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The effects of food habits and socioeconomic status on overweight.

Differences between the native Dutch and immigrants in the Netherlands.

by

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Abstract

Overweight is a worldwide growing epidemic. The Netherlands is among the countries with the highest prevalence for overweight, together with the USA, UK, and Germany. This paper investigates differences in overweight between native Dutch and three immigrant groups in the Netherlands, and the effects of food habits and socioeconomic status on overweight. The results show that all immigrant groups have a higher prevalence for overweight than the Dutch, apart from Moroccans. Males are overweight more frequently than females. Takeaway food, eating out, and fresh vegetables decrease BMI, while convenience food, ready-to-eat meals, and delivery food (in some cases) increase BMI. In all groups, BMI increases with age. For Surinamese/Antilleans and Turks BMI increases with children living at home, whereas for native Dutch BMI decreases with children living at home. The national health expenditures due to overweight is 200 million to 4 billion Euro per year, which is 1 to 5 percent of the national health expenditures. The government and health insurance companies should try to prevent overweight and encourage healthy behavior.

JEL classification: C20, D12, I12

Keywords: overweight, ethnicity, food habits

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1. Introduction

Overweight[1] is a growing problem worldwide. In the USA, it is currently estimated that mortality due to lack of exercise and to caloric intake is second only to tobacco consumption in the number of deaths that could be prevented by change in behavior (Philipson, 2001; McGrinnis and Foege, 1993). In 2000, the World Health Organization has declared overweight to be the number one global epidemic (WHO, 2000). The trend in overweight in the past decade is alarming. The Netherlands is one of the countries with the highest prevalence of overweight together with the USA, UK and Germany. In the eighties, almost 30 percent of the Dutch population was overweight. Figures from 2002 show that 48 percent of the men and 39 percent of the women aged above 20 are overweight (CBS, 2002c).

There might be important economic reasons for the growth in obesity the previous decades: 1) the increase in prosperity results in higher expenditures on food, 2) sedentary technological change has lowered the real price of food as well as the physical expenditure of calories per hour worked in market or household production, 3) relative prices of mobility and physical activity have changed by technological progress, causing a decrease in direct mobility costs (the price of driving a car, travelling by train etc), and 4) technological progress has changed the relation between physical exercise and payment (Philipson and Posner, 1999).

Past analyses have shown strong associations between obesity and cardiovascular disease, coronary artery heart disease, diabetes, and cancer (Lindström *et al*., 2003; Slot, 2003; Visscher *et al*., 2002; Philipson, 2001). Evidence showing that being overweight or obese has adverse effects on health and longevity is overwhelming. Latest surveys show that overweight and obesity shorten life expectancy with years comparable to smoking (Fontaine *et al*., 2003; Peeters *et al*., 2003). In comparison with other EU countries, the Netherlands occupies a mediate position on health of the population, in particular with respect to life expectation and infant mortality. Immigrants feel themselves less healthy than the Dutch population and immigrants report more chronic health problems (Weide and Foets, 1998). The risk of overweight is high among both children and adult women, and there is a higher risk for Turkish and Moroccan groups than for the Dutch group (Brussaard *et al.,* 2001). Nayga's (2000) results indicate that blacks have a higher relative weight and probability of becoming obese than whites. The results suggest that differences in relative weights between blacks and whites are caused by less diet-disease knowledge of the blacks (Nayga, 2000).

Overweight is associated with socioeconomic variables like income and level of education. According to Register and Williams (1990) the pay differential is minus 12 percent for obese women and minus 5 percent for obese men. Obese females work mostly in relatively low-paid occupations

[1] The Body Mass Index (BMI) is often used to determine whether a respondent is overweight. It is defined as the weight in kilograms divided by the square of height in meters (kg/m^2) (WHO, 2000). People with a BMI smaller than 18.50 are underweight. A BMI between 18.50 and 24.99 is a recommended range, and is considered as normal weight. People BMI $\geq$ 25.00 have overweight, and people with a BMI $\geq$ 30.00 have obesity.

and are largely excluded from the high-paid managerial and technical occupations (Pagán and Dávila, 1997). For women, a high BMI is associated with unemployment and a low income, whereas slimness shows a slightly weaker association with a low household income after transfers. For men, slimness is associated with unemployment, low income and social isolation (Sarlio-Lähteenkorva and Lahelma, 1999). Low-income women, in comparison with women at high-income levels, are less attentive to their weight and more tolerant to weight gain (Jeffery and French, 1996).

