The association between socioeconomic status and the risk of obesity among German children

Puck Wagemakers
S3226794
Human Geography and Urban and Regional Planning
Faculty of Spatial Science
University of Groningen
Supervised by Tobias Vogt
2019

Abstract

Obesity is becoming more and more a global issue, with many different causes and consequences. One of the things that stand in relation with obesity is socioeconomic status, the question is what is this relation? Previous research has shown that the socioeconomic status of parents affects obesity among children by the level of education and the number of working hours. This leads to the following central question of this research; *'What is the relationship between the socioeconomic status of the parents and obesity among German children?'* While researching this relationship, there is also looked at gender differences, differences between rural and urban areas and the influences of the socioeconomic factors on their own. To answer the main question, quantitative research has been done using the KiGGS dataset with approximately 15.000 participating children and adolescents. The results of the study corresponded mostly with outcomes of earlier studies. A negative relation between socioeconomic status and obesity has been found. This means that a higher level of socioeconomic status is associated with a lower probability of obesity. The study also looked into the difference between rural and urban areas. High socioeconomic status is more common in urban areas, however, there is not less obesity prevalence in urban areas. No differences between boys and girls were detected. This research suggests that socioeconomic status a good predictor is of obesity, even when controlled for age and gender.

Keywords: obesity, socioeconomic status, gender, rural and urban.

Table of content

1 Introduction

1.1 Background

Obesity is becoming more and more a global issue. Since 1975, obesity rates have nearly tripled worldwide with more than 650 million people being obese in the year 2016 (WHO, 2018). Not only in developed countries is obesity an issue, but also in developing countries with low income is obesity a common disease (Popkin and Doak, 1998). Obesity is not only leading to other (chronic) diseases, such as heart diseases and diabetes, but obesity on itself can be a weakening condition (Jastreboff et al., 2018). Obesity is often accompanied by structural and functional abnormalities, for example left ventricular hypertrophy (enlargement and thickening of the walls of the heart's main pumping chamber) or urinary incontinence (Jastreboff et al., 2018). Another problem is that the number of people diagnosed with obesity is increasing (Seidell, 1999; Mayur, 1999; Kuehn, 2018). The increasing obesity rates are visible in both developed countries and developing countries.

As mentioned above, obesity is closely related to other diseases and disorders. Type 2 diabetes, cardiovascular diseases and some forms of cancer are examples of those diseases (Jastreboff et al., 2018; Hossain et al., 2007). Also, the life expectancy of obese individuals can change negatively. The life expectancy for obese males can decrease with 5.8 years (when the male is a non-smoker) and for obese females, the life expectancy can even decrease with 7.1 years (when non-smoker) (Peeters et al., 2003).

Diseases related to obesity got a lot of negative consequences. One of these negative consequences are the costs that come with obesity. Healthcare costs are higher for overweight people than for average-weighted people. The medical costs of overweight people were on average 30% higher than the medical cost of the average-weighted (Withrow and Alter, 2009). These costs are for instance drugs for various additional cardiovascular and circulation disorders (Wolf and Colditzt, 1998). The healthcare expenditures of obesity are between 0,7% and 2,8% of the total healthcare expenditures in countries (Withrow and Alter, 2009). Fighting the rates of overweight people can probably cause a drop in healthcare expenditures. For this, prevention of obesity is necessary and possible (WHO, 2018).

In 2016, over 340 million children and adolescents aged 5 to 19 were overweight or obese (WHO, 2018). While individuals face most of the negative consequences related to obesity when they are adults, it is also important to look at why obesity is also a problem for children and adolescents because they contribute to roughly half of the obesity numbers. Obese children have mainly to deal with psychosocial consequences. They experience discrimination at a young age (Dietz, 1998). Dietz (1998) stated that children have incorporated a preference for thinness and will choose anybody as a friend above obese/overweight children. However, children do not get low self-esteem or a negative self-image because of this. In contrast, adolescents do get a negative self-image, which they keep when they are older (Dietz, 1998). Obese children and adolescents also have a greater risk of getting diabetes and cardiovascular diseases and disorders (Dietz, 1998), just like adults.

Obesity is a condition that is influenced by individual behaviours and it is important to understand what drives these behaviours in childhood as it may help to decrease the risk of being obese and

suffering from subsequent diseases over the life course. Preventing obesity during childhood is crucial because of the long term consequences and because obesity is hard to treat once present (Gillman, 2004). When being overweight is prevented, fewer people deal with related diseases and so healthcare costs can be reduced. For prevention, related factors to obesity must be sorted out. Therefore looking at the relationship between socioeconomic status and obesity is important. Knowing this relationship, appropriate measurements for preventing obesity related to socioeconomic status can be made.

A lot of research has been done on obesity and related factors, also on obesity and the influence of socioeconomic status. Most of this research is about different countries (low developed countries/high developed countries). Different studies have written about the differences between these countries when it comes to obesity (Swinburn et al. 2011 and McLaren, 2007). There has been done research on this topic specifically focused on children in Germany (Lamerz et al, 2005). However, the distinction between rural and urban areas is not included in this research. It will be interesting to see if there are also differences within a country and not only between countries. In this research, there will be looked at the differences between children living in urban areas and children living in the rural areas of Germany. Besides this, it is helpful to know related factors to obesity so there can be appropriate measurements made to prevent obesity.

