Migrants and Obesity

Explaining BMI differences between native and non-native Dutch residents.

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Date: 10-07-2020

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Abstract

Obesity is one of the world's greatest current challenges. Therefore, research on obesity and its risk factors is ubiquitous. Simultaneously, people are more mobile than ever and the global migrant stock increases each year. Migrants are generally found to be healthier than non-migrants. However, current-day research statistics show that migrants in Western Europe have a greater risk of being obese than non-migrants. In The Netherlands, nearly a quarter of the population has a migration background. Ten years ago the Dutch Central Plan Bureau established that obesity is more prevalent in minorities. This study aimed to investigate if this is still the case today and how this can be explained. Therefore, a mediation analysis through ordinary least squares regression was carried out. The positive association between being a migrant and obesity was found, however when controlling for other constructs, such as socioeconomic status, behaviour and mental health, the effect of being a migrant became insignificant. However, the mediation effect was small. Moreover, the coefficient of determination was only 5%, indicating that most variance in BMI is caused by other factors. It is argued that more research into the conflicting risk factors for obesity is needed to identify more patterns. If targeted policy is to be successful, it is crucial that the risk factors are better understood.

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1. Introduction

Obesity prevalence worldwide nearly doubled between 1980 and 2008. This is a major problem, because "overweight and obesity are major risk factors for a number of chronic diseases, including diabetes, cardiovascular diseases and cancer" (WHO, 2020). Meanwhile, the United Nations estimated the global international migration stock on 272 million of which the largest share (82 million) lives currently in Europe (UN, 2019). The Netherlands has, partially due to its colonial history, a relatively large share of international migrants. Nearly a quarter of the Dutch population has a migration background (CBS, 2020), meaning that they either migrated from another country themselves, or at least one of their parents did. This high percentage of migrants makes the Netherlands an ideal country for research between migrants and non-migrants. Research conducted by the Dutch Central Plan Bureau found that obesity is more prevalent in minorities than in native Dutch citizens (2009). This research is, however, over 10 years old, so it is interesting to explore if this higher risk for obesity in migrants still exists today and mostly how this can be explained. If migrants in The Netherlands still have elevated risks of being obese, it is important to understand why. Identifying possible mediating factors can be of great importance for creating targeted policies to reduce obesity rates. Therefore, the central research question of this paper is: "*How do BMI rates between native and non-native Dutch residents differ and how can these differences be explained?*" In order to find answers to this question, first of all, risk factors associated with obesity will be identified. Second, a quantitative analysis will be carried out in order to investigate if being a migrant is still positively associated with being heavier. Lastly, the relation between being a migrant, the identified risk factors and BMI will be researched. In practice, this will start with a theoretical framework in section two, followed by a description of the method and data in section three. After that, the results will be presented in section four and finally, in section five, conclusions will be drawn, limitations will be mentioned and recommendations based on this research will be presented.

2. Theoretical framework

Since obesity is one of the major current global health challenges, a plethora of research about this topic has been conducted. This theoretical framework consists of multiple elements. First, previous research on migrants and obesity will be presented. Second, research on risk factors associated with obesity will be discussed. This comes together in the conceptual framework before at last hypotheses are constructed.

2.1 Obesity in migrants

Comparing migrant's behaviours and outcomes to natives has been the premise of many demographic studies. Kulu (2005) describes four possible theories linking fertility outcomes and migration. Among others, these hypotheses describe to what extent migrant's behaviour matches norms in the country of destination and/or origin and why. The socialisation hypothesis predicts that migrants continue to exhibit behaviour that matches the standard in their critical period, while the adaptation hypothesis predicts that migrants will adapt to the norms in the host community. Another hypothesis is the selection hypothesis which is built on the idea that migrants relocate to areas that match certain intrinsic preferences, the outcomes of this will therefore be similar to outcomes derived from the adaptation hypothesis. Following the socialisation hypothesis obesity levels in migrants will look similar to levels in their home country, while following the selection- and adaptation hypothesis obesity levels in migrants will look similar to levels in the host country's population.