Figures from the Netherlands also show that socioeconomic status affects overweight. Van Lenthe *et al*. (2000) show that BMI is positively associated with age and negatively associated with level of education in both sexes, after adjustment for other socio-demographic variables. They find a positive association of BMI with family income in males and a negative association with occupational level in females (Van Lenthe *et al*., 2000). Visscher *et al*. (2002) also find a positive relationship between obesity and age (see also Mathus-Vliegen, 1998; Jacobs and Gottenborg, 1981). The prevalence of obesity is three times higher among men with a low level of education compared to men with a high level of education. Among women the prevalence of obesity is more than five times higher among those with a low level of education than among women with a high level education (Visscher *et al*., 2002; see also CBS, 2001a, 2002a, 2002b). Still, there are also figures that shows an increase in prevalence of obesity during the last decade of the 20th century among high-educated women (Visscher *et al*., 2002). Although little is known about overweight among immigrants in the Netherlands, some is known about their socioeconomic background. In general, immigrant groups in the Netherlands have a lower level of education and lower incomes (CBS, 2003, 2002d, 2001b). This indicates a higher risk for overweight, which is also shown in literature (Mathus-Vliegen, 1998, Brussaard *et al*., 2001).

Overweight is associated with energetic intake as well as to physical activity. A small positive energetic balance over longer periods of time leads to large differences in body weight (Health Council of the Netherlands, 2003; Mathus-Vliegen, 1998). Research shows that between the periods 1987/1988 and 1997/1998, the mean energetic intake in the diets of the Dutch population has decreased. However, there are strong indications that the amount of physical activity has largely decreased during the previous decades, which may have caused the higher prevalence for overweight in the Netherlands (Health Council of the Netherlands, 2003). There seems to be strong evidence that lack of physical activity is of great importance for the increase in overweight and obesity (Lindström *et al*., Cutler *et al*., 2003). About half the Dutch population does not meet the guideline of 30 minutes moderately intensive daily exercise (Health Council of the Netherlands, 2003; Ooijendijk *et al.*, 2002).

Outsourcing food preparation has become more popular in the previous decades. In 1975, 40 percent of Dutch households visited restaurants 1 to 9 times a year, as compared to 61 percent in 1995 (Van Dam *et al*., 1994; Tijdens, 2000). Presently, takeaway food is relatively important in the Netherlands. Sixty-three percent of all Dutch households eat takeaway food more than once a month;

82 percent of the households with a double income eat takeaway food more than once a month (SCP, 2000). Sixty percent of the households with a double income visit restaurants more than once a month, against 26 percent of the single income households (SCP, 2000). There is little data available on differences in the outsourcing of food preparation between immigrants and natives. It is known that immigrants (mainly the Surinamese/Antilleans) more often visit fast food restaurants than the native Dutch. Moroccans go to cafeterias and snack bars less frequent than the Surinamese/Antilleans, Turks, and the native Dutch (Bedrijfschap Horeca en Catering, 2001).

People with lower incomes might return to cheaper foods with inferior nutritional quality. Food insecurity or even hunger may be common among particularly vulnerable groups, such as immigrants. Also, obese people are more likely to buy cheaper food (Sarlio-Lähteenkorva and Lahelma, 2001). It might also be true that obese people need more food and buy cheaper food to be able to consume larger quantities of food. People with higher incomes and/or a higher education spend more money on food-away-from-home (like eating in restaurants), ready-to-eat meals and delivery food, and spend less time on preparing food (Heiman *et al*.,2001; Mihalopoulos and Demoussis, 2001; *Florkowski et al*., 2000).

Genetic, socioeconomic, and cultural factors like poor housing, low incomes, lifestyle, and the perception on cures and illness act upon differences in overweight between groups in the society. Little is known about the effect of outsourcing food preparation on overweight and differences between native Dutch and immigrants in the Netherlands. Therefore, it is interesting to investigate differences in determinants of overweight between the native Dutch and immigrants[23].