1.2 Research problem

Although there is already research done on the relationship between obesity and socioeconomic status, new insights can be obtained with the use of this dataset. The aim of this research is to find a link between obesity and socioeconomic status and to find out what the influence of the factors of socioeconomic status are independent. This will be done among children from Germany. Socioeconomic status will be defined as monthly household income, education level and occupation. As mentioned earlier, obesity is becoming more and more a global issue and socioeconomic status seems to be in relation with obesity prevalence. Therefore the central question in this research will be:

'What is the relationship between the socioeconomic status of the parents and obesity among German children?'

The literature suggests changes in obesity prevalence for age and gender. Besides that, socioeconomic factors are independently mentioned. Therefore, the secondary questions that arise out of the central question and the literature are;

'*Is there a difference between boys and girls?*'

'*Is there a difference between children living in urban areas and children living in rural areas?*'

'What are the influences of the socioeconomic factors independently?'

1.3 Structure of this thesis

The structure of this thesis is as follows: Chapter two will present the important concepts and theoretical backgrounds based on the literature found. Also, the conceptual model and hypothesis can be found in this chapter. In chapter three the research method is discussed. Chapter four will consist of a discussion of the results of the data analyses and the questions mentioned above will be provided with an answer. In the last chapter, the conclusion of this research, a reflection and suggestions for future research will be given.

2 Theoretical framework

2.1 Life course approach

The life course approach can be defined as an approach that aims at increasing the effectiveness of interventions throughout an individual's life. It focuses on a healthy start to life and targets the needs of people at critical periods throughout their lifetime (WHO). Obesity is important in this context because obesity is hard to treat once present and thus prevention (starting at a young age) is needed (Gillman, 2004). The following concepts, which are important concepts for this research, are related to the life course approach.

2.2 Socioeconomic status

The first important concept is socioeconomic status (SES). SES is a measure based on income, education and occupation. It is a combination of economic and social factors. This research is about children. For their socioeconomic status, there is looked at the monthly household income, education and occupation of their parents. A lot of research has been done about socioeconomic status and health outcomes. SES can be associated with many health, cognitive and socioemotional outcomes in children (McLaren, 2007). This research will be focusing on obesity as a health outcome (relationship between SES and obesity). Earlier research at the relationship between socioeconomic status and obesity shows a relation between one factor of SES and obesity. According to Jones (2018), a negative relation between the father's education and obesity exist, a higher education level of the father decreases the chance of becoming obese. However, Jones (2018) also found a positive relationship between a SES factor and obesity. When the time increases how many a mother works, the chance of becoming obese also increases. This applies for children up to eleven years old, after this age the relationship becomes negative (Jones, 2018). Novak et al. (2006) stated that under 16 years olds no social difference in overweight was observed. However, when those individuals were 30 years old a difference in educational level was detected. Men and women with low education level had more prevalence of obesity (Novak et al, 2006).

One of the main findings of the relation between socioeconomic status and obesity is the difference between low developed countries and highly developed countries. Within these countries, the groups that are sensitive to obesity differs (Swinburn et al. 2011, McLaren, 2007). This research will be on Germany, which can be seen as a highly developed country. So, the findings of the analysis of the dataset can be compared with the findings in other studies about (high) developed countries.

2.3 Differences in gender

In those developed countries lower socioeconomic status is associated with higher body size (obesity) (McLaren, 2007). However, there can be made a distinction between men and women. Women with a low socioeconomic status in highly developed countries are more sensitive to obesity than men in those countries (McLaren, 2007). Besides the difference related to socioeconomic status, there are also other factors that play a role in gender and differences in obesity. For children family environment, hormones and genes are also factors that cause a difference in obesity between boys and girls

(Wisniewski and Chernausek, 2009). However, in the study of Novak et al. (2006), no difference in gender was found at the age of 16 years.

2.4 Rural versus urban

In this research, there will be looked at the potential difference between children living in urban areas and children living in rural areas. For this, it is important to know if there is a difference between socioeconomic status between urban and rural areas. According to Nummela et al. (2007), there is a slight difference in income and educational level between the urban and rural areas (income and educational level are in Nummela et al. (2007) research the factors that represent SES). SES is a little higher in urban areas. However, the research of Nummela et al. (2007) is done in a province in Finland and may not be representative of Germany.

Not only the difference between the level of socioeconomic status between urban and rural areas is important, but it is also good to know if there are differences in obesity rates between urban and rural areas. Befort et al. (2012) stated about this that there is a significant difference in obesity rates between rural and urban areas. Obesity probability is higher in rural areas than in urban areas (Befort et al., 2012). There are different causes for this difference in obesity rates. According to Befort et al., (2012), rural residents have less access to healthful foods and were less likely to meet the physical activity recommendations.

