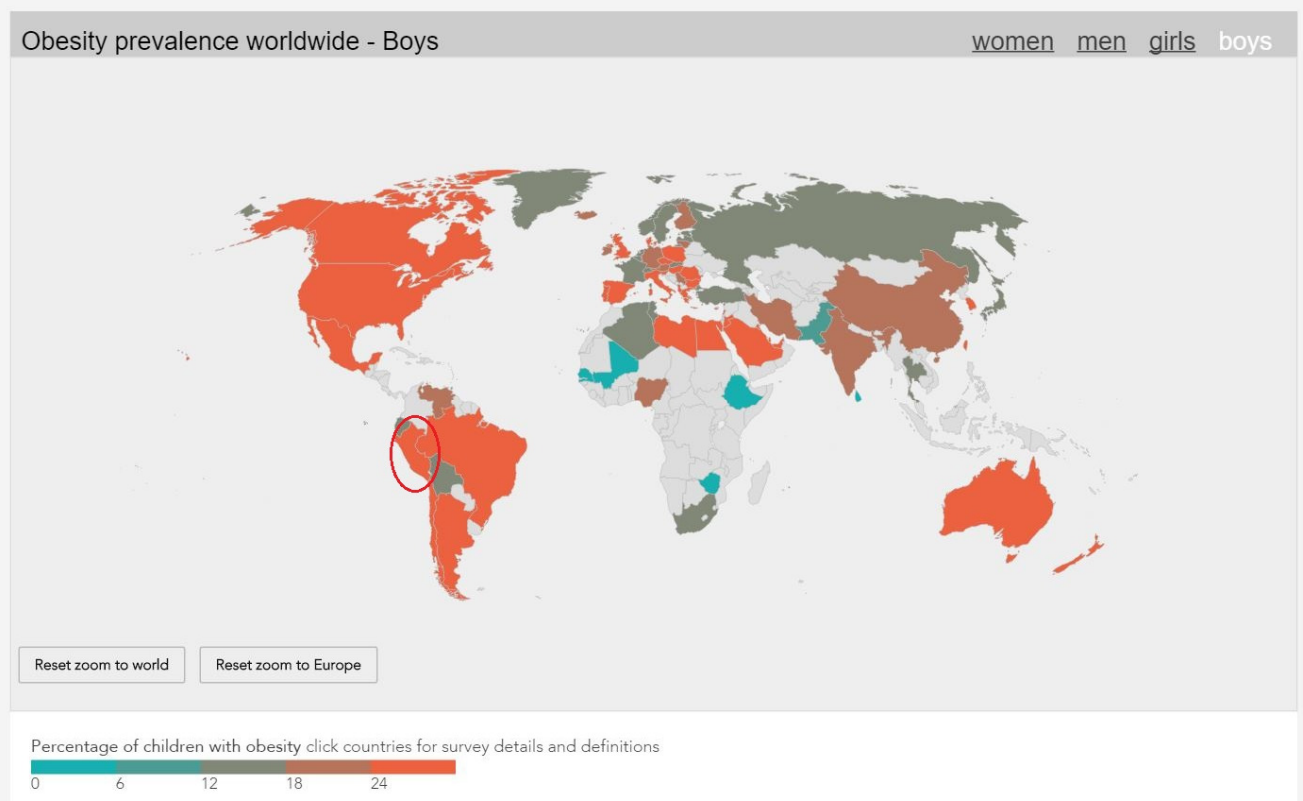


Figure 1. Obesity percentages worldwide for boys[3]

[3] Retrieved from http://www.worldobesity.org/resources/world-map-obesity/, 2015.

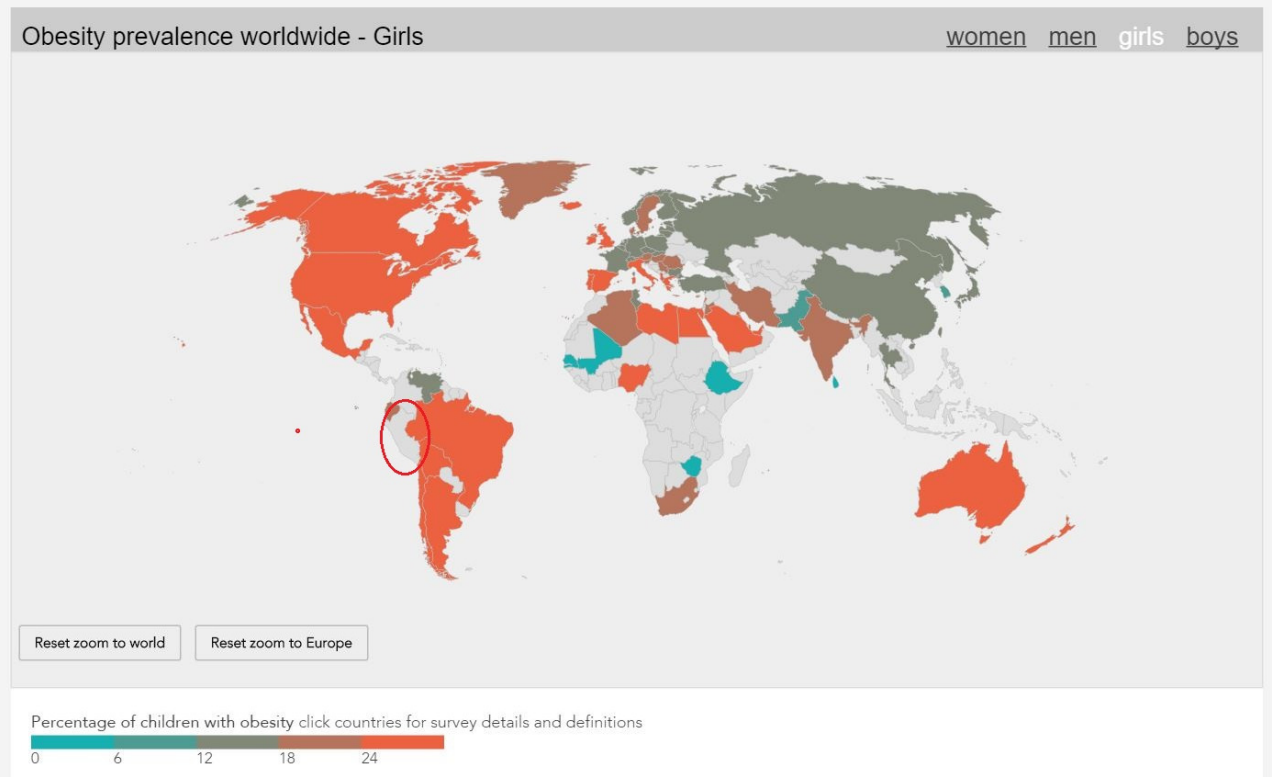


Figure 2. Obesity percentages worldwide for girls[4]

Developing countries in the middle of a transition from pre-industrial to industrial societies are prime targets for further inspection. The reason behind is that when society changes economically, technologically and politically family life changes at the same time. This is especially relevant in the case of middle income (developing) countries where patrilocal marriage pattern is changing into more modern system. No doubt that these changes affect family life also and preindustrial joint family systems are transforming into the stem and nuclear families (Winton, 1995).

Peru is one of the developing countries that is in the middle of these societal changes and is at the same time is dealing with nutritional challenges such as the double burden of malnutrition, childhood undernutrition, and childhood obesity. According to the World Bank (2016), 18% of children (under 5 years old) in Peru are underweight, and 64% are overweight and 28% obese (aged 15 and above). One explanatory reason behind may be rapid industrialization and urbanization. During the past decade, Peru has been one of the fastest growing economies in Latin America achieving in average 5.9% rate of economic growth (World Bank, 2016). Simultaneously, Peru has gone through large-scale migration from rural to urban during the 20th century. In a short period of time, Peru's population has switched from predominantly living in rural areas to over 2/3 of the population living in urban premises (Encyclopaedia Britannica, 2016). The transition from rural to urban changes food habits of families dramatically since in cities all consumed food have to be bought. In rural zones, most of the food is grown and

[4] Retrieved from http://www.worldobesity.org/resources/world-map-obesity/, 2015.

produced independently by household units. In cities, families are no longer primarily producing food, but involved in other modern activities (Den Hartog et al., 2006).

Despite societal changes, family plays a major role in lives of children in Peru. It is very common for children to live with extended family members and approximately 40% of children live in households that have other adults present than their parents. Children are especially likely to be affected by their relationships with other adults for example grandparents. The reason for this is that children's lives are lived interdependently with parents, siblings and other kin members. Family living arrangements and absence or presence of extended family members shape the course and context of children's lives and can particularly affect children's access to human resources such as good nutrition (World Family Map, 2016). Many influences are also transferred from generation to generation through the intergenerational transmission. According to D'Addio (2007) intergenerational transmission extends to several different education, care, and health outcomes. A wide range of family characteristics shape family generations and can increase or decrease the chance of certain health outcomes for children. Since family is such an important influencer in child nutrition outcomes, it is justified to state that family structure may be an important factor to explain why children in Peru are getting more overweight and obese.

From a demographic point of view, Peru is a good target for further research. Peru is one of the world most populated countries with a total population around 31.1 million people. In worldwide scale, Peru ranks as a 44th largest country and in South America 4th largest country (WPR, 2016). Peru also has a large population of children. 27.3% of the whole population are children aged between 0-14 years (51% boys and 49% girls) (Index Mundi, 2016) (see Figure 3 below). These children are especially vulnerable to inadequate nutrition and nutritional deficiencies. According to World of Obesity (2016) 32% of boys and 23.5% of girls in Peru were overweight (including obesity) year 2009. This indicates high levels of childhood obesity that are catching up with obesity prevalence in the United States which is considered the flagship of the obesity epidemic (Frank, 2016). When considering the size of the country, the size of the child population, rapid urbanization, and high childhood obesity levels it is easy to see that Peru is a prime target for a closer look and further research on the issue. It is also most evident that ensuring good health among this population group ensures good future for the whole economy (World Bank, 2016).

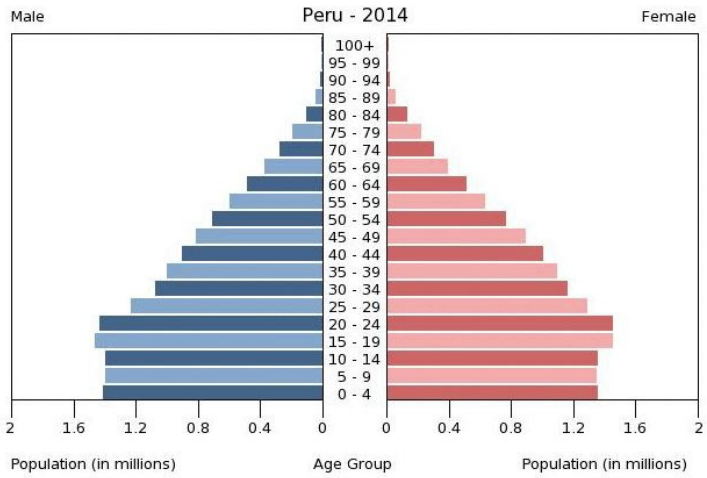


Figure 3. Population pyramid for Peru, the year 2014[5]

In the light of previous information, it is clear that childhood obesity is an important scientific and societal problem in developing countries and a large body of previous research focuses on descriptive statistics and prevention strategies but does not examine the root of the problem. Prior research lacks the knowledge and understanding of how gender and family structure mechanisms actually work and how they influence childhood obesity. Family structure and its components are yet largely unexplored, and several of its components have not been looked at separately. Family size, marital status of parents, sibship size, birth order and gender composition of children are all factors belonging to family structure and are associated with different nutritional outcomes on children (Miller, D. & Nepomnyaschy, L., 2013). These family structure components may influence childhood obesity, but prior studies have been inconsistent with their findings. Firstly, there is a knowledge gap in the prior literature that would have tested all of these factors in association to childhood obesity in one single study. Secondly, prior research lacks information how these factors play out in the lives of school-aged children. And thirdly, knowledge gap in prior findings remain in the area of whether these factors positively or negatively influence childhood obesity. New research is desperately needed.

However, it is also important to understand childhood obesity and its mechanisms for several other reasons. Firstly, obesity seems to occur differently in different social groups. Important differences are being exhibited especially across different genders. According to Wells et al. (2012) when looking at both genders separately there were 3 obese women for every 2 obese men. They also found that obesity seemed to be more prevalent in countries where gender inequality was present.

Secondly, family structure plays a key role in the healthy physical development of children and changes in family structure such as divorce or death of a family member may work as causing trajectories for children to develop unhealthy BMI's (Schmeer, 2012). Children's lives are inevitably linked to their parents, siblings and other adults in the family. A wide range of other structural differences in the family may have an impact

[5] Retrieved from http://www.indexmundi.com/peru/age_structure.html, 2016.

on childhood obesity. Birth order, sibship size and gender composition of siblings can have a profound impact on how children are treated and how for example food allocation or other investments on children are made in the family. According to Salmon et al. (2011) mothers are likely to favor female children in mixed sibships. Parents may also favor according to birth order, and firstborn or lastborn children are perceived to be more likely to receive favoring treatment. Sibship size may be an important factor influencing healthy body weight and according to Hirotaka et al. (2012) in Japan a large number of younger siblings decrease chances for overweight. The Same study identified that being the only child in the family or having a small number of a sibling would increase chances for childhood obesity. Gender composition of siblings may either have increasing or decreasing effect on childhood obesity chances. According to Rohini (2003) in India children that have multiple same-sex siblings have worse health outcomes and favoritism[6] towards boys persists despite changing cultural norms.