These hypotheses are not exclusively discussed in relation to fertility. For example, Wallace and Wilson (2019) discuss the selection hypothesis, in the context of mortality. It is known that international migrants have lower mortality than non-migrants who remain in the country of origin. This is described by the term *migrant mortality advantage.* Wallace and Wilson describe the selection hypothesis as a theory that predicts that migrants are not a representative sample of the country of origin. They might, generally speaking, be healthier and more robust and this could be an explanation for the migrant mortality advantage. Another explanation for the migrant mortality advantage that is mentioned by Wallace and Wilson is the *salmon bias effect* which describes that less healthy migrants show a preference to return to their country of origin. Thereby, they leave a healthier migrant population with lower mortality rates in host countries.

Both the migrant mortality advantage and salmon bias effect are contradictory to elevated obesity levels in The Netherlands. When following these theories, it is expected that migrants have a lower risk of being obese than natives. However, multiple studies found migrants to demonstrate similar or elevated obesity levels compared to natives. For example, Morbach et al. (2018) found that migrants in Germany on average have a higher BMI than native Germans. In Italy, Toselli et al. (2019) found a positive association between obesity and length of residence, with the odds of obesity increasing by 2.4 in long term immigrants. The findings by Toselli et al. provide substantiation for the adaptation hypothesis, since it is argues that over time North-African migrants adapt to the unhealthier behaviour in Italy.

2.2 Risk factors for obesity

2.2.1 Behaviour

Risk factors for obesity can be divided into multiple categories. The first category is behavioural risks, which have a direct influence on body weight. Obesity can only develop because of an energy imbalance where energy intake exceeds energy expenditure for a longer period (Hill & Wyatt, 2005). This is caused by immoderate consumption of (calorie dense) food and/or low levels of physical activity. Besides the quantity of food intake, the type of nutrition is also associated with obesity. For

example, increased fruit and vegetable consumption reduces the risk of obesity (Ledoux et al.,2010). Lastly, there seems to be an association between alcohol consumption and obesity. Riserus & Ingelsson (2007) found that elderly men who were heavy drinkers, were more likely to be obese. Traversy & Chaput (2015) paint a more complicated picture. They argue that research about weight gain and alcohol consumption often results in conflicting findings, for example that moderate drinkers are generally healthier. However, they claim that alcohol intake may be a risk factor for obesity for some people. Underlying to these behavioural factors, indirect risks can be identified. These factors increase the risk of performing behaviour that may lead to weight gain. In this research, these risks are divided into two types, namely socioeconomic status and mental health.

2.2.2 Socioeconomic status

Socioeconomic status encompasses numerous factors, such as income, educational attainment, financial security and subjective perceptions of social status and – class (APA, 2017). The relationship between socioeconomic status (SES) and obesity has extensively been researched. In many instances, the relation between SES and weight was negative, meaning that a lower SES correlated with higher weights. For instance, Drewnowski and Specter (2004) found that the highest obesity rates occur among population groups with the lowest income and education in the USA. Their explanation for this is that energy-dense foods with high fat and/or added sugars are often cheaper than fresh and healthier produce such as fruit, vegetables and fish, however, it is unlikely that this applies to every country. De Jong et al. (2013) found that obesity was more prevalent in children growing up in low SES families in The Netherlands and found that these families on average eat less home cooked meals, eat less often at the table and eat takeaway meals more often. In The Netherlands, takeaway is not cheaper than healthy food, so the explanation here is different than what Drenowski and Specter argue.

McLaren (2007) analysed the results of 330 articles on the relation between obesity and SES and found that in the majority of cases, the relation was negative for women in highly developed countries. She found that education was an especially strong indicator; 72% of the associations were negative. For men, the results predominantly came back insignificantly. 85% of the associations with employment and 70% of the associations came back nonsignificant. The number of negative associations was highest in highly developed countries, while positive associations were found in low developed countries. This suggests that the correlation between SES and obesity is dependent on gender, region and the chosen indicator for SES. Basto-Abreu et al. (2017) recognize these same complexities and suggest using multiple SES indicators, since relying on just a single indicator may ignore other important social processes.

2.2.3 Mental health

The difficulty with studying the relation between mental health and obesity is the problem of direction of causality. Shafari et al. (2020) found depression and anxiety potential risk factors for developing obesity and claim a direct association between obesity and mental state.