2.5 Conceptual model

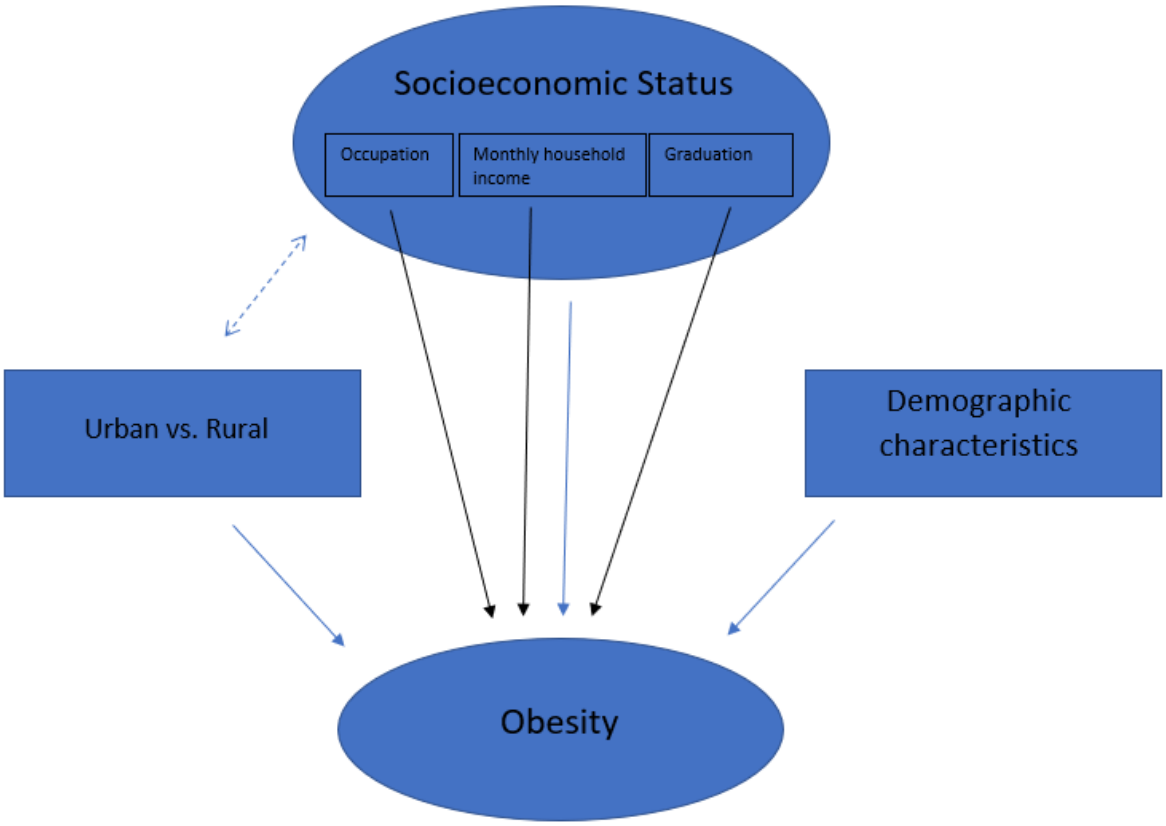

figure 1: conceptual model of the relationship between socioeconomic status and obesity.

Figure 1 shows the conceptual model of the analysis of this research. In this conceptual model, the relationship between socioeconomic status and obesity, and other factors that are related to these main components are visualized. In this research, socioeconomic status consists of occupation, monthly household income and educational level (represents by graduation). These three factors are represented in different boxes because there will also be looked at what their independent influence on obesity is. This is visualized in the model with black arrows. The relationship between socioeconomic status and obesity will be based on the level (low, average or high) of socioeconomic status. Furthermore, according to the literature, there is a relationship between living in a rural or urban area and obesity. Rural residents have a higher obesity probability than urban residents (Befort et al., 2012). In this research, there is looked if this also applied for children living in Germany. Also, there is a possible relationship between the level of socioeconomic status and living in a rural or urban area. However, it is not clear in which direction this relationship goes and this will not be discussed in this study. Control variables are added as 'demographic characteristics', those are age and gender.

2.6 Hypotheses

For the different research questions hypothesis are made based on the literature found. The hypothesis will be given per research question, starting with the main question of this research.

'*What is the relationship between the socioeconomic status of the parents and obesity among German children?*

Because Germany is a (high) developed country, there can be assumed that people with lower SES have more probability of obesity. This is based on the research of McLaren (2007). This means that socioeconomic status has a negative relation with obesity. Low socioeconomic status is associated with higher obesity probability and high socioeconomic status is associated with lower obesity probability.

'*Is there a difference between children living in urban areas and children living in rural areas?*'

Little research had been found on differences between socioeconomic status in rural and urban areas, there can be assumed that there are no big differences herein. However, when looking at the relation between rural versus urban areas and obesity there is a difference according to Befort et al. (2012). This can be linked to the assumptions that people with low socioeconomic status have more obesity probability and thus we can assume that in rural areas the socioeconomic status is lower than in urban areas.

'*Is there a difference between boys and girls?*'

There can be assumed that girls are more sensitive to obesity than boys when looking at SES (McLaren, 2007).

'What are the influences of the socioeconomic factors independently?'