Thirdly, the family is in the center role when preventing or treating a child's overweight or obesity. According to Stewart (2010) successful childhood obesity interventions put a lot of weight on the family and that the whole family has to be taken into account when trying to manage the weight problem of a child. Inheritable behaviors and genes may increase chances for overweight or obesity. In-Iw & Biro (2011) found in their study that genetics account for 40-60% of the individuals BMI. Genes that direct individuals towards obesity interact with other genes that are linked to environment, nutritional and behavioral factors that may have been learned in the nuclear family. Concerning well-being of children in developing countries, it is important to take care of their health. A good and healthy start in their life will benefit the whole economy and reduce problems in future when they become adults.

Fourthly, childhood obesity has society level consequences which can have an effect on the economic productivity of a country as well as burden health care system. According to WHO (2016), 2.8 million people die each year because of being overweight or obese and an estimated 35.8 million of the global DALY's are due to overweight and obesity. Mortality rates increase steadily when degrees of overweight and obesity rise. Another source claims that societal consequences of obesity are multidimensional ranging from booming health care expenses to losses in labor efficiency. (Lavizzo-Mourey, 2009).

In this thesis, Peru will be examined in the light of childhood obesity and data from Peru will be used for further research. The focus of research will be on childhood overweight and obesity in lives of school-aged children. School-aged children are chosen because these two health conditions can have a major impact on their lives in the present moment as well in the future. According to Lavizzo-Mourey (2009) obese adolescents are more likely not to succeed in their studies and miss classes more often. Another reason for choosing school-aged children is that obesity and overweight prevalence is observed to be highest among school children (aged between 2-17 years) in urban areas in India (Midha et al., 2011). And as a last, small body of research literature

[6] Unfair support shown to one person or group, especially by someone in authority. Definition retrieved from http://dictionary.cambridge.org/dictionary/english/favouritism 3 October 2016.

addresses school-aged children in developing countries and focuses on what kind of impact overweight and obesity can have in their lives.

2. OBJECTIVE AND RESEARCH QUESTIONS

The objective of the research is to investigate the relationship between child's body mass index, gender, and a several family structure factors.

This research project explores reasons and factors behind childhood obesity epidemic and risks for its development through the lens of the life course. Differences between gender and childhood obesity are investigated by looking at the influence of several social factors and one location factors. Social factors chosen for this project are family size, sibship size, birth order, gender composition, marital status of parents which are all part of the family structure. Location factors chosen for this research project are rural and urban. These factors together with gender have been indicated to be the most relevant indicators to do research on even though combined effect on childhood obesity is yet unexplored.

Once we understand why childhood obesity is becoming more prevalent and what factors contribute to it, we might also better understand reasons and bigger picture behind the obesity epidemic. This can help others in the same field to understand why it is happening and smooth their way of finding effective interventions and ways to address and stop the epidemic.

2.1 Objective

To understand the family structure and gender influence on childhood obesity. To understand and improve knowledge on why children are getting obese at younger ages and why girls are more often obese than boys. To find out which family structure factors contribute to childhood obesity and which not. To identify negative and positive associations between these factors.

2.2 Research questions

In relation to the objective of the study, the following general research question was formulated:

"How does gender and family structure (and the relation between them) have an influence on childhood obesity development in school-aged children?"

In this study, the conceptual framework of family structure and gender will be used to answer the general research question. The Young Lives: an International Study of Childhood Poverty round 1 data (conducted 2002) (OC Household data; age 8) from Peru will be used to answer all research questions.

In total two sub-questions are formulated to answer the general research question:

1. “To what extent are children obese in Peru?”
2. “How can gender and family structure explain obesity chances in childhood?”

2.3 Data

Data from The Young Lives: an International Study of Childhood Poverty (round 1 data on 8 years old children) will be used to conduct a logistic multivariate regression analysis and answer all research questions. Several gender and family structure factors that are linked to childhood obesity in prior research are being used and examined more closely.

3. CONCEPTUAL FRAMEWORK

3.1 Thesis framework and dimensions

Based on prior research the following framework (see Figure 4 below) is created which identifies the most important family structure and gender factors that may have an influence on childhood obesity and overweight. Prior research has found proof to support that each of these factors either negatively or positively influence childhood obesity and its development. Prior studies lack knowledge on how all these factors influence school-aged children’s lives in developing countries and more research is needed. This research paper focuses solely on these dimensions and attempts to find out how exactly family unit and gender influences a child’s well-being and health.

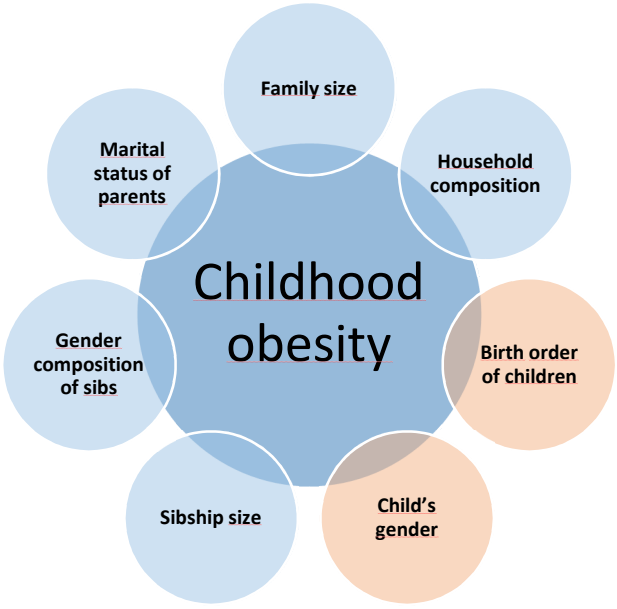


Figure 4. Thesis conceptual framework

4. GENDERED OBESITY

Gender may influence childhood obesity, and a large body of prior research elaborates on the topic. In prior research, gender is strongly associated with obesity, and since obesity has increased for boys and girls, equally it is important to acknowledge differences in consequences and causes for each sex. According to a study made by Wells et al. (2012) in the United States, there are three obese women for every two obese men. The Same study found significant evidence to support gender differences in the worldwide distribution of obesity. The situation is very similar in Latin America and study made by Mertorell et al. (1998) indicates that women have similar obesity levels in Mexico as in the United States.

Different societies have different distributions for overweight and obesity between sexes. In developed countries, women tend to be more inclined to be overweight whereas in developing countries boys tend to be more often overweight or obese (World of obesity, 2016). Several studies found that being a female increases risk of becoming overweight and obese (Wells et al., 2012; Martin & Lippert, 2012; Garg et al., 2010). The study made by Martorell et al. (1998) found evidence to state that obesity was 10-20% more common in girls than boys in Peru. Another study supports this finding and states that females had higher scores on obesity prevalence than males which may indicate that gender has an impact (McArthur et al., 2001). The reason behind may be gender inequality. United Nations reports that for example in Peru gender inequality index is 0.406 for (where score 1 indicates ideal situation) which indicates high levels of lost potential in human development due to gender inequality (UNDP, 2016).

Several reasons can explain obesity differences between sexes. One explanation for this is differences in body composition between females and males. Significant proof has been found that body fat patterns, fat levels that impact health, resisting energy expenditure, energy consumption and ability to exercise are factors that differentiate sexes from each other (Sweeting, 2008). Another study found similar proof that boys and girls indeed differ in patterns of weight gain, body composition, hormone biology and specifically in certain environmental, genetic, ethnic and social factors (Wisniewski & Chernausek, 2009). The second explanation for differences between girls and boys was identified in a study made by Campbell (2007) where girls were more likely than boys to consume unhealthy foods such as sweet snacks or take-out food when having conflicts with other family members. Another study enhances this finding and states that parents may have different restrictive feeding practices based on child's sex. Association was found for girls to consume food more often when not feeling hungry than boys (Fisher & Birch, 2002). Last explanation for gender differences can be cultural, gender-based disparities in the allocation of food inside the household and dietary behavior differences between the sexes (Aurino, 2016). According to Aurino (2016) in India, females are in a disadvantaged position in regards to food allocation and do not receive the same quality of food as males. Pro-boy attitudes in intra-household food allocation may lead to worse health outcomes for girls.

In the context of developing countries, gender inequality can also explain the differences between sexes. The study made by Rohini (2003) found that In India boys and girls are not treated equally in families and that preference for sons is high. They argued that parents might discriminate children based on gender and this would explain why some children are worse off than others health wise. Parents might desire a certain sex composition of children in the family and therefore prefer sons for daughters.

Little attention has been directed to the prior body of research literature to explain how these gender differences play out within the family structure. Family structure is inevitably influenced by individuals that live in it and that are born to the core or extended family unit. According to Santow (1995), it is very common for gender distinctions to be reinforced through feeding practices in the family. Females are more often eating less or less well than males. For example in Egypt, India and Nepal males eat first and often obtain larger portions of food than their sisters or other females in the family. It is not clear whether females are reinforcing these habits in families themselves or participating involuntarily (Santow, 1995). Same gender-based differences in eating patterns can already be seen in lives of small children. Gender composition of a family may affect even the earliest feeding practices of children. According to Khan et al. (1989) in some cases, small girls were breastfed less and shorter period of time than boys. Birth order may affect feeding practices as well since the same study found that girls were less well fed when they happened to be born first and parents had pressure to conceive son as a second child. The Same study distinguished that son often received more nutritious and special proportions of foods than daughter which would indicate a higher risk for malnutrition among girls in families (Khan et al., 1989). Another study indicated that In India males consumed more calories and protein when compared to girls and found evidence that malnutrition and nutritional deficiencies are more common among girls than boys (Bairagi, 1986).

However, some studies suggest that gender would not be a significant factor in obesity, but that differences are marginal and not really worth noting. The study made by Sweeting found evidence to support this. According to Sweeting (2008), obesity level differences between females and males are very general when compared to each other. Another study observed higher overweight prevalence among school-aged boys, but not girls (Midha et al., 2011). The study made by Yang (2007) in China even indicates negative association and that being a female would reduce overweight risk. A research paper from Gaiha (2010) supports this finding and claims that girls in India are less likely to be obese than boys.

Based on previous research findings, females in developing countries are consistently worse off nutrition wise than boys. Girls are considered to be in an unequal position with boys due to cultural norms and persistent gender inequality. Girls may eat smaller portions of food or eat less nutritious foods. This type of pro-boy favoring in food allocation may lead up girls to have worse health outcomes and may cause girls to be more vulnerable to undernutrition, malnutrition, overweight and obesity.

Therefore, the hypothesis is:

Hypothesis 1: Girls are more overweight or obese than boys

5. FAMILY STRUCTURE

5.1 Household composition

Family plays an important role in children's lives. Many essential cultural habits and behaviors are learned within families. Family structure may influence childhood obesity chances. According to Ryan et al. changes in family structure early in life can predict children's behavior in later life (Ryan, R. & Claessens, A., 2012). Fundamentally, each family is a unique interpersonal system with its own belief system, actions, and meanings (Muncie et al., 1995). Each member of the family may have their own perceptions and actions that may interact with other members lives for example children's lives. Prior studies lack in knowledge how family structure and its various compositions influences children's obesity chances in developing countries. New research is desperately needed.

Few reasons explain the importance of family in developing countries. These reasons are related to cultural heritage and gender inequality. First of all women and men are treated differently especially in countries that were formerly poor. According to Jayachandran (2014), GDP and gender-inequality are inevitably related to each other. She argues that economic growth of a country has a direct impact on gender inequality. When a country grows in economic power gender gap narrows. However, other factors that define a specific society needs to be taken into account. Each country has its own unique cultural label and customs that direct lives of men, women, girls and boys. According to Inglehart & Carballo (1997), cross-cultural differences matter because these differences can be seen as a catalyst for different types of behavioral consequences. People in developing countries may behave in a completely different way than people in the developed countries. The reason behind it may be different worldviews and values. Specific historical events may shape developing societies and produce new cultural implications.

It is safe to say that in a family of origin children learn consumption behavior through interdependent relationships with relatives and perhaps parental or sibling modeling. New consumerism talks about consumption as a rather social, but not so much independent behavior from surrounding influences such as marketing or advertisements. French sociologist Pierre Bourdieu stated that social patterning of consumption and taste is embedded and learned through family socialization process and educational influences. These two determinants were identified to have a high impact on wide range of cultural goods consumption such as food, clothes and home furniture. Individual can either lose things, gain things or access things through consumption activities. Jobs and social circles can change based on choices of the individual. Business opportunities can be opened through expressing accurate tastes, manners and/or culture. This model explains why it is so important for people to invest

in consumption activities and goods. It also illuminates why inequality should be considered as a focus point when thinking about consumption activities in families. It might explain why certain gender or population groups are more sensitive to (for example) obesity (Schor, 1999).

Family influence matters in the context of childhood obesity, because family is identified to be key when preventing or treating childhood obesity. According to Steward (2010), family lifestyle change is recommended widely as an effective prevention and intervention method for childhood overweight and obesity. Another study supports this finding and states that key prevention method is lifestyle modification for the whole family (Seth & Sharma, 2012). Lifestyle change interventions can consist recommendations such as increased physical activity, reduced screen time, use of low-energy snacks and avoiding sugary juices. When lifestyle change is not sufficient, enough then other more radical measures are recommended such as anti-obesity drug therapy or bariatric surgery, but side and long-term effects are not well-known for these (Stewart, 2010).

Family structure is an entity in itself, but it consists several components that can be looked at separately. Family size, marital status of parents, sibship, birth order and gender composition of children are all factors belonging to family structure and are associated with different nutritional outcomes on children (Miller, D. & Nepomnyaschy, L., 2013). These family structure components may influence childhood obesity, but prior studies have been inconsistent with their findings. Firstly, there is a knowledge gap in the prior literature that would have tested all of these factors in association to childhood obesity in one single study. Secondly, prior research lacks information how these factors play out in the lives of school-aged children. And thirdly, knowledge gap in prior findings remain in the area of whether these factors positively or negatively influence childhood obesity.