This paper estimates the effects of food habits and socioeconomic status on overweight. Differences between immigrants and native Dutch in food habits and socioeconomic status and their effect on overweight are studied. The determinants of overweight may differ across the ethnic groups, caused by cultural differences in food habits, lifestyle, socioeconomic status, or the way overweight is judged in a social environment. Four groups are studied: a Dutch group, a Surinamese/Antillean group, a Moroccan group, and a Turkish group. The three immigrant groups are taken, since these are the largest non-western immigrant groups in the Netherlands.

The organization of the paper is the following. Section 2 gives the hypotheses based on the literature and describes the data. Section 3 gives the estimation results of the regressions with Body Mass Index as dependent variable and socioeconomic, lifestyle, and food habits as independent variables. Section 4 concludes and discusses the findings.

[2] An immigrant is defined as a person who has at least one parent who was born abroad (CBS, 2000).

[3] In 2003, the percentage of non-western immigrants (including Moroccans, Turks, Surinamese and Antilleans) within the Dutch population was 10 percent, which is about 1,483,000 immigrants against a total population of about 16 million. The share of Moroccans, Turks, Surinamese, and Antilleans of the non-western immigrants is about 70 percent (CBS, 2003).

2. Hypotheses and description of the data

It is expected that immigrants have a higher BMI than the native Dutch, because immigrants have lower levels of education and income, which in the literature is associated with higher weight; therefore a positive effect of ethnicity on BMI is hypothesized. Also another factor may contribute to this. Higher BMI-scores are significantly related with lower self-assessments of personal happiness in social groups where overweight is less common. In societies where overweight is more common and associated with happiness and well-being (like on Pacific Islands) the reverse is true (Pinhey *et al*., 1997, see also Averett and Korenman, 1996).

On basis of the literature, it is expected that females have a lower BMI than males. Outsourcing of food preparation is expected to affect BMI positively, since takeaway food, delivery food etc. have the image of 'fat food' which will add weight. Nevertheless, outcomes might diverge over the different types of outsourcing food preparation. For example, takeaway food could be less 'fat' than delivery food (usually pizza's). The results might also differ across the ethnic groups, because food habits and types of food will vary across the groups. Maybe the native Dutch eat out more (which is more expensive than takeaway food and delivery food) than immigrants. The effect of eating out in restaurants is unsure, since restaurants can cook low-caloric food just as easily as high-caloric food (Cutler *et al*., 2003). Fresh vegetables are considered to be good for health and 'low-fat', therefore a negative effect on BMI is expected.

As it comes to weight, smoking is an important factor. Studies show a negative relationship between smoking and body weight (Jacobs and Gottenborg, 1981, Wack and Rodin, 1982, Mathus-Vliegen, 1998, and Wannamethee, 2001). Obesity is more prevalent among people who have never smoked than among current smokers (Visscher *et al*., 2002). Starting smoking results in an average weight loss of 3 to 4 kg. Giving up smoking is associated with gaining 2 to 5 kg in weight in the first 6 to 12 months (Mathus-Vliegen, 1998). We anticipate on the literature by hypothesizing a negative sign for smoking.

Being married/cohabiting is assumed to affect BMI positively, because people might be less careful of their weight once they are married or live together. Yet, for children living at home a negative relation is hypothesized, because with the arrival of children people might reconsider their eating pattern whether it is healthy or not. For both income and level of education negative effects on BMI are expected, because of the strong evidence in the literature. For age a positive effect on BMI is expected, because literature indicates that weight increases with age. Sports is expected to be negatively associated with BMI.

The data were collected between September and November 2001 by an agency specialized in collecting quantitative data. The response rate was 23 percent. In telephonic interviews respondents were asked about their ethnicity, household size, level of education, income, labor participation, food

habits, and health. The method of telephonic interviews was chosen, since it ensures a better response rate and could be performed within a relative short period of time.

The total sample size is 2551. All respondents were older than 18 years. The Moroccans, Surinamese, Turkish and Antilleans were selected since they belong to the largest immigrant groups in the Netherlands. The Surinamese and Antilleans respondents are considered as one group, since they are from comparable origin. The intention was to have 700 respondents of each group. However, Moroccans appeared hard to reach; only 449 Moroccan respondents agreed on participating within the time available for the data collection.