When looking at the three factors of socioeconomic status (occupation, education level and monthly household income), it is assumed that educational level has a negative relationship with obesity and occupation a positive relation (especially for mother occupation). This is based on the findings of Jones (2018).

3 Methodology

3.1 Data collection

This quantitative research is based on secondary data (the KiGGS dataset) and literature. The KiGGS dataset (Health Study of Children and Adolescents in Germany) provides rich information on children's parental characteristics, their schooling career, health and deviant behaviours, health status and educational success. Under approximately 15.000 0- to 17-year-old children and adolescents in Germany, a cross-sectional sample was conducted (Mauz et al., 2017). Therefore, we can state that the data is representative of the researched population group. The examination of this data is carried out by professional surveyors and physical examiners.
KiGGS is part of the Robert Koch Institute's Federal Health Monitoring, and therefore the survey of the KiGGS dataset must comply to strict data protection regulations set out in the German Federal Data Protection Act (Mauz et al., 2017). The Robert Koch Institute got the ethical approval of the Hanover Medical School's ethics committee and the Federal Commissioner for Data Protection and Freedom of Information (Mauz et al., 2017).

With the data of the KiGGS dataset and the literature, an answer to the question *'What is the relationship between the socioeconomic status of the parents and obesity among German children?'* will be provided. The goal of this research is to find patterns and regularities in the data, which can represent the outcome of some underlying regularity or process (Clifford et al., 2010). According to Clifford et al. (2010), this would then be an extensive research, which fits a quantitative research method.
The literature is used to gain insight into the subject of this research and to see what is already known in this field. The dataset is used to look at the specific case of children in Germany.

The variables from the KiGGS dataset shown in table 1 are used and analysed:

Variable	*Name in dataset*	*Kind of variable*
Gender	sex	Nominal
Age	agegrp	Ordinal
Obesity	AdiposKH & AdiposIO	Nominal
Urban/rural	STALA	Ordinal
Socioeconomic Status (SES)	schichtz	Ordinal
Occupation	e091m & e091v	Nominal
Graduation	e089m & e089v	Nominal
Monthly household income	e093	Ordinal

Table 1: used variables from the KiGGS dataset.

3.2 Data analysis

To give an answer to the central question of this research, the data from the KiGGS dataset is analysed in SPSS. This is done with multiple binary logistic regressions. This regression can be used when dealing with a binary dependent variable, which the variable for obesity was. Before the binary logistic

regression was done, all variables (except gender and obesity, because both were already suitable for the binary logistic regression) were made into dummies. The used variables only were nominal and ordinal. The dummies were made in SPSS with transform -> recode into different variables. Also, the variable for urban/rural areas, which existed out of four categories, was combined into two categories which represent urban areas and rural areas. The variables for occupation and education were combined into categories to make the outcomes of the regressions clearer. The categories can be found in the descriptive statistics, table 2.

First, there is looked at the level of socioeconomic status and the relation with obesity. The factor socioeconomic status is subdivided into three categories; low, average and high socioeconomic status. Two different regressions are done with different variables that represent obesity. AdiposKH is based on reference values by Kromeyer-Hauschild, the other variable AdiposIO is based on reference populations. This is done to see if there is any major difference in the two variables and thus to see if it makes a difference which variable for obesity is being used. The way in which obesity is measured does not change the effect of SES on the probability to have obesity. When doing this, and when the conclusion is that it does not make a major difference which variable is used, the results of the research are more reliable. The first binary logistic regression is done with the variables obesity, gender, age, urban/rural and socioeconomic status. After this, a binary logistic regression with occupation, graduation and monthly household income has been done to see what the influences are of the different factors of socioeconomic status. The results of the regression analyse are then compared with the findings of the literature.

4 Results

4.1 Descriptive statistics

	Category	Number (Percentages)	Total
Gender	Boys Girls	8985 (50,9) 8655 (49,1)	17640
Age	0-2 years 3-6 years 7-10 years 11-13 years 14-17 years	2805 (15,9) 3875 (22,0) 4148 (23,5) 3076 (17,4) 3736 (21,2)	17640
Obesity	Yes No	904 (6,1) 13842 (93,9)	14746
Socioeconomic status	Low SES Average SES High SES	4794 (27,8) 7997 (46,5) 4423 (25,7)	17214
Rural versus urban	Rural Urban	3913 (22,2) 13727 (77,8)	17640
Monthly household income	< 500€ 500 - < 750 € 750 - < 1.000 € 1.000 - < 1.250 € 1.250 - < 1.500 € 1.500 - < 1.750 € 1.750 - < 2.000 € 2.000 - < 2.250 € 2.250 - < 2.500 € 2.500 - < 3.000 € 3.000 - < 4.000 € 4.000 - < 5.000 € > = 5.000 €	194 (1,2) 498 (3,0) 739 (4,5) 919 (5,6) 1239 (7,5) 1188 (7,2) 1601 (9,7) 1726 (10,4) 1843 (11,1) 2571 (15,5) 2409 (14,6) 982 (5,9) 643 (3,9)	16552
Occupation father	Not working Part-time working Full time working	1933 (11,8) 459 (2,8) 13980 (85,4)	16372
Occupation mother	Not working Part-time working Full time working	6890 (40,4) 6752 (39,6) 3405 (20,0)	17047
Education mother	No education Haupt/volksschulabschluss Realschulabschluss Abschluss polytech. Oberschule Fachhochschulreife Abitur	262 (1,6) 3603 (21,6) 5125 (30,7) 2820 (16,9) 1313 (7,8) 3577 (21,4)	16700
Education father	No education Haupt/volksschulabschluss Realschulabschluss Abschluss polytech. Oberschule Fachhochschulreife Abitur	283 (1,8) 4572 (28,5) 3393 (21,1) 2628 (16,4) 1574 (9,8) 3585 (22,4)	16035

Table 2: descriptive statistics.