However, most common and dominants form of a family is a nuclear family where parents live with their children as one unit (Muncie et al., 1995). A nuclear family, when complete, consists of a husband, a wife, and their children who are either biological or adopted. Interpersonal dynamics that work within a nuclear family are greatly affected by influences that come from other social networks. Therefore, a nuclear family exists inside an extended family network (Winton, 1995). According to De Vos (1995), 24-32% of households in Latin America are complex[7], and 30-43% of all people live in complex family households. This reveals us that extended family members are important and often welcomed to live together with nuclear family members. Extended family includes grandparents, great-grandparents, aunts, uncles, cousins, nieces, nephews, and in-laws. Extended family members can be connected by blood or marriage (Winton, 1995).

A traditional household in Peru is a nuclear family which consists of husband and wife with their children, and average household size is 5.1 people in urban areas and 4.9 people in rural areas. Depending on economic resources couples may either move

[7] Extended and multiple family households which include at least two closely related couples living together.

away and form their own nuclear family unit or continue to live with one of the partner's families. Peruvian families usually follow a patrilineal system where wives belong to husband's side of the family tree, but extended families may also consist wife's kin members. The family unit is strongly centered on the father as a head of the family. However, women have increasingly occupied household head role due to economic pressure and resource scarcity. In Peru approximately, 20% of households are run by a female as a household head (Every Culture, 2016; Country Data, 1990).

In a family unit, separate roles are very important between members. Traditionally, father is head of the family (Hudson, 1992) (IIYH, 2016). However, in Peru women are seen more frequently in different types of jobs due to economic pressure and need to support family together with husband. Girls and boys in families are treated differently and according to traditional gender roles. Women are often managing internal affairs of the household by giving tasks to children and perhaps female servants. Men are exercising authoritarian power by managing the family budget, keeping up discipline, maintaining good relations with the outside world. Second explanation refers to economic and educational advantages that can be only acquired through family, community or perhaps other religious connections. In Peru, religion is a major part of family life. Most Peruvians are Roman Catholic (81.3%) (Country Reports, 2016) and therefore religious ceremonies are an obligatory part of social life and also celebrated elaborately with small fiestas among families. Godparenthood is perceived in special importance. Godparenthood is more than a religious sacrament and parties involved are expected to make a bond for life. A godparent is perceived to act as a sponsor and a protector who ensures child's well-being. Godparents may assist with education, in job hunting or in other ways. Godchild is expected to form a friendship with Godparents and respond to favors that might be asked by Godparents. In Peru school is very important and main job of children. Success in school work is kept in high value, and if the child does well, then it is very likely that he/she will be assigned to private school later on (Hudson, 1992). Which again might mean better future job opportunities and connections for children (Nations Encyclopedia, 2016).

According to World family map (2016), 45% of Children in Peru are living together with other kin members than parents. Ideally, children live in so-called 'stem' family households where three adjacent generations live together, but extended families can take several other forms in Latin America. Many households' types can be called complex, and they may contain different compositions of family members (De Vos, 1995). In Latin America children may live with large extended families where several generations live under the same roof (Hudson, 1992). Children's lives are linked to influences from grandparents, aunts, uncles and cousins (World Family Map, 2016) (see Figure 5 below).

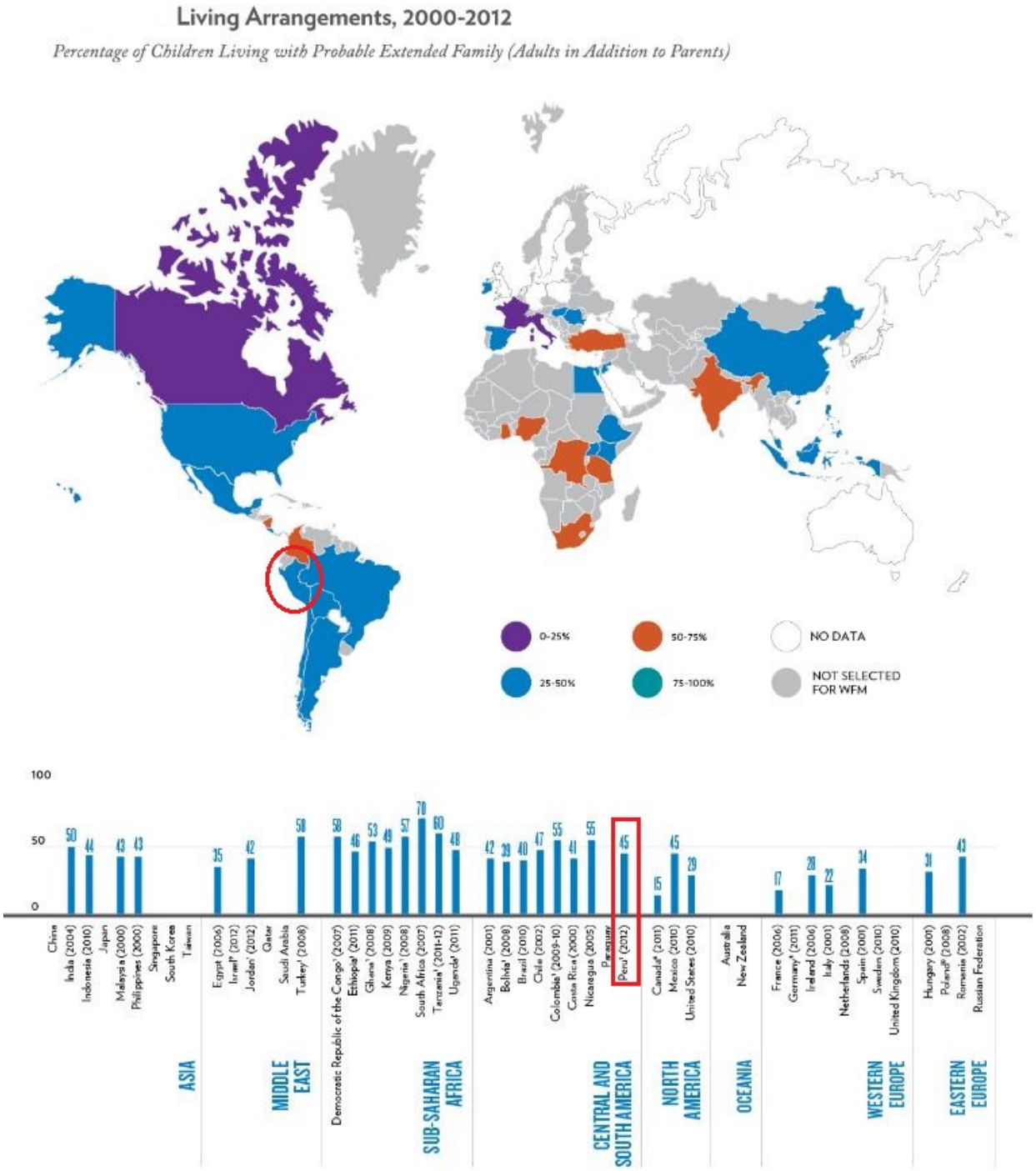


Figure 5. Percentages of children living in extended families in Peru[8]

Children's experiences in a family system that includes extended family members can be very different from other family member's experiences. This way of interacting with other kin members may even be more common, especially in developing countries

[8] Retrieved: http://worldfamilymap.ifstudies.org/2014/articles/world-family-indicators/family-structure

where scarcity of resources, jobs, and income acquires families to develop different types of support networks. It might also be that certain jobs are only accessible through family (De Vos, 1995). Sometimes extended family members can have a very powerful influence over what is going on within a nuclear family. Particularly grandparents can have a great influence on for example who grandchildren will marry or not marry. In-laws may have similar power and have an effect for example where the nuclear family spends holidays or vacations (Winton, 1995).

Different family members may influence children's chances to develop obesity in few different ways. Each family member may make decisions or take actions that have consequences to other members in the family unit. It is important to understand what kind of consequences certain actions may have when taken by certain family members and what kind of effect these actions may have on children. Other family members may employ functional or dysfunctional actions that either increase or decrease children's chances to develop obesity (Winton, 1995). According to Xu at al. (2011), the presence of obese parents increased the odds of a child being overweight or obese. Having an obese mother was stated to increase the likelihood of childhood overweight/obesity for girls, but not for boys. Having obese father was associated to increase the likelihood of childhood overweight/obesity for both boys and girls.

Grandparents may influence chances for obesity on children as well. According to Kime (2010), grandparents eating patterns may be more structured and therefore decrease chances for childhood overweight or obesity. The reason behind may be generational differences in eating habits and rapid urbanization. Dietary convergence[9] and dietary adaptation[10] may be the mechanisms behind changing food habits, and both of these are often characterized by over nutrition (Den Hartog et al., 2006). Another study made by Matthew et al. (2008) also confirms this and claims that grandparent's weight do not particularly influence childhood obesity on their grandchildren and children with normal-weight parents and grandparents to have the least overweight/obesity.

However, the study made by Bai et al. (2015) in China found counter-evidence to suggest that children who were either living or cared for by their grandparents had increased the risk for overweight or obesity. The reason behind was identified to be consumption of sugar-added drinks and unhealthy snacks. Children who were mainly cared for by their parents were less likely to have overweight or obesity problems.

So, I hypothesize:

Hypothesis 2: Children living with one or two grandparents are more obese than children without grandparents

[9] Increasing similarity in diets all over the world (www.fao.org)
[10] People adapt their diets according to surroundings (www.ncbi.gov)

5.2 Family size

Prior research does not clearly indicate whether family size is influencing factor in childhood obesity or not. Many discrepancies exist. Nonetheless, it is safe to say that family size may have an effect on the development of childhood obesity and prior studies indicate some level of association. According to Jacoby et al. (1975) family size is inevitably related to obesity and childhood obesity is proportionally higher in smaller families with fewer children. The reason behind this may be the absence of certain family members. The Same study found that fatherless children had different nutritional intake and quality of diet as children with both parents (Jacoby et al., 1975). Another study supports this claim and states that family size plays a role in promotion and reduction of childhood obesity (Epstein et al., 1986). However, two other prior studies found evidence to claim that household size or type of family has no strong influence on child's diet or childhood obesity development (Aurino, 2016; Gaiha et al., 2010).

Several reasons can explain family size effects on childhood obesity. The first explanation is maternal distress in larger families which might indicate that mothers have less time for each child in large families which indicates less time to take care of each child separately. The second influencing mechanism is time investment of parents in each child. Parents have less time per child in large families and more time in smaller families. According to Bras et al. (2010) when a number of children in a family increase then their well-being outcomes consistently drop. Families that have a large set of children also experience resource dilution where the presence of several siblings reduces available resources per sibling. The third possible mechanism is negative child-parent interaction in large families. According to Burgess et al. relationship with parents and children are more negative in large families (Burgess et al., 1981; Epstein et al., 1986; Zussman, 1980). Parents have less time to spend on each child and more responsibilities when supporting a large family. Other mechanisms could be the better socioeconomic status of smaller families', healthy eating habits and exercise routine modeled by parent's example (Garg et al., 2010) (Epstein et al., 1986). In smaller families, income is distributed differently, and more wealth can be invested per child. In large families income needs to be divided among several children and less wealth can be invested per child.

Prior studies have also been inconsistent in their findings indicating whether children from small or large families are more vulnerable to childhood obesity. The study made by Epstein et al. indicates that 20% of children from small families (families with only one child) were obese and only 10% of children from large families (families with 4 or more children) were obese. Another study supports these findings and claims that young men from one child families were at higher risk for obesity than men from larger families (Ravelli & Belmont, 1978) (Epstein et al., 1986). Another study reports counter-evidence and states that children from large-sized families have remarkably higher BMI and skinfold thickness than children from smaller families. Children from large families also had worse diet quality when compared to medium- or small-sized families. A study conducted by Singh & Parasuraman (2013) supports counter-evidence and reports that large size of the family was linked to the worse nutritional status of children.

Based on this prior information, the hypothesis becomes:

Hypothesis 2: Children from small families are more obese than children from large families

5.3 Birth order

Birth order of children may also be an influencing factor in childhood obesity. Few prior studies address birth order of children and its direct influence on childhood obesity. Prior research has linked birth order with different intra-household food allocation practices, parental preference between children and different human capital investments on children (Behrman, 1986; Emerson, P. & Souza, A., 2007). Prior research has mostly concentrated on birth order and other child outcomes, so scientific research gap remains in the area of birth order and childhood obesity outcome.

However, a study conducted by Hirotaka et al. did find evidence to say that being the youngest child would increase the possibility for obesity (Hirotaka et al., 2012). Many other studies support this and indicate that earlier born children have better human capital and nutritional outcomes (Emerson, P. & Souza, A., 2007) (Behrman, 1986) (Horton, 1988) (Price, 2008). One mechanism explaining this is that parents simply have more time to invest in earlier born children when the time was not allocated with other siblings (Emerson, P. & Souza, A., 2007).

Another study indicates otherwise. According to Salmon et al. parents might not favor only earlier born children, but firstborns and lastborns equally. One reason for this is that firstborn children have highest reproductive value and have survived longest which makes sense in the context of developing countries where older members of the family are kept in higher value. The reason for favoring lastborn children might be their more vulnerable status in general when compared to firstborns or middleborns (Salmon et al., 2011).

Few reasons can explain why the birth order of children matters in the context of childhood obesity and family structure. First reason is hierarchical nature of the societies in developing countries (such as Peru) which is also important inside families (IIYH, 2016). Older children are treated differently based on age and gender. Formal respect is important in relationships among children and their parents so age differences are noted, and younger children might even learn to address older children rather formally (Asia Society, 2016). The second explanation is that parental bias would be influencing mechanisms behind the different treatment of children. According to Behrman up to 12% of parents in India favor earlier-born children which indicate that later-born children are more vulnerable to food scarcity (Behrman, 1986).