On the other hand, Penedo and Dahn (2005) found that regular physical activity has a positive effect on mental and physical health. Since obesity can lead to a reduced mobility, it seems plausible that obesity can also lead to mental health problems. Demirci (2019) argues that there is no single cause in the relation between obesity and depression. Based on his review, he argues that on the one hand, it has been found that obesity increases the risk of developing depression, while on the other hand, depression was found to be a predictor for the development of obesity.

2.3 Conceptual model

In figure 1, the conceptual model on which this research is build is visualized. The model shows the expected relation between being a migrant and BMI, with the possible mediating influence of risk factors. In this research, a migrant is an individual who lives in The Netherlands, but was born elsewhere, thus, only first-generation migrants are taken into consideration. Risk factors include the

aforementioned risk factors for obesity, such as socioeconomic status, mental health and behaviour. Risk factors are expected to have a mediating effect on the relation between migrant and BMI. An example of this can be: being a migrant increases the risk of having a lower income. Lower income in turn increases the risk of a higher The arrow from 'risk factors' also returns to 'being a migrant', because the decision of becoming a migrant can be influenced by factors that are simultaneously risk factors for obesity. For example, people's decision to migrate can be influenced by their socioeconomic status. Lastly, the arrow from risk factors to BMI also goes in the opposite direction. This is, for instance, because of the aforementioned possibility of obesity leading to depression or obesity leading to reduced mobility.

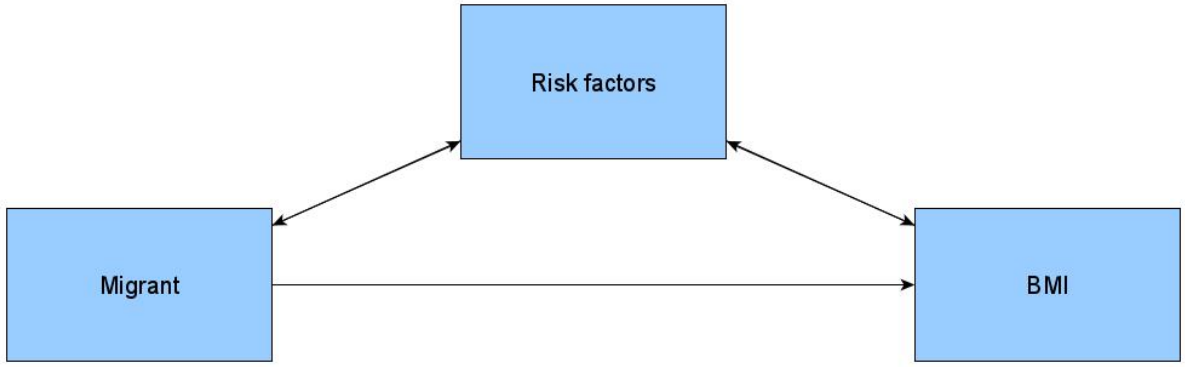

Figure 1: Conceptual model

2.4 Hypotheses

Based on earlier research, it is expected to find a relation between being a migrant and BMI.
The null hypothesis that will be tested is: *There is no relation between BMI and being a migrant.*
Based on earlier research, it is expected that other variables also have an effect. These variables might explain the relation between migrants and BMI. The second null hypothesis that will be tested is:
Risk factors for obesity have no mediating effect.

3. Methodology

3.1 Data collection

To find answers to the aforementioned questions, a large data set was required. Since it was not possible to collect these amounts of data with the time and resources available, the decision was made to make use of secondary data. The data set that was used in this research is the SHARE dataset (Survey of Health, Ageing and Retirement in Europe). SHARE is a biannual panel study, which has been conducted since 2004. This database includes about 140,000 individuals aged 50 or older, who live in 27 European countries or Israel (SHARE, 2020). The previous research of the CPB in 2009, as mentioned in section 1, indicated that the risk of obesity increased with age. This is a general trend, however in this case, when comparing migrants to non-migrants the differences increased in older age groups. Therefore, this dataset is suitable for this research. The specific SHARE release that was used for this research is the Dutch Mixed Mode experiment, since this is the most recent data released from The Netherlands. The data in this set data set was collected in 2015-2016 and nearly consists of the same modules as the large SHARE release. The Netherlands was not included in the 6th wave of SHARE because of differences in method of data collection. Usually SHARE data is collected by means of face-to-face interviews (CAPI). However, because of financial restraints, due to funding issues, this was not possible at that moment. Therefore, the data in this research was collected by mostly online surveys (CAWI) and, a smaller proportion, telephone interviews (CATI), depending on whether or not the research subject had access to a computer. The sample consists of both a longitudinal sample and a refreshment sample. For the longitudinal sample, all people who participated in earlier SHARE releases were approached. For the refreshment sample, members of an existing probability-based panel, LISS, were used. 8560 respondents were invited, of which 4582 (54%) responded.