The KiGGS dataset exists out of 17640 cases, from which 8985 boys and 8655 girls. In total 904 children in the dataset have obesity, 463 boys and 441 girls. Some cases are left out, these are the cases with the age up to two years old. Obesity is not applicable to children up to this age. Because of this 14746 cases are left with this variable. The variable of socioeconomic status is divided into three categories; low SES, average SES and high SES. In total 4794 children have parents with low socioeconomic status, 7997 an average status and 4423 a high socioeconomic status. There are 426 missing cases in this variable, therefore the total is not the same as the total of the dataset (17640). Most of the children are living in urban areas, in total 13727 of the 17640 children. Only 3913 children in the dataset are living in rural areas. Some variables have missing system cases, this applies to the variables that do not have 17640 cases as total. For occupation, the category internship has left out, while those did not really fit the other categories and was just a really small percentage of all cases (0,6 for mothers and 1,0 for fathers). For education, the category 'other graduation' has left out. This was also a small percentage of all cases and does not fit with the other categories, because it is not clear what the level of these 'other' graduations is. Also, 'not yet graduated' is left out, because it is not clear which education level they now have or will have in the future.

4.2 Socioeconomic status and obesity

The first two binary logistic regressions are done with the two different variables for obesity to see if there is a major difference in which variable is used. The results are shown in table 3 and 4.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Low_SES	,601	,074	65,292	1	,000	1,823
	High_SES	-,579	,106	29,604	1	,000	,560
	Constant	-2,822	,052	3000,004	1	,000	,059

Table 3: results of binary logistic regression with AdiposKH as obesity variable.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Low_SES	,688	,083	69,150	1	,000	1,989
	High_SES	-,660	,126	27,638	1	,000	,517
	Constant	-3,112	,059	2809,034	1	,000	,045

Table 4: results of binary logistic regression with AdiposIO as obesity variable.

In tables 3 and 4 can be seen at the value of B that there are no major differences between the variable based on reference values by Kromeyer-Hauschild and the variable based on reference populations. The values for the prediction of the dependent variable are more or less the same. For this reason, the following regressions will be only done with the Kromeyer-Hauschild variable. Also, in the tables 3 and 4, it can be seen at the B value that there is a negative correlation with the height of socioeconomic status and obesity. Children with parents with low socioeconomic status are more often detected with obesity than children with parents with an average or high socioeconomic status. Also, children with

parents with a high socioeconomic status are less often detected with obesity than children with parents with an average economic status. These results are in line with the conclusions in other literature. As McLaren (2007) already stated; lower socioeconomic status is associated with higher body size. Furthermore, Exp(B) in table 3 and 4 shows that the size of the effect for low socioeconomic status is much larger than the size of the effect of high socioeconomic status.

4.3 Rural versus urban

Another factor that can be related to socioeconomic status and obesity is living in a rural or urban area. First, there is looked at the relation between the level of socioeconomic status and living in a rural or urban area. The results are shown in Appendix A. According to Nummela et al. (2007), the level of SES is a little higher in urban areas compared to rural areas. However, the research of Nummela et al. (2007) was done in a province in Finland and would not per se be true for Germany as well. Appendix A shows that only average and high socioeconomic status are significant. For the children with parents with a high SES, table A3 indeed shows that those children are more often living in an urban area like Nummela et al. (2007) stated. Because table A1, for children with parents with low SES, is not significant, there cannot be said that children with parents with low socioeconomic status are more often living in rural areas. What there can be said is that children with parents with an average SES are more often living in rural areas according to table 2 in Appendix A.

With the results stated above, the next question is if children living in urban areas (with more often a higher socioeconomic status) have less often obesity. The result of the binary logistic regression with the variables obesity, rural versus urban and socioeconomic status suggests that there is no significant difference between rural and urban areas when it comes to obesity (table 5). This is in contrast with the findings of Befort et al. (2012). They stated that there actually is a significant difference in obesity rates between urban and rural areas with them being higher in rural areas. However, the research population of this study differs from the study of Befort et al. (2012) which has as research population adults living in America. This can be the reason why the results differ.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Low_SES	,602	,074	65,565	1	,000	1,826
	High_SES	-,574	,107	28,929	1	,000	,563
	Urban areas	-,071	,081	,761	1	,383	,932
	Constant	-2,769	,079	1219,486	1	,000	,063

Table 5: results of binary logistic regression with SES, rural/urban areas and obesity.