Thus, the hypothesis is:

Hypothesis 3: Firstborn children are less obese than other children

5.4 Sibship size

Few studies have focused on childhood obesity and sibship size in developing countries. Several studies talk about differences between siblings and resource allocation, but not specifically how a number of siblings influence childhood obesity as an outcome. Research gap remains in this field, and new information is needed.

A number of siblings may influence childhood obesity development. According to Yang and Hirotaka sibship size is a related factor that influences overweight or obesity risk on school-aged children. (Yang, 2007) (Hirotaka et al., 2012). Another study made by Yao indicates that sibship size can have a negative influence on children's material and non-material resources such as food and parental time. The reason for this is that resources get more scarce when sibship size increases which can indicate lower quality of food for certain children in the family and may lead to overweight or obesity in childhood (Yao, 2005) (Downey, 1995). Another reason is that parents may make a difference between siblings and provide extra food to the preferred child in a sibling group. Higher quality food may be allocated according to gender, age or both (Aurino, 2016).

Prior studies have been inconsistent in their findings whether children from large or small sibling groups are more at risk to develop childhood obesity and what kind of influence (negative or positive) can be expected based on sibship size. One study found that having more than two siblings can have a negative influence on overweight development (Yang, 2007).

Having no siblings at all may have an influence on childhood obesity also. According to Yang children with no siblings had a higher incidence of overweight when compared to other children. Single children aged between 7 and 12 had an overweight prevalence of 15.4% whereas children with siblings had only 10.8% prevalence (Yang, 2007). Two other studies state that childhood overweight is associated with being the only child in the family and that there is a negative association with a large number of younger siblings and overweight (Hirotaka et al., 2012) (Hunsberger et al., 2012). A small number of siblings may influence childhood obesity also. According to Hirotaka et al. a small number of siblings would increase risks for obesity (Hirotaka et al., 2012).

Therefore, I hypothesize that:

Hypothesis 4: Children with small number of siblings are more obese than children with large number of siblings

5.5 Gender composition

Few prior studies have focused on childhood obesity and gender composition within the family. The scientific gap in prior research is identified in this area, and further research is needed on the subject. However, one study offers findings that can be used for further research.

Having certain sex siblings may influence childhood obesity. The study made by Yang did find a negative association between having a brother and being overweight. The Same study found that having a sister had a positive association with overweight (Yang, 2007). Few reasons can explain this. First of all, parents might desire a certain sex composition or sex balance of children in the family and children born after multiple same-sex siblings might be given a different treatment of the family unit. Second, of all, parents might discriminate children based on gender alone and prefer sons for daughters which seem logical in the context of developing countries where the family in considered very important and gender inequality is high.

So, therefore I hypothesize:

Hypothesis 5: Children with a sister/sisters are more obese than children with brother/brothers

5.6 Marital status

Marital status of parents may be an influencing factor in childhood obesity. According to a study made by Biehl et al. (2014), family structure changes may be a cause for higher childhood overweight and obesity prevalence. An increasing number of parents are either divorced or cohabiting. The Same study found evidence that overweight (incl. obesity) was more prevalent among children that had divorced parents when compared to children with married parents. Reasons behind may be socioeconomic resources, values and psychological characteristics which may have an effect on eating patterns after the divorce has occurred. The family is getting used to new life circumstances and new food behaviors (Biehl et al., 2014). Another study indicates that children experiencing family breakdown have an increased risk of obesity two years before and after breakdown (Arkes, 2012). Few economic and social reasons can explain this. Married couples tend to have better and more stable economic situation than divorced or single parents. Better economic situation indicates better income, less economic pressure, and more resources. More economic household resources might mean that children have better access to healthier foods, safer neighborhood and more leisure activities (Schmeer, 2012; Grow et al., 2010; Lopez, 2007). Two parent households have more time to spent on eating/preparing meals, eating meals at regular times, leisure activities and going to bed at regular times (Anderson & Whitaker, 2010). However, one study found counterevidence and argues that marital status would not be associated with risk of obesity (Gaiha et al., 2010).

Having just one parent or living with a single parent may influence childhood obesity. According to Miller et al. single mother households had highest food insecurity, marries-couples household lowest and cohabiting households were somewhere in between these two (Miller, D. & Nepomnyaschy, L., 2013). Another study supports this claim and found that children living with their mother who did not have a new partner had increased the risk to become overweight or obese (Schmeer, 2012). Several reasons for this can be identified. When marital breakdown occurs mothers experience stress,

depression, may neglect their children and be more insensitive towards their children (Stenhammar et al., 2010). At the same time, some studies suggest that single mothers have harsher parenting styles and worse mental health (Klausli & Owen, 2009) (Meadows et al., 2008).

So, I hypothesize that:

Hypothesis 6: Children from broken families (divorced, separated, single or widowed parents) are more obese than children from married families

6. METHODOLOGY

In this section, the methodology of the study will be described and outlined. Firstly, study design will be explained in more detail. Then, a conceptual framework will be operationalized. Next, the method of data collection and analysis are described.

6.1 Study design and data

To answer the research questions, a quantitative study will be conducted. Data from Young Lives is being used to answer all research questions. This study has good quality data that can be used and applied to general and sub-research questions. The main interest of this study is in school-aged children in developing countries and their obesity levels. Dataset offers information on several countries which are Ethiopia, India, Vietnam, and Peru. Only data from Peru will be used in this study, and it was chosen, because of the size of the country and based on background research which indicated that childhood obesity prevalence is in a steep rise in many areas of Peru (World of obesity, 2016). Survey round 1 was conducted 2002 and in this study, the household level data on children 8 years old will be used for analysis.

For the quantitative method, the Round 1 (conducted 2002) (OC Child level and Household data; age 8) from Peru will be used. This survey includes information on household composition, births, and deaths in the family, caregiver's background, socioeconomic status, social capital, and anthropometry. Each survey is specifically constructed for each survey round, and it aims to capture changes in household circumstances and children's lives as they grow up. Core questions stay the same, but according to the target country, different sections may be added to illustrate and capture particular relevant changes within the family and that specific culture (Young Lives, 2016).

In total, the Young Lives has been conducted 4 times between years 2002-2014. Approximately 12 000 children and their families are questioned every three years. The survey is built from three different main elements which are a child, a household and community questionnaire. Household questionnaire data is similar to any other cross-sectional dataset, and it covers a wide range of topics and is supplemented with extra questions. The questionnaire also covers children's daily activities, experiences, and

attitudes towards work and school, some of their likes/dislikes as well as hopes, aspiration and how they feel people are treating them (Young Lives, 2016).

6.2 Operationalization

In this section, the operationalization of research questions is described. In the following table, conceptual framework and connected research questions are presented with their dimensions. For each dimension, the indicators and level of measurement are given (see Figure 6 below).

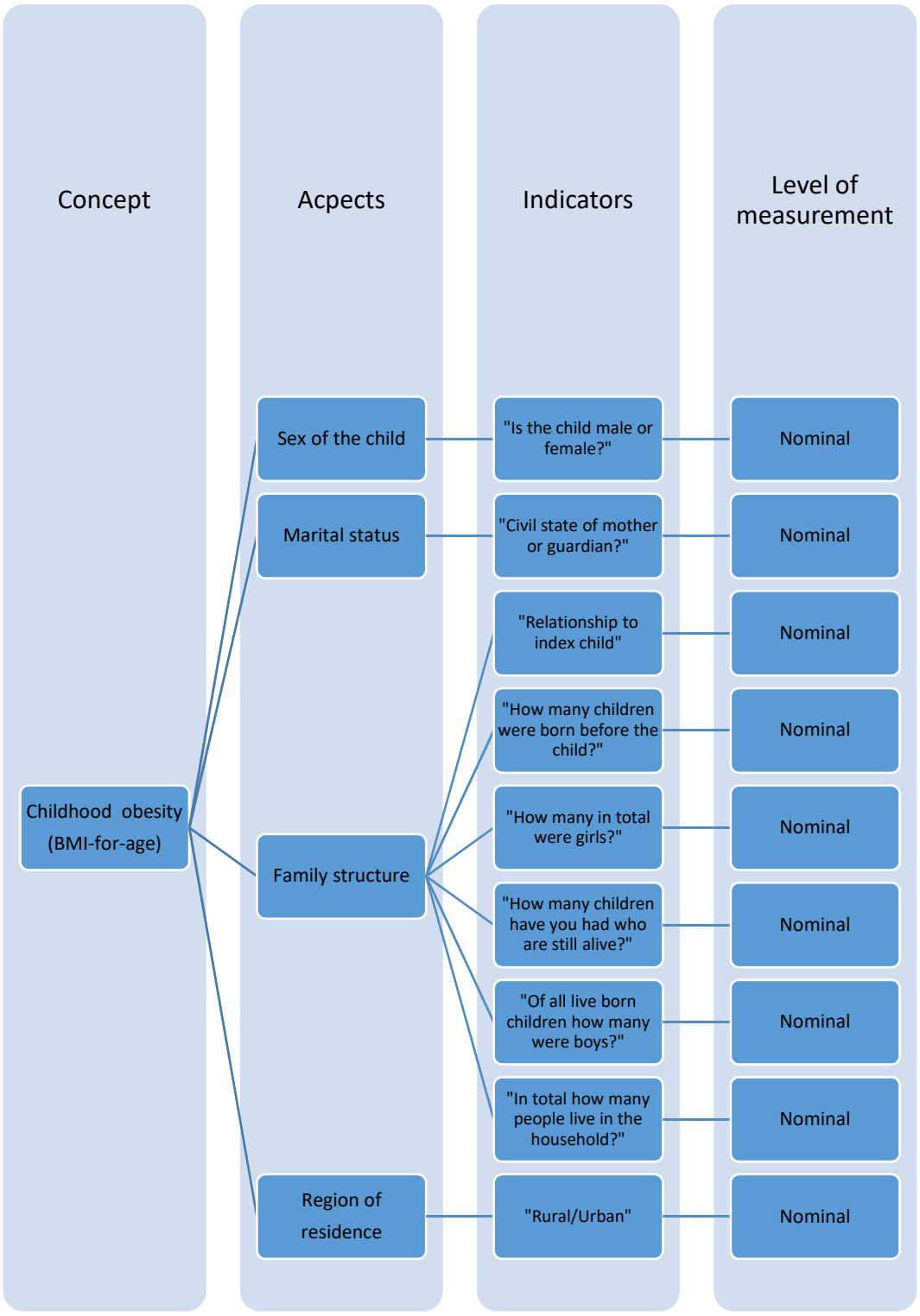


Figure 6. Operationalization of research concept

Childhood obesity is assessed by using BMI-for-age measurement. Obesity and overweight can both be measured and determined by body mass index (BMI) which takes into account individuals proportions (height and weight) (WHO, 2016). BMI is a

reliable screening tool to determine obesity levels in large adult or child populations (Janiszewski, 2016). Overweight and obesity affect children in a similar way as adults, but for children, these conditions are determined by BMI-for-age measure instead of simple BMI. BMI is calculated by dividing individuals weight (kg) by height (m) in meters squared. For children, BMI differs by age and gender, so BMI-for-age is calculated differently for each age. BMI-for-age can be used from 2 years on until children are up to 20 years old. BMI-for-age is calculated in a similar manner as for adults but compared to growth charts by gender and age (CDC, 2016). In general terms, the child is considered to be overweight when BMI-for-age is at or above the 85th percentile and obese when at or above the 95th percentile. Different charts are being used for girls and boys separately.

Data from the Childhood Poverty study is used, and anthropometrics are used to determine the BMI of selected children. In the study “weight” and “length” of the children are measured, and BMI-for-age is calculated for each selected child (Young Lives, 2016).

In the survey, gender and age of selected children are recorded based on the answer of the main caregiver of the child. Minimum entry in the data is “month” and “year” when the child was born. The main caregiver is also asked to answer a question about child’s gender. Gender is simply marked to be either (1) “female” or (2) “male” (Young Lives, 2016).

In the questionnaire section “household composition” the marital status of parents is recorded. Main caregiver of child is asked to state what their marital status is of the following options; (1) “Married”, (2) “Living together”, (3) “Divorced”, (4) “Separated”, (5) “Widowed”, (6) “Single”, (8) “N/A” or (9) “NK” (Young Lives, 2016). In the same section, household size is recorded by asking child’s main caregiver to state number of people living in the household. Simply number is recorded.

In the same section, family size is recorded in the form of household roster. For each child in family sex, age and relationship to the selected child are recorded. Roster records all members in household and indicates each members’ relationship to selected child with the following options; (01) “Biological parent”, (02) “Partner or biological parent”, (03) “Grandparent”, (04) “Uncle/aunt”, (05) “Brother/sister”, (06) “Cousin”, (07) “Domestic servant”, (8) “Lodger”, (9) “Nephew/Niece”, (10) “Half-sibling”, (11) Brother/sister-in-law”, (13) “Other” or (99) “NK” (Young Lives, 2016). This data will be used to deduct new variable so that hypothesis for household composition can be tested.

In questionnaire section ‘Births and deaths,” number of children and their gender is recorded. Mother is asked to state how many children are still alive and how many of them are boys and how many girls. Simply a number is recorded. In the same section, birth order of children is recorded. Mother is asked to state how many children were born before selected child. Just a number is recorded (Young Lives, 2016). This data will be used to deduct new variable in order to test sibship hypothesis.

Area of residence is recorded separately outside of questionnaire, and it is recorded in data. In data “Region of residence” is recorded and chosen from the following options (31) “Coast”, (32) “Mountain”, (33) “Jungle” or (88) “NA”. Also “Type of site” is recorded and marked to be either (1) “Urban” or (2) “Rural” (Young Lives, 2016).