3.2 Data analysis

For the analysis it was necessary to know the respondent's BMI and whether or not he/she was born in The Netherlands. Then, possible mediating factors were used to explore their effect. The method of analysis that was chosen for this project is mediation analysis through Ordinary Least Squares regression. This means that first the relation between BMI and being a migrant is tested. Then, underlying reasons for why this relation exists are included into the model to test their influence on the found effect. These mediating variables are the aforementioned risk factors for obesity.

3.2.1 Variables

The following section will address which variables were included in the analysis and why. Table 1 shows an overview of the chosen variables per category. Under the table, the choices for these variables will be explained more in depth. Correlations between variables showed no problems regarding multicollinearity, so they were all kept in analysis. The correlation matrix can be found in Appendix B.

Table 1: Variables

Dependent variable	*Main independent variable*	*Socioeconomic status*	*Behaviour*	*Mental health*
Body Mass Index	Born in the country of interview	Is household able to make ends meet	Activities requiring a moderate level of energy	Depression scale EURO-D - high is depressed
		Respondent: ISCED-11 coding of education	How often serving of fruits or vegetables	Hopes for the future
			Units of alcoholic beverage the last seven days	Loneliness (short version of R-UCLA Loneliness Scale) - high is lonely
				Feels isolated from others

Body Mass Index

The dependent variable in the analysis is BMI, which was included in the dataset as a generated variable, calculated by dividing the respondents weight in kilograms by its squared length in meters. The decision was made to treat BMI as a continuous variable, rather than creating a dichotomous variable 'obese/not obese', because this preserved as much information as possible and it made linear regression possible. This way the assumption is made that the variables have a constant effect on the BMI at all levels. Moreover, inspection of the data indicated that there was no large group of respondent with underweight.

Main independent variable

The main independent variable of the research is 'Born in the country of interview'. This question is part of the demographics module and was therefore answered by approximately half of the respondents. This variable is dichotomous, since only respondents that answered this question with yes or no were kept in the analysis.

Socioeconomic status

To measure the construct of socioeconomic status, one usually looks at income and/or education. However, income is a difficult variable to use, since respondents are often reluctant to share their financial situation. Furthermore, release notes of the data set state that wealthier respondents are more willing to share their financial information. Therefore, data that was collected is likely not representative. Moreover, the average age of the sample is 64, since this is close to the retirement age in The Netherlands, there is a divide in the data. Half of the respondents receive income, while the other half receive pensions. Keeping all of this in mind, the decision was made to not use a discrete value for income, but instead use the data that was collected on the question 'to what extent is your household able to make ends meet?'. Valid values range from 1 to 4 (1=with great difficulty, 4=easily). The difficulty with level of education was that the question was specifically targeted on the Dutch educational system. A significant share of the foreign-born respondents completed their education abroad, which was coded as 'other' in this module. However, the data was used later in the generated variables module. The International Standard Classification of Education 2011 (ISCED11) makes it possible to make comparisons between education from varying countries.

Behaviour

The decision-making process for selecting variables for behavioural risks was straightforward. Based on the literature it is expected that consumption of alcoholic beverages and fruit and vegetables as well as the level of physical exercise might influence body weight.

Mental health

For mental health multiple factors were selected. They are depression, loneliness, future hopes and isolation. Future hopes and isolation are questions from the mental health module of the questionnaire. On a Likert scale respondents were able to indicate to what extent they have hopes for the future and to what extent they experience isolation. Depression and loneliness are generated variables based on other questions in the mental health module. Depression is indicated on the EURO-d scale, which is a depression scale specifically designed for elderly persons. The variable loneliness is a short version of the R-UCLA loneliness scale. The decision was made to create multiple indicators for mental health because the way it is operationalized and measured determines the outcomes. Moreover, the chosen variables highlight different aspects of mental health, therefore, just selecting 'depression' felt as not being complete or thorough.