4.4 Gender differences

According to McLaren (2007), women with low socioeconomic status have more probability of obesity than men in developed countries. However, looking at table 6 it can be seen that gender is not significant. So, there is no significant difference between boys and girls when looking at the relationship between gender and obesity. However, when adding socioeconomic status into the analyse, the results change a bit. Looking at table 6 and 7, there can be seen that the value of B changed into zero. Which means that the obesity probability for gender is influenced by socioeconomic status. However, gender is still not significant in table 7, so there can't be said more about it. The results of

this analyse are in contrast with the statements of McLaren (2007). Using the socioeconomic status of the parents from the child instead of their own socioeconomic status can be an explanation for this result. Also, McLaren (2007) is talking about adults instead of children. So, age could also play a role in this difference in outcome. Differences in gender can occur at a higher age.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Geschlecht	-,006	,069	,009	1	,925	,994
	Constant	-2,719	,108	636,190	1	,000	,066

Table 6: results of binary logistic regression with gender and obesity.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Low_SES	,602	,074	65,563	1	,000	1,826
	High_SES	-,574	,107	28,928	1	,000	,563
	Urban areas	,071	,081	,761	1	,383	1,073
	Geschlecht	-,001	,069	,000	1	,992	,999
	Constant	-2,839	,117	591,948	1	,000	,058

Table 7: results of binary logistic regression with gender, SES, rural/urban areas and obesity.

4.5 Age differences

Age is an important factor when it comes to obesity. In the results mentioned above, and especially the differences between the results found in this research and in other studies can probably be explained with age differences. In table 8 can be seen that the B values are decreasing per younger age category. This means that the younger the child is, he or she has less obesity prevalence. Mentioned in the descriptive statistics, children up to two years are left out because obesity is not applicable to these children. Also, there is a big gap in B value between the oldest children with the age of fourteen to seventeen and the youngest children with the age of three to six.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Low_SES	,626	,075	70,262	1	,000	1,871
	High_SES	-,552	,107	26,649	1	,000	,576
	Urban areas	,081	,082	,998	1	,318	1,085
	Geschlecht	,002	,069	,001	1	,980	1,002
	Age_3_6	-1,048	,111	89,575	1	,000	,351
	Age_7_10	-,276	,087	9,994	1	,002	,759
	Age_11_13	-,248	,094	6,945	1	,008	,781
	Constant	-2,519	,126	397,281	1	,000	,081

Table 8: results of binary logistic regression SES, gender, rural/urban, age and obesity.

When looking at table 3 and 8 there can be seen that the B values of socioeconomic status are more or less the same. Thus, obesity is a good predictor of obesity, even when controlled for age and gender.

4.6 The three components of socioeconomic status

Socioeconomic status in this research is defined as education level, occupation and monthly household income. The goal is to see what the influences of these three factors independently are. First, a binary logistic regression with obesity and monthly household income is done. The results are shown in Appendix B. As expected, lower income is associated with a higher probability of obesity. Not all income groups are significant. But looking at the B value, there can be seen that the value is more or less decreasing per income group, which means that the higher the income group the less obesity prevalence. These results are in line with the results of the total socioeconomic status (which included also educational level and occupation) on obesity. However, interesting is that the B value of the lowest income group (< 500 €) is lower than the B value of the second lowest income group (500 – 750€). This means that obesity prevalence is higher in the second income group. This is interesting because the expectation was that the lower the income, the higher the obesity probability, so there are exceptions on this rule.

According to Jones (2018), obesity prevalence increases when the mother works more. Appendix C shows the results of the KiGGS dataset. First, a binary logistic regression with only the mother's occupation and obesity was done. There can be seen that only 'not working' is significant. The B value shows a positive value. This means that for the child, the obesity probability is higher when the mother is not working than when the mother is part-time working. This is in contrast with the statements of Jones (2018). However, looking at 'full time working', the B value is also positive. Thus, children of which the mother is working full time have more obesity probability than children with part-time working mothers. However, this is not significant. The same regression is done with the occupation of the father as the independent variable. These results are also visible in Appendix C. For the occupation of the father also applies that only 'not working' is significant and that the probability of obesity is higher when the father is not working than when the father is working part-time. This finding can be related to the results of the regression with monthly household income. Because, when the parents are not working, the monthly household income is probably lower than when the parents have a job.

The last factor of socioeconomic status is educational level. Jones (2018) stated that a higher educational level of the father is associated with lower obesity prevalence. Appendix D1 shows the same results. All education levels are significant and for each education level applies that the higher the education level of the father, the lower the obesity probability. This can be seen at the B value, which is negative and increases with every step to a higher education level. The result of the educational level of the mother is a bit different. In Appendix D2 can be seen that only 'realschulabchluss', 'fachhochschulreife' and 'abitur' significant are. Still, the statement higher educational level is associated with lower obesity probability applies. These findings are in line with the results of the regression with socioeconomic status and obesity. For both apply a negative relationship with obesity probability.