6.3 Data collection

Data from the Study of Childhood Poverty is being used to answer the above-stated research questions. This study has good quality data that can be used and applied to the general and sub-research questions. The main interest of this study is to the school-aged children in the developing countries and their obesity levels. Dataset offers information on several countries which are Ethiopia, India, Vietnam, and Peru. Only data from Peru will be used in this study, and it was chosen, because of the size of the country and based on background research which indicated that childhood obesity prevalence is in a steep rise in many areas of Peru (World of obesity, 2016). Survey round 1 was the conducted 2002 and in this study, the household level data on children 8 years old will be used for analysis.

6.4 Data analysis

In this section, a method of data analysis will be explained in more detail. Data analysis process of the study of Childhood Poverty will be described.

Firstly, data from Childhood Poverty study will be used to describe childhood obesity in Peru. Data will be used to illustrate the state of childhood obesity in Peru and more specifically to answer sub research question: “How can childhood obesity in Peru be described?” Graphs and tables will be constructed for descriptive use either by using counts, percentages or both.

Secondly, in a multiple regression analysis will be conducted. The dependent variable is childhood obesity level measured by BMI-for-age. BMI-for-age cut-offs will be used to determine obese children from overweight and normal weight children. For girls, this cut-off will be different and for boys as well due to biological growth differences. Cut-offs are determined according to a CDC Growth Chart for 8 years old girls and boys separately (CDC, 2016).

Independent variables are factors from household and anthropometry section in Childhood Poverty Older Cohort Household survey (2002) and can be found in household and anthropometry factors. Regression model will be made from this cohort of children that are 8 years of age to measure differences between gender, family size, birth order, sibship size, gender composition and marital status of parents in relation to obesity level of children. One control variable will be used, and this will be an urban/rural location which has been associated with childhood obesity in the prior research literature.

The model will be constructed so that it can be fitted to data and that it is possible to investigate whether independent variables actually have predictive value over

dependent variable “childhood obesity”. The aim is also to investigate whether regression slopes are different for girls and boys. Model is constructed in such way that research questions can be answered and hypotheses tested. Therefore, two dummy variables are needed to measure gender and urban/rural variables. Variables need to be also combined together in such a way that their outcome levels will be reduced to fewer levels.

Thirdly, in order to compare different groups in the study (for example girls and boys from small families), additional data analysis method will be used. In order to answer these questions correctly, additional t-tests will be conducted to compare means of two different groups. The aim is to compare BMI-for-age means between two different samples (for example girls and boys) to test formulated hypotheses. In this way average obesity level of children can be determined, differences in it measured and working hypotheses answered.

7. TIME PLANNING

In this section, the time schedule and planned steps for thesis writing are illustrated in a table form. Each activity and its approximated duration are listed below (schedule includes holidays).

Planning:

Week	**Duration**	**Activity**
June/July/August	+-5 weeks	Write thesis proposal
July/August (Summer holiday)	*3-4 weeks*	*Free time*
September	+-5 weeks	Reading and organizing references/notes for background research and defining conceptual framework
October/November	+-5 weeks	Data collection & analysis: multivariate regression and t-tests in SPSS
November/December	+-5 weeks	Working with results: constructing tables and graphs (descriptive statistics etc.), reading/writing additional literature if needed
December (Christmas holiday)	*1-2 weeks*	*Break in writing*
December/January	+-4 weeks	Writing discussions
January/February	+-4 weeks	Writing introduction and conclusion
February/March	+-4 weeks	Finishing touches references etc.
Total duration:	**27 Weeks** (excl. holiday)	

Table 1. Time planning of thesis

8. DATA

Data that is being used for this thesis is from Young Lives database that gathers information on 12 000 children and their families. Cross-sectional surveys are conducted among these children every three years. Data is collected from four developing countries which are Ethiopia, India, Peru, and Vietnam. This database resembles other cross-sectional datasets such as World Bank's Living Standard Measurement Study and consists three separate sections; a child questionnaire, a household questionnaire, and a community questionnaire. Child questionnaire covers several important topics from child's weight and height to their daily activities, likes, and dislikes. Household data covers topics from child health to household composition and family livelihoods (Young Lives, 2016).

In this thesis, child questionnaire data is being used, and country of reference is Peru excluding other three countries. This data is longitudinal and is the first survey round that was collected 2002 in Ethiopia, India, Peru and Vietnam. Dataset from Peru is similar to others and OC child questionnaire and household questionnaire will be used for multiple regression. Girls and boys in the data sample are all aged between 7.5 and 8.5 years old. Each questionnaire is specifically targeted for each survey round, and the aim is to record changes in circumstances and in children's lives as they grow up. Each questionnaire has similar core questionnaire, and for each country, additional sections are added to capture specific country related information. In addition to child level data, some household questionnaire data is being used to provide information on grandparents and their involvement in the life of the specifically surveyed child. Community questionnaire is not being used for this thesis.

Table 2. Characteristics and percentages of child and household questionnaire data

	Frequency	**% Percent**
Child questionnaire		
N of children	714	
Location:		
Urban	530	74.2
Rural	184	25.8
Gender:		
Boy	386	54.1
Girl	328	45.9
Marital status of caregiver:		
Permanent partner	595	83.3
Divorced/separated	76	10.6
Single	22	3.1
Widowed	21	2.9

Household size (largest groups):

3 people	48	6.7
4 “	169	23.7
5 “	156	21.8
6 “	128	17.9
7 “	74	10.4
8 “	69	9.7
9 “	30	4.2
10 “	20	2.8

N of children born to mother (largest groups):

1 child	52	7.3
2 children	192	26.9
3 children	166	23.2
4 children	103	14.4
5 children	63	8.8
6 children	50	7.0
7 children	21	2.9
8 children	25	3.5

Household compared to others:

Better off	73	10.2
Similar	445	62.3
Worse off	191	26.8

Child’s weight compared to other children:

Heavier	129	18.1
Similar	291	40.8
Lighter	279	39.1

	Frequency	**% Percent**
Household questionnaire		
N of household members	3358	
Relationship to index child (largest groups of family members):		
Biological parent	1231	36.7
Partner of biological parent	27	0.8
Grandparent	206	6.1
Uncle/Aunt	247	7.4
Brother/Sister	1355	40.4
Cousin	98	2.9
Nephew/Niece	27	0.8
Half-sibling	124	3.7

9. MEASURES

Dependent variable

The dependent variable predicts how selected independent variables influence overweight and obesity as an outcome. The dependent variable in this thesis measured girls or boys overweight/obesity prevalence and used BMI-for-age as a precise measurement. Other ways to measure childhood overweight/obesity can also be used, but BMI-for-age is the easiest, simplest and most reliable way to look at a specific group of children. BMI-for-age was also chosen because it was available in the data immediately. In the data, BMI was provided under name 'BMI' and label described how this BMI was calculated (calculated bmi=weight/squared (height)). In order to deduct BMI-for-age from based on gender, further data management was done. Deduction for boys and girls were made in two separate steps. Firstly, the gender of the child was checked and chosen under 'Sex' in data (label: gender). Secondly, WHO's (2016) growths reference charts for 5-19 years old children were used to determine overweight and obesity level of girls and boys separately. Girls cut-offs were determined to be in (8 years of age) for overweight in 20.6 (Z-score 2 SD) and obesity in 24.8 BMI kg/m² (Z-score 3 SD). Boys cut-offs were determined to be in 19.7 (Z-score 2 SD) for overweight and 22.8 BMI kg/m² (Z-score 3 SD) for obesity.

The independent variables were selected based on previous findings and theoretical assumptions. These variables attempt to explain why children in Peru are overweight or obese and how different genders are affected by it. Relationships between family structure, gender and childhood overweight and obesity are yet unexplored, and this thesis attempts to find out more about this relationship.

Gender

Gender was provided in data and selecting children by gender was very straight forward. Young Lives data set provided this information in the section where basic information of the child was recorded. In data gender of children were provided under name 'Sex' and labeled 'Gender'. From this variable in data, a dummy variable was created in order to include gender in the data analysis. Children were categorized into two groups. Boys were marked as male "0" and girls were marked as female "1".

Family structure variables: *household composition, family size, birth order, sibship size, gender composition, marital status*

Altogether 6 independent variables were chosen for the analysis. Several variables needed to be deducted from others, but several were available in the data immediately. Altogether 3 variables were available in the data straight forward.
Family size was available in the data immediately under name 'Hhsize' and labeled 'Household size'. Household size was indicated as a number, and it measures a total number of individuals in the household taking into account different generations as well as grandparents, uncles, and aunts. The range of numbers is between 2 and 13.

Marital status was available immediately in data under name 'Partner' and labeled as 'Marital status of caregiver'. Answers were measured in 4 different categories 'Permanent partner', 'divorced or separated', 'Single' and 'Widowed'.
Sibship size was also available immediately in the data and can be found under name 'Chdborn' and label 'Number of children born to mother'. This variable measures a number of children that have born to a mother of the selected child. A number of children were simply recorded as a number and ranged from 1 to 12 in data.

Three of the independent variables needed to be constructed from other variables and included in the analysis by using these new deducted and constructed variables.
Birth order of children independent variable was deducted from a variable in the data that indicated how many children have born before selected child. This variable can be found under name 'Order' and labeled as 'Number of children born before index child'. This measure was simply number ranging from 0 to 11. New variables named 'Birthorder' was created and deducted from 'Order' variable. This new variable indicates the birth order of children and indicates where selected child is in the birth order. Birth order ranks range from the Firstborn child (1^{st}) up to the 12^{th} child. Simply number indicates where selected child is in the ranking. Numbers range (similar to ranks) from 1 to 12. Starting with firstborns and giving them a number '1' in this new variable.

Gender composition of siblings in the family was deducted from two different variables in the original data. These two variables are named 'Boyborn' and 'Grlborn' which indicates (also labeled this way in data) the number of boys or girls born to the mother of selected child. A new variable was named 'Gendercompsibs' and indicates whether selected child has sister(s), brother(s) or sister(s) and brothers(s). These three categories were included in the data analysis and marked simply with numbers.

Household composition variables were constructed from another variable that was acquired from separate household level data. All variables before this one were either immediately used or constructed based on Young lives (Round 1) child level data variables, but this one needed to be copied from Young lives (Round 1) household level data and new variable deducted from this variable named 'Relate' (labelled 'Relationship to index child'). This variable indicated what kind of relationship a certain person had with the selected (studied) child. This variable indicated family relationship and included for example is a person is 'Biological parent', 'Grandparent' or 'Uncle/Aunt' and many other relationships. From this 'Relate' variable new variable named 'Hhcomp' was deducted and created as a dummy variable. This variable measured whether there is a grandparent in the household or not. No grandparent(s) in the household were marked as '0', and grandparent(s) in the household was marked as '1'.

Control variable: *Urbanization*

As a control variable, urbanization was included since it has been identified to be one of the main causes for nutritional changes in people's diets. In the original data, this information was available immediately and was used from child level data where it was recorded. In the data variable named 'Typesite' and labeled 'Type of site R1' indicates if

the area where selected child lives is either 'Urban' or 'Rural' by nature. This variable was included in the regression as a control variable since it is clear from background research that children in urban premises are more likely to be overweight and obese than children in rural settings.

Table 3 summarizes the characteristics of the sample. It lists means and percentages for dependent variable BMI-for-age and for all dependent variables. Note also sample size, children's age that varies in the date and proportion of children living in urban settings.

Table 3: Means and percentages of dependent and independent variables

	Min	Max	Mean	Std. dev.	%
Body Mass Index	17.42	28.01	19.04	1.697	
Sex (0=male, 1=female)					
Family size	2	13	5.61	2.087	
Sibship size	1	12	3.53	2.237	
Marital status of caregiver			1.30	0.723	
Birth order of children	1	12	2.85	2.210	
Gender composition of siblings (1= sister(s), 2=brother(s), 3=sister(s) and brother(s))	1	3	2.31	0.812	
Household composition (0=no grandparent(s) in household, 1=no grandparent(s) in household)					
% of no grandparent(s) in a household					95.5
% of grandparent(s) in a household					4.8
% of children in urban location					74.2
% of children in rural location					25.8
Age of children in years	7.5-8.5				
N of children	714				

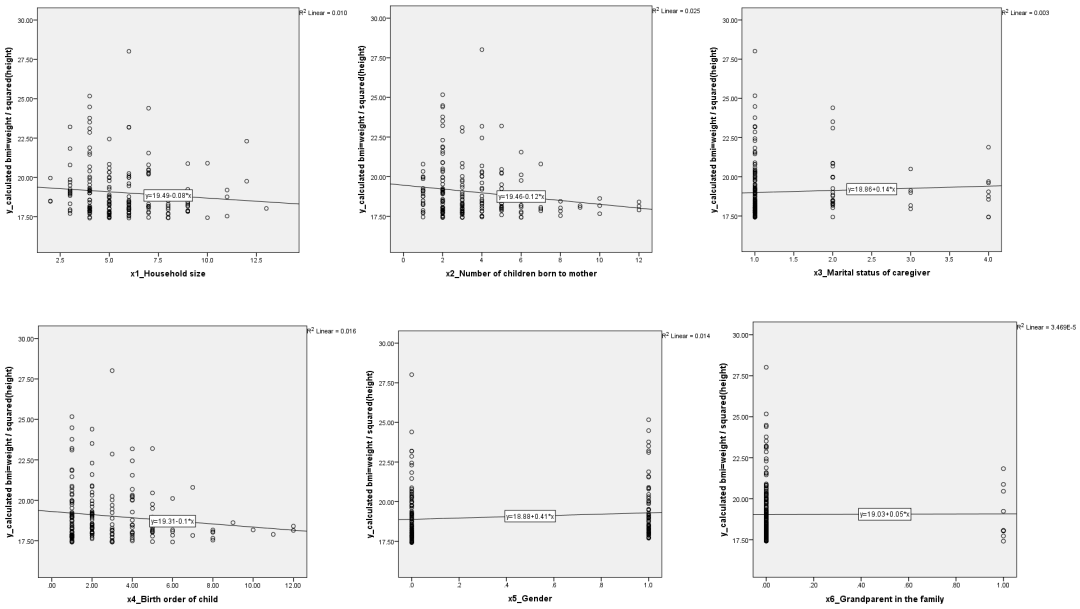
Source: Young Lives OC Child and household level data, round 1 (2002), gathered from Peru for children of 8 years of age.