Table 2: Missing Values

		Exercise	Fruits/vegetables	Alcohol	Financial	Migrant	Depression	Loneliness	Future hopes	Isolation
N	Valid	4464	2478	3218	3081	2483	4338	4338	4339	4338
	Missing	8	1994	1254	1391	1989	134	134	133	134

3.2.2 Missing values

The SHARE survey consists of multiple modules, of which the most general are answered by all respondents. However, the majority of the modules are only answered by a portion of the sample. Who answers which modules and in what order is decided at random. The choice to not have all respondents answer each module is made to include as many variables as possible, without making the survey too exhausting to answer for the respondents. In reality, this leads to a large number of missing values in the dataset. Table 2 shows the number of these missing values and valid values per variable. The largest share of missing values can be found in the variables fruits/vegetables, alcohol, financial and migrant. The large amount of missing values required a strategy to handle missing data that would lead to as little biases as possible and safeguard the representativity of the sample. The decision was made to exclude missing values listwise. Since the missing data are MCAR (missing completely at random), excluding the cases listwise leads to a random subsample of the original sample (Allison, 2009). Unfortunately, excluding cases listwise leads to a substantial decrease in sample size, which ultimately leads to loss of statistical power. However, the original sample size was substantial enough to carry the data loss and still allow the regression analysis.

4. Results

4.1 Descriptive statistics

The final sample for analysis consists of 2483 cases of which 184 (7.4%) are migrants. This means that there is a slight underrepresentation of migrants in this sample, since according to CBS Statline data (2019), on the first of January 2016, elderly (50+) first generation migrants made up approximately 10% of the total population in this age category. The subjects are aged between 31 and 93 with an average age of 64 (individuals who are over fifty years old and their partners) and have an average BMI of 26. This average BMI is similar to statistics from the Dutch RIVM for individuals in this age category (Rijksinstituut voor Volksgezondheid en Milieu, 2012). The male/female ratio in the sample is 48.5/51.5. This is to be expected, since women on average have a higher life expectancy than men, therefore, the elder Dutch population consists of more females than males (CBS,2018). As mentioned in section 3.2.2, the decision was made to exclude missing values listwise, therefore, the number of cases included in the regression analysis is 1188 of whom 75 are migrants. The average BMI of this subsample is still 26, while the average age remains 64. These statistics and their corresponding standard deviations are depicted in table 3.

Table 3: Descriptive statistics regression sample

	Mean	*Std. Deviation*	*N*
Body mass index	26.01	3.739	1188
Born in the country of interview	0.93	.24330	1188
Gender	0.52	0.49924	1188
Age	64.78	8.498	1188

4.2 Model 1: Being a migrant and BMI

Multiple models were tested to explain the relation between being a migrant and BMI. The first model is the simplest one, with only migration status as explanatory variable. The association between BMI and being a migrant was tested using linear regression. The results of this analysis are visualised in table 4 below under 'model 1'.

The regression is significant (p=0.022), which means that being a migrant predicts BMI significantly well. However, the R^2 was small: 0.004, which means that being a migrant only explains 0.04% of the variance found in the variable BMI. Based on model 1, being a migrant is a significant explaining variable for BMI. The results indicate a positive relation between being a migrant and BMI. However. the magnitude of the effect is small, since the expected difference between migrants and non-migrants is 0.255.

Table 4: Regression coefficients

	B(sig)			
	Model 1	*Model 2*	*Model 3*	*Model 4*
Constant	25.694	27.599	25.720	24.980
	(.000)*	(.000)*	(.000)*	(.000)*
Migrant	.255	.246	.201	.200
	(.022)*	(.026)*	(.065)	(.068)
Education		-.157	-.132	-.131
		(.003)*	(.013)*	(.0148)*
Financial		-.424	-.390	-.374
		(.001)*	(.002)*	(.005)*
Exercise			.687	.684
			(.000)*	(.000)*
Fruits or vegetables			.468	.473
			(.001)*	(.001)*
Alcohol			.006	.007
			(.647)	(.608)
Hopes for the future				-.149
				(.663)
Loneliness				-.301
				(.252)
Isolation				.575
				(.029)*
Depression				.044
				(.493)