5 Conclusion

5.1 Conclusion

The purpose of this study is to determine what the relation is between socioeconomic status and obesity. The literature shows that there is a negative relation between SES and obesity. Low socioeconomic status can be linked to higher obesity probability. The literature also shows a difference in gender and obesity probability. Women in (high) developed countries would have more obesity probability when having a low socioeconomic status than men in those countries. This study, with the KiGGS dataset, also shows a negative relation between SES and obesity. However, a difference between the boys and girls has not been found. Age could be the reason for this, while the results show that children in older age categories were more obesity prevalence. It is possible that differences in obesity probability and additional factors get more visible with age. The population in this dataset are children and the literature was mostly about adults, so there is an age difference in here. The results of the KiGGS dataset shows different outcomes than the literature when it comes to rural versus urban areas. The literature shows that obesity rates in rural areas are higher than in urban areas, this was not supported with the results of the KiGGS dataset. The influences of the socioeconomic factors independently are in line with the statement that socioeconomic status has a negative relation with obesity. We can conclude that socioeconomic status is a good predictor of obesity, even when controlled for age and gender.

5.2 Reflection

In this research secondary data has been used. That data has been collected for other purposes, so there could be errors in the data collection. Furthermore, some categories in variables are combined to make it easier to get results with meaning. Also, most of the literature found was about adults, while this research was about children. This could be a reason why the outcomes differ from each other. The strengths of this research are that, firstly, new insights into the relationship between socioeconomic status and obesity are obtained. And secondly, on the basis of this research new questions arise, mentioned below.

5.3 Further research

It would be interesting for further research to look deeper into the relationship between socioeconomic status and obesity and to see what the differences in obesity triggers. Also, when looking at rural versus urban areas and the level of socioeconomic status, it would be interesting to see which way this relation goes. Is someone's socioeconomic status high because he/she is living in an urban area or is someone living in an urban area because his/her socioeconomic status is high and can afford it?

References

Befort, C.A., Nazir, N. and Perri, M.G. (2012). Prevalence of Obesity Among Adults From Rural and Urban Areas of the United States: Findings From NHANES (2005-2008). *The Journal of Rural Health*, 28(4): 392-397.

Clifford, N., Cope, M., Gillespie, T. and French, S. (2016). *Key Methods in Geography*. Third edition. SAGE, 752.

Dietz, W.H. (1998). Health Consequences of Obesity in Youth: Childhood Predictors of Adult Disease. *Pediatrics*, 101(2): 518-525.

Gillman, M.W. (2004). A life course approach to obesity. In: D. Kuh and Y.B. Schlomo, ed., A Life Course Approach to Chronic Disease Epidemiology, 2nd ed. Oxford: OUP Oxford, 189-217.

Hossain, P., Kawar, B. and El Nahas, M. (2007). Obesity and Diabetes in the Developing World — A Growing Challenge. *The New England Journal of Medicine*, 356: 213-215.

Jastreboff, A.M., Kotz, C.M., Kahan, S., Kelly, A.S. and Heymsfield, S.B. (2018). Obesity as a Disease: The Obesity Society 2018 Position Statement. *Obesity, a Research Journal*, 27: 7-9.

Jones, A. (2018). Race, Socioeconomic Status, and Health during Childhood: A Longitudinal Examination of Racial/Ethnic Differences in Parental Socioeconomic Timing and Child Obesity Risk. *International Journal of Environmental Research and Public Health*, 15(4): 728.

Kuehn, B. (2018). Obesity Rates Increasing. JAMA, [online] 1632. Available at: https://jamanetwork-com.proxy-ub.rug.nl/journals/jama/fullarticle/2708127 [Accessed 14 March 2019].

Lamerz, A., Kuepper-Nybelen, J., Wehle, C., Bruning, N., Trost-Brinkhues, G., Brenner, H., Hebebrand, J. and Herpertz-Dahlmann, B. (2005). Social class, parental education, and obesity prevalence in a study of six-year-old children in Germany. *International Journal of Obesity*, 29: 373-380.

Mauz, E., Göβwald, A., Kamtsiuris, P., Hoffmann, R., Lange, M., Schenck, von, U., Allen, J., Butschalowsky, H., Frank, L., Hölling, H., Houben, R., Krause, L., Kuhnert, R., Lange, C., Müters, S., Neuhauser, H., Poethko-Müller, C., Richter, A., Schaffrath Rosario, A., Schaarschmidt, J., Schlack, R., Schlaud, M., Schmich, P., Schöne, G., Wetzstein, M., Ziese, T. and Kurth, B.M. (2017). New data for action. Data collection for KiGGS Wave 2 has been completed. *Journal of Health Monitoring*, [online] 2(S3). Available at: https://www.rki.de/EN/Content/Health_Monitoring/Health_Reporting/GBEDownloadsJ/Journal-of-Health-Monitoring_02S3_2017_KiGGS-Wave2_Methods_Modules.pdf?__blob=publicationFile [Accessed 26 May 2019].

Mayur, K. (1999). Obesity: a growing problem. *Futurist*, 33(8): 14-15.

McLaren, L. (2007). Socioeconomic Status and Obesity. *Epidemiologic Reviews*, 29: 29-48.