10. METHOD

When studying the relationships between childhood overweight/obesity, gender and family structure, problems of multicollinearity and homoscedasticity may play a role. Many variables are intertwined and may collide with each other in the process. Especially family structure variables may have multicollinearity issues, and that is why it is important to apply appropriate measures if model violates any of the assumptions determined by multiple regression. It is likely that for example family size and sibship size have an effect on each other or just correlate in a similar way. The pattern between

these two variables may be same and therefore collide. In this thesis, research multicollinearity is not possible to be avoided completely but to use appropriate troubleshooting methods such as robust regression. According to Field (2013) robust regression is a good tool to use when assumptions are violated. Homoscedasticity may be an issue since not all sample is equal in variances. In this sample, it is likely because sample sizes are not the same and boys and girls are not overweight or obese in a similar way, but this may vary a lot between these two genders.

Model building starts by selecting and constructing appropriate variables and then checking assumptions for multiple regression. In the data, most variables were easy to select, but few needed careful construction based on other suitable variables. Not all independent variables were available immediately and roughly half of the variables needed to be inducted from others.
In this statistical method assumptions for equal variances, normality and linearity were checked. Independence is assumed since this data is used from a Young lives and it is most assumable that research design is done well. Firstly, the assumption of linearity between outcome and independent variables were checked by plotting each individual independent variable against outcome variable (See
Figure ***7*** below). Each scatterplot shows how each relationship between outcome and predictors is linear and also indicates that there is one possible outlier in the sample.



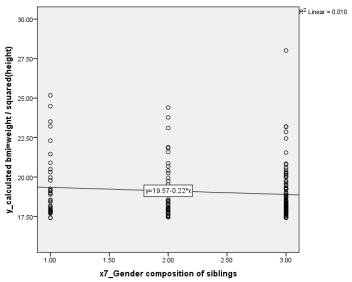


Figure 7. Linearity between each independent variable and outcome variable BMI-for-age.

Secondly, the assumption of normality is checked by plotting unstandardized residuals with expected and observed values. Figure 8 below indicates that data meets the assumption of normality since values follow roughly straight line. So, the assumption of normality is in order. However, a closer look at the data with histogram (see Figure 9 below) indicates that data is somewhat positively skewed, but still follows normality curve for the most part.

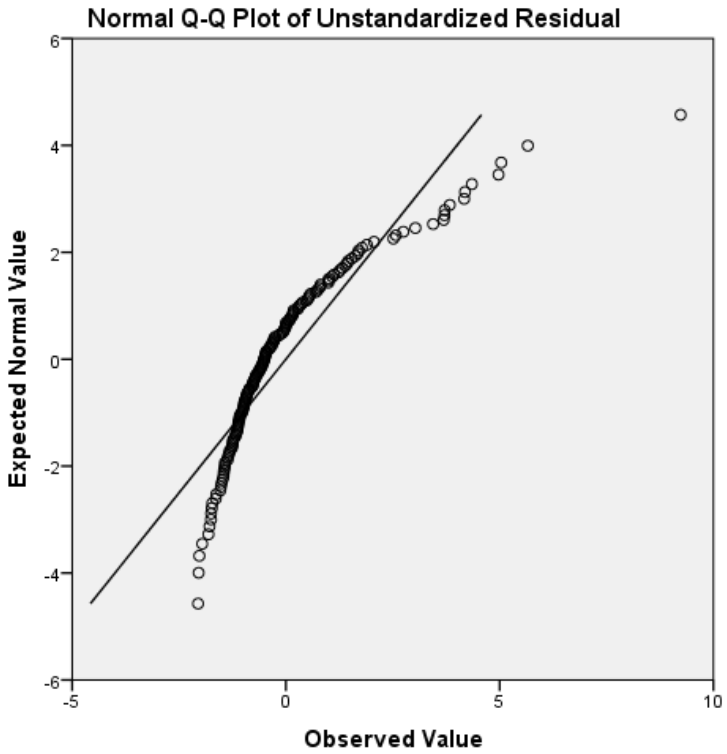


Figure 8. Q-Q plot checking normality.

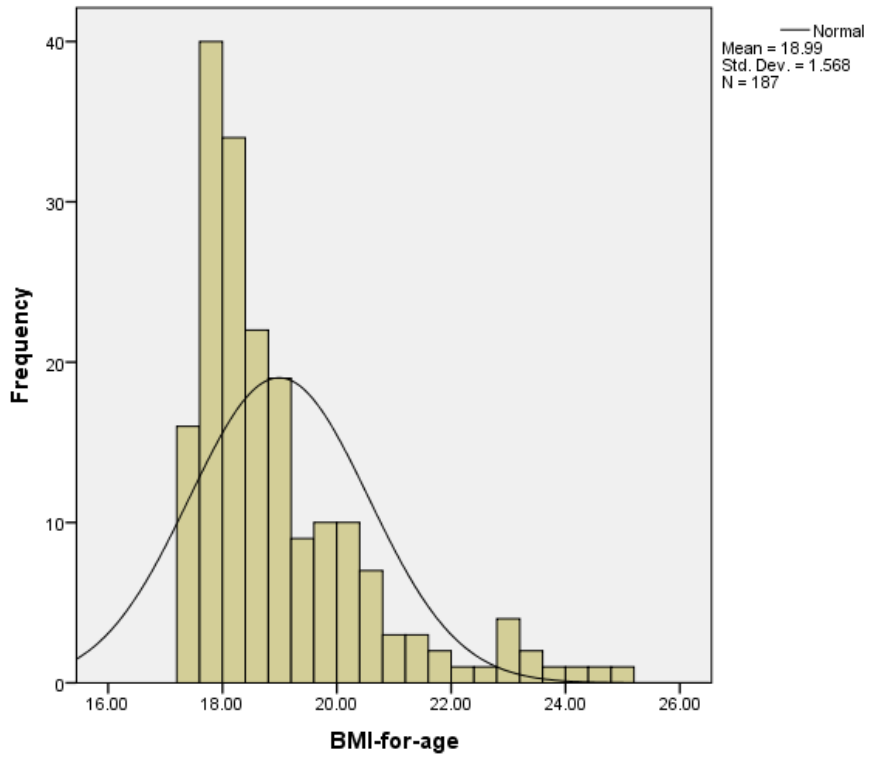


Figure 9. Histogram to illustrate positive skewness and normality distribution.

As a last, assumption for equal variances is being checked and this is where the problem is encountered. Figure 10 below shows that variances are not the same and data forms a funnel shape and there for s violating this assumption. For this assumption to be met data should be in a cloud-like formation and there should be no visible pattern.

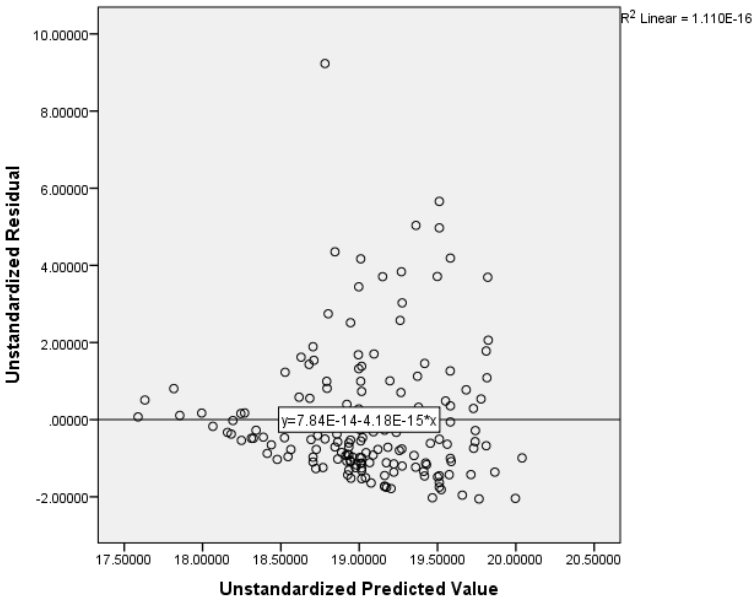


Figure 10. Scatterplot for checking assumption for equal variances.

After checking assumptions and carefully examining their results a multiple linear regression model is constructed, appropriate regression method was chosen and multiple regression analysis conducted. At this point, the model is violating one of the assumptions and therefore troubleshooting is applied. According to Field (2013) when model violates assumptions these problems can be largely ruled out by doing Robust Regression and bootstrapping that give correct estimates despite these problems. Robust regression does not need assumptions of homoscedasticity or normality to be met but gives correct estimates for predictors nevertheless. Based on Field's recommendation multiple linear robust regression is conducted by using bootstrapping.

11. RESULTS

11.1 Gender, family structure, and childhood overweight: descriptive results

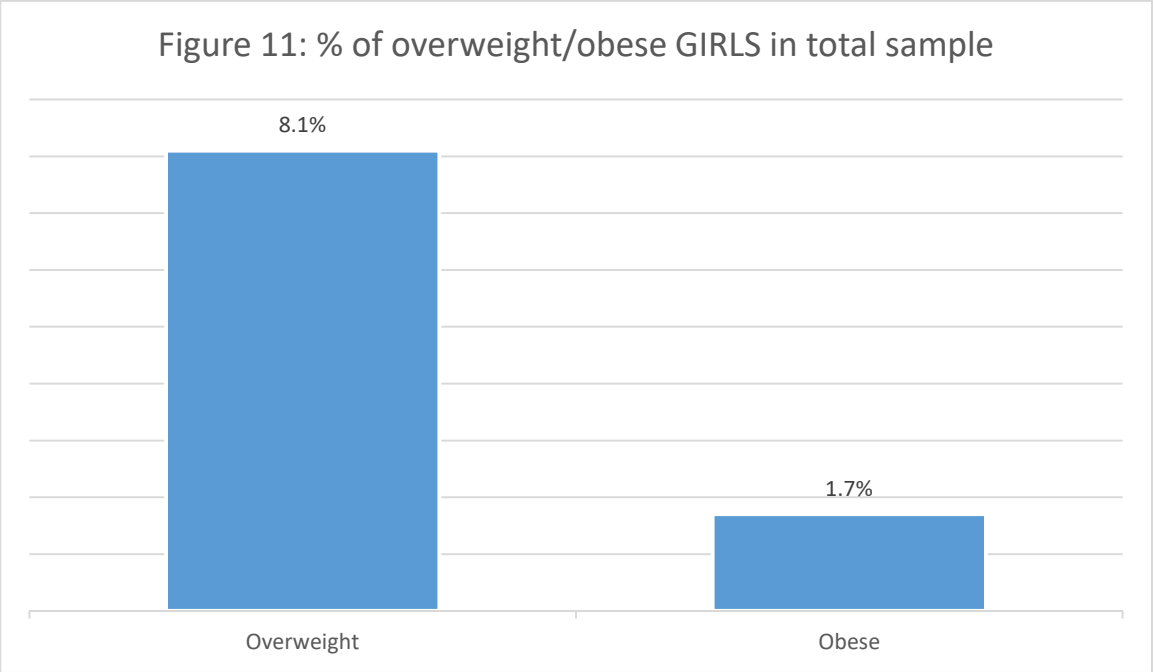
In this thesis, descriptive results will answer the following research question: "To what extent are children obese in Peru?". Descriptive results will focus on illustrating this as accurately as possible and to generalize these findings if possible. These findings will paint a picture how school-aged children are doing health wise and how gender and family structure influences may contribute to the development of childhood overweight and obesity.

In the Young Lives total data sample, 714 children are selected for further analysis. In the sample of 714 children, 148 children are classified as overweight (20.7%) and 40 children obese (5.6%) according to WHO's growth charts and cut-off points. Girls are classified to be overweight when their BMI-for-age exceeds 20.6 and obese when exceeding 24.8. Boys are classified to be overweight when BMI-for-age exceeds 19.7 and obese when exceeding 22.8 (WHO, 2016). These descriptive findings are very much in line with general population and country level estimates for childhood overweight and obesity. According to World of Obesity (2016) 27.7% of children in Peru are estimated to be overweight (including obesity).

When looking at each gender separately, it is clear that overweight and obesity affects boys and girls differently in Peru. In the total sample of 714 children only 58 girls are overweight and 12 obese. This descriptive result indicates that very few girls in the sample are overweight and even fewer girls are obese. Altogether 70 out of 328 girls in total sample are eligible to be classified overweight or obese. Which means that 9.8% of girls from total sample of 714 children are overweight or obese.