*= significant at the 5% level

4.3 Model 2: Socioeconomic status

The second model includes more independent variables. In addition to being a migrant, two indicators for socioeconomic status are included, namely education level and financial stability. The results of this analysis can be found under model 2 in table 4. This regression is significant ($p<0.001$), which indicates a linear relation between the explaining variables and BMI. Moreover, the adjusted R^2 is slightly bigger than in the first model. This model explains 2.2% of the variance in BMI. Looking at the coefficients, all independent variables are significant: migrant: p=0.026, education: p=0.003 and financial stability: p=0.001). The coefficients for education and financial stability are negative, indicating a negative relation between education and financial stability with BMI.

4.4 Model 3: Behaviour

The third model consists of the variables used in model 2, combined with behavioural factors, namely exercise, fruit and vegetable consumption and alcohol intake. This regression is significant ($p<0.001$). The adjusted R^2 again slightly improved in comparison to the previous models. This model explains 5.52% of the variance in BMI. Interestingly, being a migrant is not significant in this model (p=0.065) just as alcohol intake (p=0.647). All other factors are statistically significant. The association between obesity and fruits and vegetables and exercise is positive, which seems surprising. However, the coding of those variables is slightly counterintuitive, with higher values representing less exercise or fruit/vegetable intake. The interpretation should be that more exercise and fruit/vegetable consumption is associated with lower BMI, which is what was to be expected based on the literature.

4.5 Model 4: Mental health

The final and most extensive model consists of the variables used in model 3, combined with variables relating to mental health, namely hopes for the future, loneliness, isolation and depression.

This regression is significant ($p<0.001$). The adjusted R^2 remained nearly the same (0.053), while the R^2 rose to 0.061. It is not surprising that the model improves when more variables are added. However, none of the models explain the variance in BMI very well. This model explains just 5.52%, implying that a great number of variables that explain variance in BMI are still unknown. In this model there are no changes to the coefficients and significance of the variables that were included in model 3. The newly included variables regarding mental health are all statistically insignificant, except for isolation. Isolation is again coded counterintuitively: 1=feels often isolated, 3=feels hardly ever or never isolated. This means that this result is surprising, indicating an association between less isolation and lower weights. A possible explanation for this could be that the oldest people in the sample are on average the most isolated and weight the least. This would not be surprising, since lonely elderly are common in The Netherlands and frailty at old age can often result in weight loss. If the order of analysis is reversed and mental health variables are the only variables in the model, the results do not change much, while the coefficients slightly change, only the variable isolation is significant.

5. Conclusion

This study set out to explain BMI differences between natives and migrants in The Netherlands.
A positive association between BMI and being an older migrant in The Netherland was identified, which was to be expected based on previous research. The observed effect, however, was relatively small. When expanding the model with more relevant variables, the effect of being a migrant on BMI became insignificant. The risk factors, identified in the theoretical framework, were mostly positively associated with BMI. However, the association between mental health and BMI was almost non-existent. The expectation of mediation effects was confirmed, since the value of the regression coefficient decreased when other variables were included in the model. It is, however, important to note that the identified effect was small. The strengths of this research are, first of all, that it combines many constructs regarding obesity and thus tries to paint a complete picture of the complex relations. In the theoretical framework it was established that numerous previous studies describe conflicting results and complex associations between variables. Furthermore, this research is quite unique, because there are very few studies that researched mediation effects in this topic.