Novak, M., Ahlgren, C. and Hammerström, A. (2006). A life-course approach in explaining social inequity in obesity among young adult men and women. *International Journal of Obesity*, 30: 191-200.

Nummela, O.P., Sulander, T.T., Heinonen, H.S. and Uutela, A.K. (2007). Self-rated health and indicators of SES among the ageing in three types of communities. *Scandinavian Journal of Public Health*, 35: 39-47.

Peeters, A., Barendregt, J.J., Willekens, F., Mackenbach, J.P., Al Mamun, A. and Bonneux, L. (2003). Obesity in Adulthood and Its Consequences for Life Expectancy: A Life-Table Analysis. *Annals of Internal Medicine*, 138(1): 24-32.

Popkin, B.M. and Doak C.M. (1998). The Obesity Epidemic Is a Worldwide Phenomenon. *Nutrition reviews*, 56(4): 106-114.

Seidell, J.C. (1999). Obesity: a growing problem. *Acta Pædiatr*, 428: 46-50.

Swinburn, B.A., Sacks, G., Hall, K.D., McPherson, K., Finegood, D.T., Moodie, M.L. and Gortmaker, S.L. (2011). The global obesity pandemic: shaped by global drivers and local environments. *The Lancet*, 378: 804-814.

Wisniewski, A.B. and Chernausek, S.D. (2009). Gender in childhood obesity: Family environment, hormones, and genes. *Gender Medicine*, 6(1): 76-85.

Withrow, D. and Alter, D.A. (2009). The economic burden of obesity worldwide: a systematic review of the direct costs of obesity. *Obesity Reviews*, 12(2): 131-141.

Wolf, A.M. and Colditzt, G.A. (1998). Current Estimates of the Economic Costs of Obesity in the United States. *Obesity, a Research Journal*, 6(2): 97-106.

World Health Organization (WHO) (2018). Obesity and overweight. [online] Available at: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight [Accessed 27 May 2019].

World Health Organization, Europe (WHO) (n.d.). Life-course approach. [online] Available at: http://www.euro.who.int/en/health-topics/Life-stages [Accessed 27 May 2019].

Appendix

Appendix A

1. Low socioeconomic status:

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Urban areas	-,042	,041	1,085	1	,298	,959
	Constant	-,953	,036	713,629	1	,000	,386

2. Average socioeconomic status:

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Urban areas	-,354	,036	94,748	1	,000	,702
	Constant	,087	,032	7,468	1	,006	1,091

3. High socioeconomic status:

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Urban areas	,467	,045	106,345	1	,000	1,595
	Constant	-1,467	,041	1282,839	1	,000	,231

Appendix B

Monthly household income and obesity:

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	MHI <500	,694	,280	6,159	1	,013	2,002
	MHI 500-<750	,707	,194	13,259	1	,000	2,029
	MHI 750-<1000	,581	,176	10,901	1	,001	1,788
	MHI 1000-<1250	,452	,172	6,912	1	,009	1,572
	MHI 1250-<1500	,474	,156	9,268	1	,002	1,607
	MHI 1500-<1750	,390	,162	5,782	1	,016	1,478
	MHI 1750-<2000	,126	,158	,638	1	,424	1,134
	MHI 2000-<2250	-,230	,168	1,867	1	,172	,795
	MHI 2250-<2500	-,083	,159	,275	1	,600	,920
	MHI 2500-<3000	-,065	,145	,199	1	,656	,937
	MHI 3000-<4000	-,291	,153	3,621	1	,057	,747
	MHI 4000-<5000	-,761	,235	10,526	1	,001	,467
	Constant	-2,795	,110	640,659	1	,000	,061

Appendix C

1. Binary logistic regression occupation mother and obesity:

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	not working mother	,214	,079	7,238	1	,007	1,238
	fulltime wokring mother	,084	,093	,821	1	,365	1,088
	Constant	-2,834	,056	2570,688	1	,000	,059

2. Binary logistic regression occupation father and obesity:

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	not working father	,702	,257	7,480	1	,006	2,018
	fulltime working father	,156	,245	,405	1	,524	1,169
	Constant	-3,001	,241	154,457	1	,000	,050

Appendix D

1. Binary logistic regression education level father and obesity:

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	haupt/volksschulabschluss father	-,523	,201	6,742	1	,009	,593
	realschulabschluss father	-,916	,210	19,083	1	,000	,400
	abschluss polytechn oberschule father	-,955	,213	20,025	1	,000	,385
	fachhochschulreife father	-1,028	,231	19,847	1	,000	,358
	abitur father	-1,509	,220	47,154	1	,000	,221
	Constant	-1,908	,192	98,313	1	,000	,148

2. Binary logistic regression educational level mother and obesity:

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	haupt/volkschulabschluss mother	,029	,242	,014	1	,906	1,029
	realschulabschluss mother	-,540	,244	4,892	1	,027	,583
	abschluss polytechn oberschule mother	-,388	,248	2,444	1	,118	,678
	fachhochschulreife mother	-,547	,270	4,087	1	,043	,579
	abitur mother	-1,104	,258	18,364	1	,000	,332
	Constant	-2,322	,234	98,238	1	,000	,098