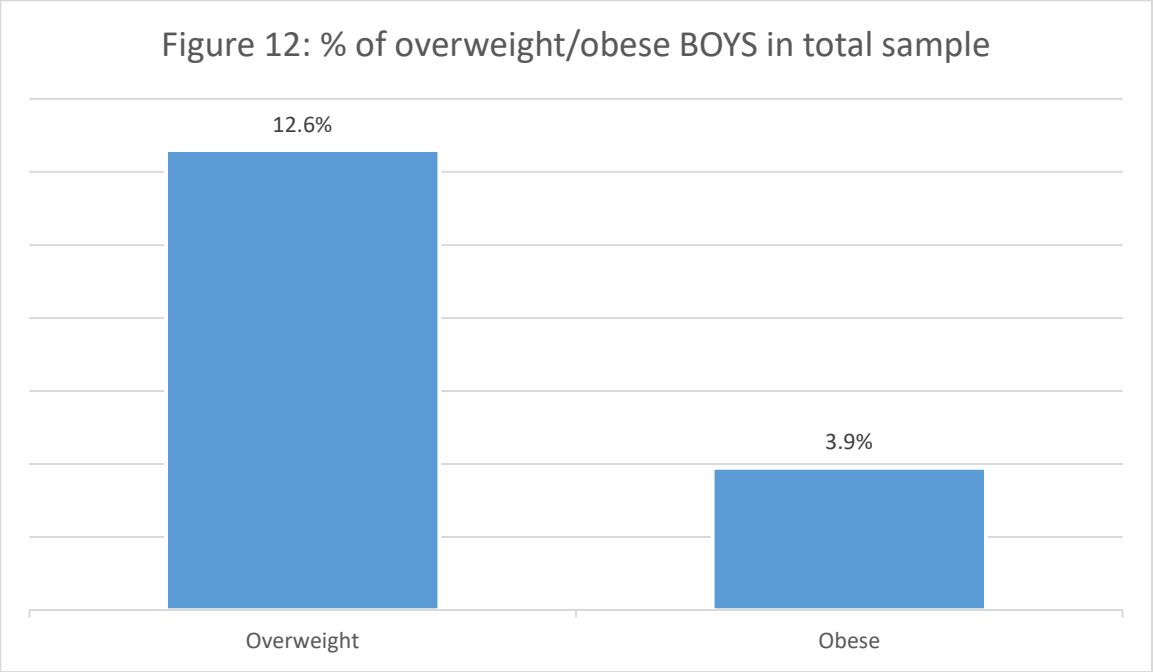
Figure 11 below shows how many percent of girls from total sample are overweight or obese. In the total sample (N=714), 8.1% of girls are classified to be overweight, and 1.7% obese. These descriptive findings are not in line with general population level or country estimates. World of Obesity (2016) estimates that 24.5% of girls in Peru are overweight (including obesity). This finding indicated a lot lower levels of overweight and obesity among girls in Peru and can be considered to be positive finding when considering girls health which usually is worse than boys in developing countries.

However, it is uncertain if this can be generalized to the child population of Peru. Young lives (2016) data may not be representative when looking at Peru's child population and age groups. This finding may also indicate that it is not representative and cannot be generalized, but determining the representativeness of the data sample is outside of the scope of this thesis.

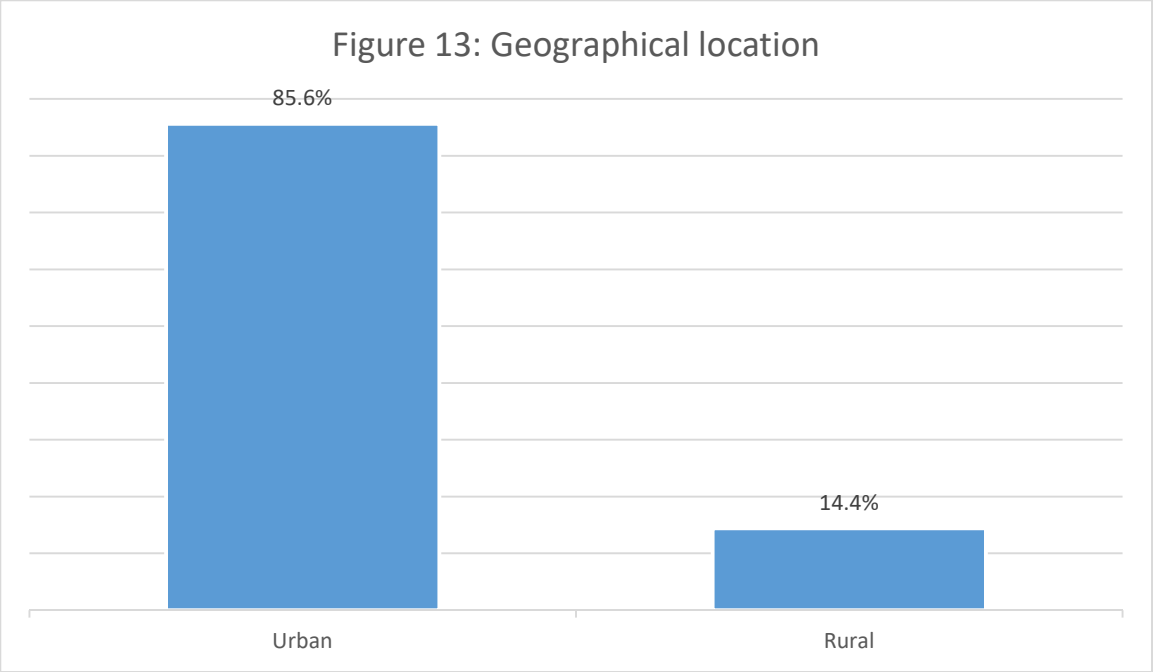


In the total sample 714 children, altogether 188 children are classified to be either overweight or obese. Majority of these children are boys (63%). Altogether 118 boys are determined to be overweight or obese. 90 boys are classified to be overweight, and 28 obese according to WHO's growth charts. This is in line with previous research findings and World of Obesity (2016) estimates which indicate that larger proportion of boys are overweight in Peru (incl. obesity).

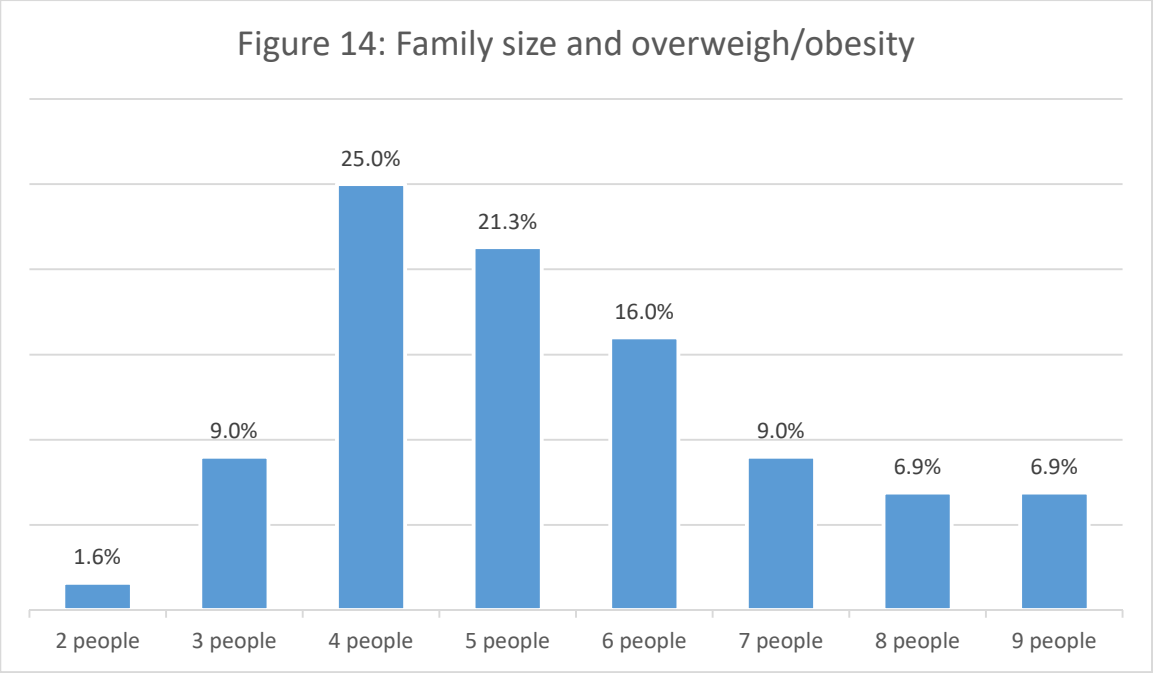
Figure 12 below shows how many percent of boys from total sample are overweight or obese. From the 188 selected children 12.6% boys are overweight and 3.9% obese. This finding is in line with the global estimates of childhood obesity for boys. As mentioned earlier, boys are more likely to be overweight/obese in developing countries such as Peru (World of obesity, 2016). When compared to girls the difference is noticeable since 9.8% of girls and 16.5% of boys are overweight/obese. This indicates 6.7% difference in overweight levels between girls and boys in Peru.



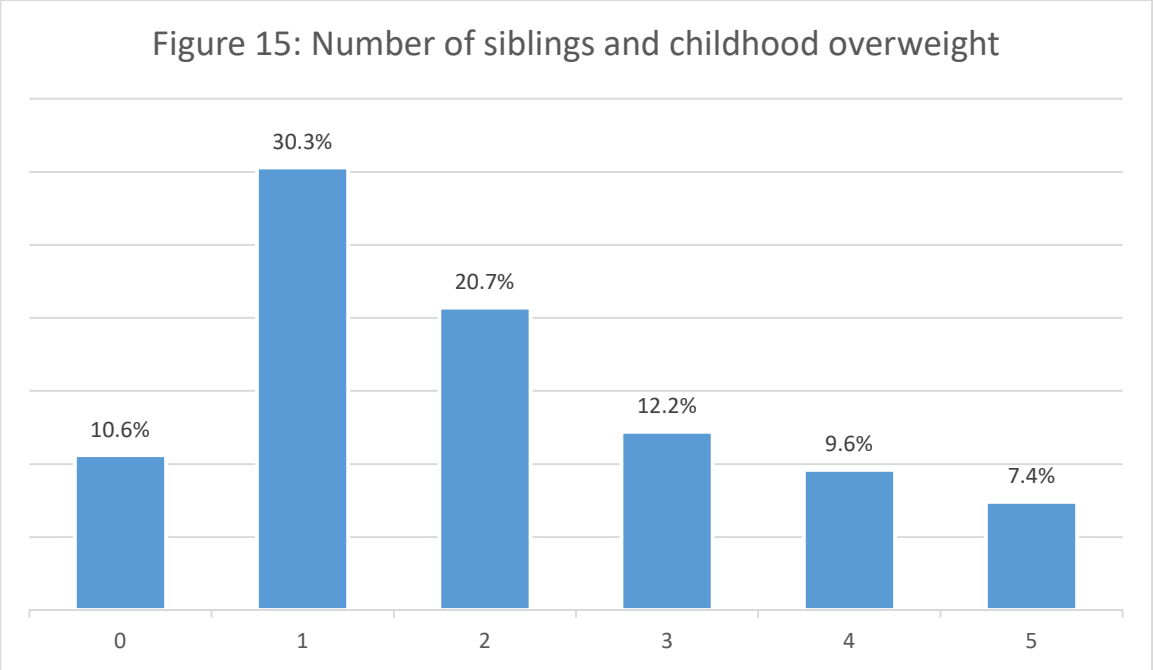
Geographical location matters when looking at causes and influences for childhood obesity. According to Kolčić (2012) one of the driving forces behind childhood overweight and obesity is urbanization. Families eat differently in different geographical locations. **Figure 13** indicates that overweight and obese children in Peru live predominantly in urban areas. All 188 children that were either overweight or obese were included, and 161 of these children were living in urban areas and 27 in rural areas. This finding indicates that children indeed are more likely to be overweight in urban surroundings and is in line with earlier findings. This finding makes perfect sense since manufactured foods are well available in cities and families tend to eat more processed and refined food items.



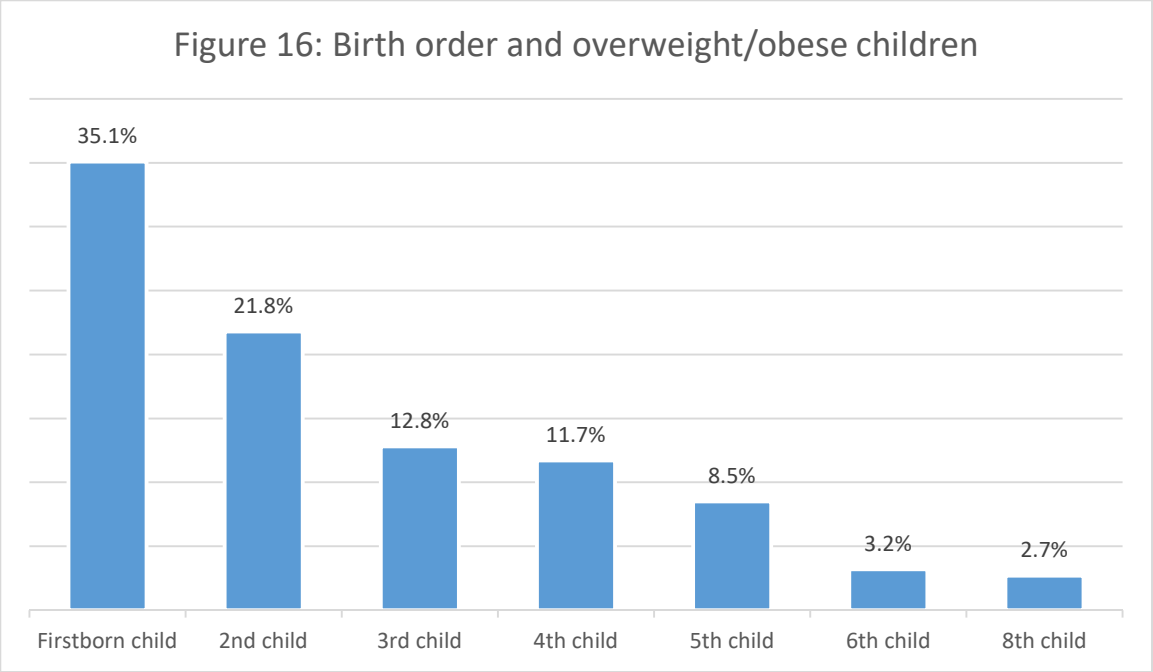
Family size matters when analyzing childhood obesity. Resources are distributed differently in different family sizes. **Figure 14** below shows that children from small- or middle-sized families are more often overweight and obese. In the sample of 188 overweight and obese children family size of 3, 4, 5 or 6 people were most common, and therefore it can be concluded that children in families with these sizes are more often overweight/obese. Altogether, 134 children (71.3%) from 188 overweight and obese children lived in these families.