Naturally, this research also has its weaknesses. First of all, the choice to select the SHARE dataset meant that the sample consists of elderly citizens. Since research suggests that obesity is positively associated with long term migration, older migrants seemed to be the most interesting group to research. However, this means that there is bias in the sample. It is possible that this sample has an overrepresentation of unhealthy migrants, because the more mobile ones migrated back to their country of origin. On the other hand, following the salmon bias theory, it is also possible that the unhealthy ones moved back, leaving an especially healthy migrant population in The Netherlands.
A second limitation to this research is the number of missing values, which was substantial due to the design of the survey. The decision to exclude cases listwise had consequences for the statistical power of the tests. The chances have increased that null hypotheses were accepted while they could have been rejected with larger sample sizes. The reasoning behind listwise deletion as opposed to pairwise was to reduce the chances of biases. However, this decision led to small changes in the composition of the sample. A critical remark regarding this research as a whole, is the low coefficient of determination (R^2). If the most extensive model still only explains 5% of the variance in BMI, one can question the added value of this research. 95% of the variance in BMI was not explained, even though the attempt was made to identify as many risk factors as possible. Another weakness is that this research did not take biological or medical factors into account, which might be of crucial importance when studying different ethnicities. Moreover, in this study, there were no distinctions made between birth places of migrants. This was not possible, because it would result in groups that would have been too small to be able to use in statistical tests. Therefore, it is difficult to make assumptions about adaptation or socialization, because the backgrounds of the migrants are too dissimilar just as the extent to which it differs from The Netherlands. It can also be questioned if a migrant from Belgium is more similar to a migrant from Indonesia than to a native Dutch resident. However, migrants from all

backgrounds were considered as one group, which may not be theoretically sound. Lastly, culture was not a factor that was taken into consideration, while it is obviously an important factor in what a person eats and how body ideals are constructed.

From this research follow some recommendations for future research. First of all, since this research problem is so broad and complicated, it is very suitable for mixed methods research. Qualitative studies could provide more insights in the meanings behind the food culture of migrants and to what extent they adapt to the host country or keep habits from their native country. Moreover, research in which distinctions between countries or regions of origin are made could be very informative. Next to recommendations for further research, there are also some policy recommendations. Obesity remains one of the greatest challenges of the present day. The average BMI of 26, identified in the results, translates to 'overweight'. The most important recommendation regarding policy is that it is important to treat obesity as the multifaceted construct it is. In the theoretical framework (section 2), the difficulty of causality and conflicting variables and outcomes was established. The results showed significant associations between BMI and SES and behavioural factors. Based on this, policy aimed at reducing obesity should focus on promoting healthy behaviour and specifically paying attention to low SES families. From this research, there can no clear recommendation be given on how to combat obesity in migrants, specifically. The limitations are too great and the results are not convincing enough. However, if more research is conducted, it may be possible to create more targeted policies, specifically aimed at reducing obesity rates among migrants in The Netherlands.

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Appendix A: Syntax

```
DATASET ACTIVATE DataSet1.
MATCH FILES /FILE=*
  /FILE='DataSet2'
  /RENAME (country coupleid6 hhid6 language mergeidp6 = d0 d1 d2 d3 d4)
  /BY mergeid
  /DROP= d0 d1 d2 d3 d4.
EXECUTE.

MATCH FILES /FILE=*
  /FILE='DataSet3'
  /RENAME (country coupleid6 hhid6 language mergeidp6 = d0 d1 d2 d3 d4)
  /BY mergeid
  /DROP= d0 d1 d2 d3 d4.
EXECUTE.

MATCH FILES /FILE=*
  /FILE='DataSet4'
  /RENAME (country coupleid6 exrate hhid6 language mergeidp6 = d0 d1 d2 d3 d4 d5)
  /BY mergeid
  /DROP= d0 d1 d2 d3 d4 d5.
EXECUTE.

MATCH FILES /FILE=*
  /FILE='DataSet14'
  /RENAME (country coupleid6 hhid6 language mergeidp6 = d0 d1 d2 d3 d4)
  /BY mergeid
  /DROP= d0 d1 d2 d3 d4.
EXECUTE.

MATCH FILES /FILE=*
  /FILE='DataSet5'
  /RENAME (country coupleid6 hhid6 language mergeidp6 = d0 d1 d2 d3 d4)
  /BY mergeid
  /DROP= d0 d1 d2 d3 d4.
EXECUTE.

DATASET ACTIVATE DataSet15.
MATCH FILES /FILE=*
  /FILE='DataSet7'
  /RENAME (country coupleid6 exrate hhid6 language mergeidp6 = d0 d1 d2 d3 d4 d5)
  /BY mergeid
  /DROP= d0 d1 d2 d3 d4 d5.
EXECUTE.

MATCH FILES /FILE=*
  /FILE='DataSet8'
  /RENAME (country coupleid6 hhid6 language mergeidp6 = d0 d1 d2 d3 d4)
  /BY mergeid
  /DROP= d0 d1 d2 d3 d4.
```

```
EXECUTE.

MATCH FILES /FILE=*
  /FILE='DataSet9'
  /RENAME (country coupleid6 hhid6 language mergeidp6 = d0 d1 d2 d3 d4)
  /BY mergeid
  /DROP= d0 d1 d2 d3 d4.
EXECUTE.

MATCH FILES /FILE=*
  /FILE='DataSet10'
  /RENAME (country coupleid6 hhid6 language mergeidp6 = d0 d1 d2 d3 d4)
  /BY mergeid
  /DROP= d0 d1 d2 d3 d4.
EXECUTE.

MATCH FILES /FILE=*
  /FILE='DataSet11'
  /RENAME (country coupleid6 hhid6 language mergeidp6 = d0 d1 d2 d3 d4)
  /BY mergeid
  /DROP= d0 d1 d2 d3 d4.
EXECUTE.

MATCH FILES /FILE=*
  /FILE='DataSet12'
  /RENAME (country coupleid6 hhid6 language mergeidp6 = d0 d1 d2 d3 d4)
  /BY mergeid
  /DROP= d0 d1 d2 d3 d4.
EXECUTE.

MATCH FILES /FILE=*
  /FILE='DataSet13'
  /RENAME (country coupleid6 hhid6 language mergeidp6 = d0 d1 d2 d3 d4)
  /BY mergeid
  /DROP= d0 d1 d2 d3 d4.
EXECUTE.

DATASET ACTIVATE DataSet1.
FILTER OFF.
USE ALL.
SELECT IF (bmi >= 15).
EXECUTE.

FILTER OFF.
USE ALL.
SELECT IF (dn004_ >= 0).
EXECUTE.


DESCRIPTIVES VARIABLES=age_int bmi
  /STATISTICS=MEAN STDDEV MIN MAX.
```

```
FREQUENCIES VARIABLES=gender dn004_
  /ORDER=ANALYSIS.


DATASET ACTIVATE DataSet1.
REGRESSION
  /DESCRIPTIVES MEAN STDDEV CORR SIG N
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS R ANOVA CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT bmi
  /METHOD=ENTER dn004_
  /METHOD=ENTER dn004_ isced2011_r co007_
  /METHOD=ENTER dn004_ br016_ br029_ br040_
  /METHOD=ENTER dn004_ mh003_ mh037_ mh036_ eurod.

DATASET ACTIVATE DataSet1.
LOGISTIC REGRESSION VARIABLES dn004_
  /METHOD=ENTER co007_ isced2011_r
  /METHOD=ENTER br016_ br029_ br040_
  /METHOD=ENTER eurod mh003_ mh036_ mh037_
  /CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).
```

Appendix B: Correlation Matrix

Table A: Correlation Matrix

	BMI	*Migrant*	*Education*	*Financial*	*Exercise*	*Fruit & Vegetables*	*Alcohol*	*Hopes future*	*Lonely*	*Isolated*	*Depression*
BMI	1.000	.066	-.104	-.116	.170	.108	.012	.008	-.050	.017	.058
Migrant	.066	1.000	.020	-.042	.074	.008	-.038	.042	-.015	-.006	.043
Education	-.104	.020	1.000	.193	-.097	-.017	.070	-.112	-.001	-.018	-.059
Financial	-.116	-.042	.193	1.000	-.023	-.081	-.014	.032	.209	.148	-.252
Exercise	.170	.074	-.097	-.023	1.000	.047	.006	.052	-.065	-.039	.073
Fruits or vegetables	.108	.008	-.017	-.081	.047	1.000	.045	.029	-.086	-.085	.112
Alcohol	.012	-.038	.070	-.014	.006	.045	1.000	.011	-.059	-.051	-.004
Hopes future	.008	.042	-.112	.032	.052	.029	.011	1.000	.064	.065	.009
Lonely	-.050	-.015	-.001	.209	-.065	-.086	-.059	.064	1.000	.513	-.465
Isolated	.017	-.006	-.018	.148	-.039	-.085	-.051	.065	.513	1.000	-.440
Depression	.058	.043	-.059	-.252	.073	.112	-.004	.009	-.465	-.440	1.000