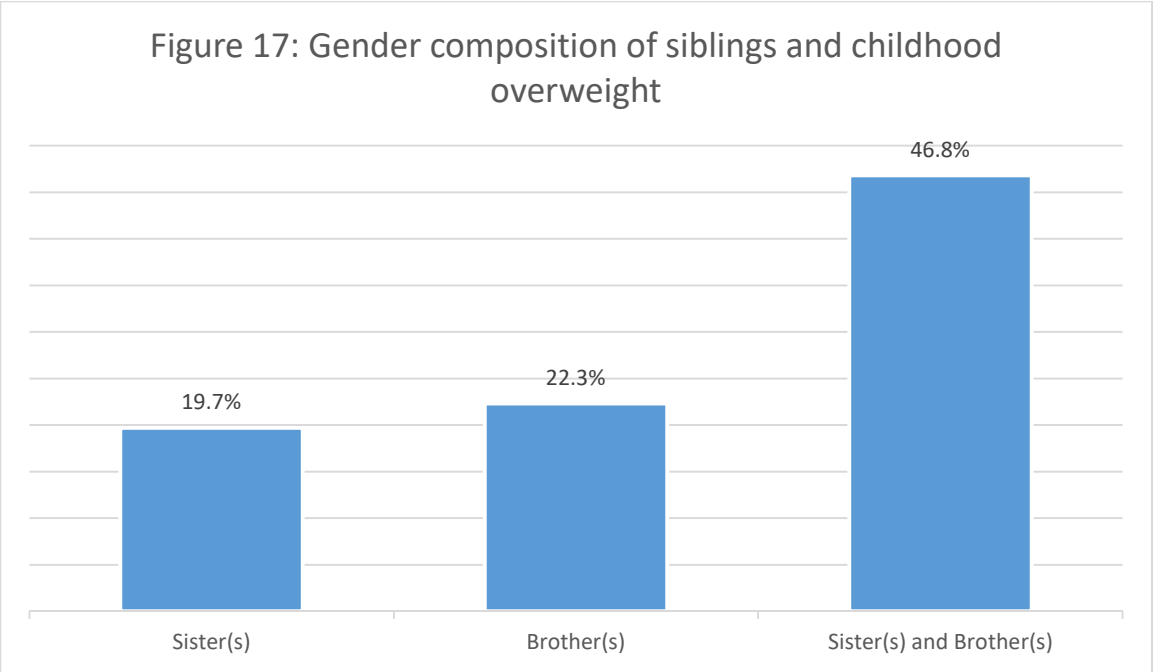
Number of siblings matter also when looking at childhood obesity. **Figure 15** below shows that children with a small number of siblings are more likely to be overweight and obese than children with a large number of siblings. This makes sense since resources are divided differently in small and large sibling groups. In Peru, most overweight/obese children live in families where they have 0-3 siblings. 10.6% of overweight/obese children have no siblings, 30.3% have one sibling, 20.7% two siblings, 12.2% three siblings, 9.6% four siblings and 7.4% of these children have five siblings (brothers or sisters). Based on these findings it can be concluded that children with fewer siblings are more likely to have overweight or obesity issues.



Birth order has an effect when looking at childhood overweight and obesity issues. **Figure 16** below indicates that most of the overweight/obese children in the sample (N=188) are firstborn children (35.1%). Children that are born 2nd in the sibling series are second largest group with 21.8%, 3rd born children are third largest group with 12.8%, children born 4th in the sibling series have 11.7% share, 5th born children have 8.5% share, 6th[h,] and 8th born children have 3.2% and 2.7% share. Based on these percentages it can be concluded that children who are most likely to be overweight and obese are firstborn or 2nd born children. This finding is contradictory since it is not clear from previous findings why first or second born children would be more sensitive to overweight and obesity. The mechanism behind may be pressure to succeed or larger responsibility for other siblings or household chores. Further research to find out why is needed.



Having sister(s) or brother(s) matters in childhood overweight and obesity. **Figure 17** below shows that overweight and obese children who have at least one sister and a brother are the biggest group (46.8%). Children with brothers are a second largest group with 22.3% and children with sister or sisters are a third largest group with 19.7%. Based on this finding most overweight/obese children live in families where they have multiple same-sex or opposite-sex siblings.



11.2 Multivariate analysis: explanatory results

In this section, the following research question will be answered as thoroughly as possible: “How can gender and family structure explain obesity chances in childhood? In Peru”. In this thesis, gender and several family structure variables are tested in order to find out how these variables interact with childhood obesity. As discussed in theory part earlier, these variables may have an influence on the development of childhood overweight and obesity. Several hypotheses will also be tested, and the results of these tests will be reported separately for each hypothesis.

One multiple linear regression model was created, and all 6 predictors were forced into the model simultaneously (excluding family size due to collinearity issues with sibship size). It was not clear from previous research literature which predictors are more important than others. Therefore, methods of forced entry seemed most appropriate. According to Field (2013) forced entry method does not make decisions about the order of the predictors and when each of them is entered into the model, but it gives room for thoroughly testing each variable inside a theory. Previous research literature did give good solid reasons why to include all these 6 (excl. family size) predictors. All of them had been researched before and had been proven to have an effect on the development of childhood obesity.

Results table (see **Table 4** below) indicates that 4 out of 7 predictors have a positive association on BMI-for-age and therefore on childhood overweight. Birth order of children (b=.18), grandparent in the family (b=.18), marital status of caregiver (b=.06) and living location (b=.61) all have positive associations with dependent variable BMI-for-age. B-values also tell how dependent variable is affected and in this analysis for example, when birth order of children increases by one unit then BMI increases by 0.18 units. However, only living location is statistically significant with p-value ≤ 0.05 which indicates that there is difference in BMI between children who live either in urban or rural living surroundings. This also tells that living location is making a significant contribution to model. Sibship size (b=-.16), sex of child (b=-.28) and gender composition of siblings (sisters (b=-.57), brothers (b=-.83) and sisters and brothers (b=-.79)) all have negative associations with BMI-for-age. Sibship size, dummy for brothers and dummy for sister(s) and brother(s) all have statistically significant results with p-values ≤ 0.05 indicating that there is a notable difference between each two compared groups.

Based on these explanatory results, it can be concluded that children who are male, have grandparent(s) in their family, are born earlier in sibling series and are from families where mother is divorced, widowed or separated (broken families) have higher BMI’s. This indicates higher likelihood to develop childhood overweight or even obesity. However, children who are female, have several siblings, have sister(s), brother(s) or both have lower BMI’s. This makes sense since gender differences are very typical in developing countries such as Peru. Resource dilution theory explains why several siblings matter and then resources are divided differently among children and it lower likelihood to develop overweight or obesity.

Constructed model also predicts variation in the outcome variable well. R^2 indicates how much chosen predictors in the model explain variability in the outcome variable. In this model R^2 is 0.043 and there for predictors explain 4.3% of the variance in BMI-for-age which is outcome variable. F-test also tells that model is significant with p-value <0.05 and therefore data fits to the model well.

Table 4. Forced entry (robust) multiple regression model estimating the effect of gender and family structure on childhood obesity (BMI) (N=714). Confidence intervals and standard errors based on 1000 bootstrap samples

	B	**SE**	**t**	**Sig. (p-value)**
Constant	17.26 (16.50, 17.69)	.346	34.00	.001
Sibship size	-.16 (-.30, -.01)	.08	-1.87	.04
Marital status of mother (0 intact, 1 broken)	.06 (-.32, .49)	.21	.31	.78
Birth order of children	.18 (.04, .32)	.07	2.19	.02
Sex of child (0 boys, 1 girls)	-.28 (.05, 1.12)	.15	-1.75	.06
Grandparent in the family (0 no, 1 yes)	.18 (-.21, .57)	.20	.96	.37
Gender composition of siblings (sisters) (0 otherwise, 1 sisters)	-.57 (-1.15, 0.42)	.42	-1.08	.09
Gender composition of siblings (brothers) (0 otherwise, 1 brothers)	-.83 (-1.16, .07)	.31	-1.89	.00
Gender composition of siblings (both) (0 otherwise, 1 both)	-.80 (-1.16, .07)	.34	-1.66	.00
Living location (0 rural, 1 urban)	.61 (.33, .89)	.14	3.71	.00

Note. R^2=.043, p<0.05.

12. CONCLUSION AND DISCUSSION

Previous empirical research evidence regarding the development of childhood overweight and obesity in developing low-middle income countries is limited. In the case of Peru and school-aged children, previous findings are non-existent. This thesis aimed to fill this knowledge gap and to bring new insights and findings. Findings in this paper also paint a picture of how school-aged children in Peru are doing health wise and how surrounding social influences affect their well-being. Gender and family structure play an important role in this. Overweight and obesity can cause serious health problems early on as well as later in life. Below is a summary of these findings.

In the previous research literature, **gender** was associated with overweight and obesity very often. In the developing countries such as Peru overweight is a growing problem and especially among young children. It was estimated that 64% of the children in Peru are overweight and 28% obese. This thesis did not find evidence to support these numbers from WHO but did follow estimates for Peru from World of Obesity. Approximately 21% of children were overweight and 6% obese according to the findings in the Young Lives sample. Descriptive findings also indicated that girls are not more often overweight or obese than boys in Peru. In the developed countries girls are more likely to be overweight or obese than boys, but in the case of developing countries situation is vice versa. In the findings from Young lives, sample boys were more overweight than girls.

Gender does have a profound impact on overweight and its development. Children are no exception and based on research findings in this thesis it is clear that gender also has an effect on overweight and obesity development in Peru. Child's BMI is strongly related to gender and negative association in explanatory findings may explain why gender needs to be considered when treating or preventing childhood obesity. It does matter whether child is girl or a boy. In developing countries, different genders are treated differently and cultural norms play their part in children's lives very early on. However, more specific hypothesis test did not support this finding and did not prove that girls are more overweight than boys, but it did indicate that girls on average have higher BMI's. This finding is in line with previous research findings that indicated females (women and girls) to be more often overweight and obese around the world. Since research findings for school-aged children in Peru are limited it can only be concluded that gender has a major impact, but it cannot be said which gender is more likely to develop overweight and obesity in Peru. From this point of view, findings are contradictory among school-aged children in Peru.

In this paper, several family structure variables were tested in order to find out how they influence childhood overweight and obesity among school-aged children in Peru. Family structure research on childhood obesity in developing countries was, for the most part, non-existent and these new findings shed light on an area that was not well researched before. Altogether six different hypotheses were created to test different family structure variables and three of them had a substantial effect on child's BMI. Birth order, marital

status of caregiver and grandparent in the family had all highest positive associations with children's BMI's.

Sibship size is associated with childhood obesity in several previous studies and in this thesis results it was proven that sibship size has a negative association with childhood obesity and difference between numbers of siblings was big enough to be notable statistically. Based on this, it can be said that a number of siblings do have an effect on child's BMI and the hypothesis was proven that children with fewer siblings indeed are more overweight/obese on average. Therefore, it can be concluded that larger number of siblings reduces childhood obesity chances and this finding is in line with the previous body of research literature. The mechanism explaining this finding would most likely be resource dilution theory which states that number of children in a family will determine how resources are divided. When number of children increase then resources diminish per sibling (Bras et al., 2010).

Also **sibship composition** was associated with childhood obesity in the previous research literature. It matters what gender siblings are and in this thesis, it was tested whether children with a sister(s) are more overweight/obese than children with a brother(s). Analysis revealed that having sister(s), brother(s) or sister(s) and brother(s) can decrease child's BMI and are less likely to be overweight or obese. Two of these associations also had notable difference statistically and therefore need to be considered seriously. This also reinforces the earlier finding that gender is a major influencer what comes to overweight and obesity development. The mechanism behind this could be different treatment of boys and girls and girls tend to have worse nutritional outcomes in developing countries (World Family Map, 2016).

Birth order is associated with overweight and obesity in a similar way as gender in the previous research literature. In the descriptive findings, overweight/obese firstborn children were the largest group with 35.1% share. This indicates that most overweight/obese children in the sample were born first in sibling series. Based on research findings in this paper, it can be concluded that birth order does have a positive influence in childhood overweight development. Therefore, findings for birth order are contradictory and it can only be concluded that it does have a positive effect, and that this difference is statistically notable. Therefore, this also backs-up previous research findings. In the case of Peru and school-aged children, further research is needed and possibly with a larger sample size to rule out limitations due to small sample size.

Results in this thesis indicate that gender and family structure does contribute into childhood overweight and obesity development for school-aged children in Peru. Most of the factors had positive associations with BMI-for-age. Only three had a negative association. It is important to understand that different types of family circumstances influence children's well-being and how they grow up. Family and child's sex cannot be ignored when planning interventions for overweight and obesity reduction. As Stewart (2010) has pointed out; family is one single most important aspect when treating overweight child.

This paper has one major limitation that needs to be taken into account. According to Martorell (1998) using this measurement tool on children is difficult because their body bone mass and body proportions change rapidly throughout their growth. BMI may not be as a reliable measure of fatness in children as it is in adults. BMI may also be different according to the racial or ethnic background of the child. BMI has not been well tested cross-culturally and therefore careful consideration is needed when classifying children to be overweight or obese solely based on BMI measurement.

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