Respondents were asked about their weight and height and BMI was measured as described in the Introduction. Takeaway food is food that people get from restaurants (like Chinese restaurants), snack bars etc. Delivery food is food that is brought to homes of the people that ordered the food, for example pizza delivery. When people eat their meal in a (fast-food) restaurant, it is called eating out. Eating out includes paid meals, no meals at family or friend's houses. Ready-to-eat meals are meals that for consumption only need to be heated up in oven or microwave. Convenience food is food that is partly prepared, like pre-cut vegetables. In Table 2.1 the mean values and standard deviations of the used variables are presented per group.

Table 2.1 about here

In the sample, the Turkish respondents have the highest mean BMI, followed by the Surinamese/Antillean respondents. The Moroccan respondents have the lowest BMI, and the native Dutch are in between. The Turks have the highest prevalence for takeaway food, delivery food, and eating out, whereas the Dutch have the highest prevalence for convenience food and ready-to-eat meals. Immigrant groups eat more frequently takeaway food than native Dutch. The highest prevalence of smokers in the sample is found in the Turkish group, whereas the Moroccan group has the lowest prevalence of smokers. The Turkish and Moroccan respondents have the lowest income levels. Surinamese/Antillean respondents have a slightly higher income level than the native Dutch in our sample while normally, the income levels of Surinamese/Antilleans and native Dutch are comparable (Kee, 1995). Our sample includes relatively more women with low-income levels. The mean age of the Moroccan and Turkish respondents may have had some effect on our results.

Table 2.2 shows the distribution of the groups over the BMI-classes.

Table 2.2 about here

Within the entire sample, only very few people are underweight (BMI < 18.50): about 3 percent of women and less than 1 percent of men. Thirty-nine percent of the Dutch women in the

sample are overweight (which is the lowest rate in the whole sample) against 48 percent of the Dutch men. These figures closely correspond with those of CBS (2002c) indicating that 39 percent of the women and 48 percent of the men in the Netherlands are. In our sample, the Turkish males have the highest rate of overweight. The Moroccans have the least incidence of overweight amongst males in the sample. In the Dutch, Moroccan and Turkish groups, men are more often overweight than women. Although the difference is small, only for the Surinamese/Antilleans the reverse is true: Surinamese/Antillean females have a higher prevalence for obesity than males with the same ethnicity. See Appendix I for the food habits in the sample, divided by overweight people and people having a normal weight.

In the Netherlands, the participation on sports among immigrants is lower than among the native Dutch. In 1999, 66 percent of the native Dutch aged between 6 and 79 do some kind of sports, for immigrants the figure then is 51.5 percent (Van der Meulen, 2003). Table 2.3 gives the frequencies of doing sport in our sample.

Table 2.3 about here

Our sample also shows that the participation of immigrants on sports is lower than the participation of the native Dutch. The figures of the Surinamese/Antillean group correspond to the most to the figures of the native Dutch, although the frequency of exercising of the Surinamese/Antilleans is higher. The Turks have the lowest prevalence for exercising and have the lowest frequency of sporting. If the Turks and Moroccans do sports, they do it quite frequently. This could be caused by the relative young age of the Moroccans and Turks in our sample (as seen in Table 2.1).

3. Results

A linear regression with dummies for ethnicity was conducted[4]. BMI was used as a dependent continuous variable. As independent variables the following variables were used: ethnicity, sex (dummy, 1=female, 0=male), takeaway food (times per month), delivery food (times per month), eating out (times per month), convenience food (times per week), ready-to-eat meals (times per month), fresh vegetables (times per week), smoking, married/cohabiting, children at home, income of the respondent (net per month), age, and level of education. First, an OLS was done for the whole sample for food habits, and other variables like smoking, household composition, and age. Thereafter, an OLS with the same variables was done with control variables income, and level of education included. The parameter estimates are depicted in the Table 3.1.

[4] SPSS (version 10.0.5) was used for the analyses.

Table 3.1 about here

All immigrant groups have a higher BMI than the native Dutch, indicated by the significant positive effect of the dummies for ethnicity on BMI. Takeaway food only has a significant negative effect on BMI in the model without income, age, and level of education (results not shown). When age is included in the regressions, no significant relationship for takeaway food is found, which could indicate an 'age-effect' for takeaway food. Eating out has a significant negative effect on BMI in both models, indicating that eating out does not increase BMI and that eating out is not depending on income, age and education in relation to BMI. Smoking affects BMI significantly in a negative way, which implies that smoking will decrease BMI. The first model gives a significant positive effect for the variable married/cohabiting, signifying that by being married or living together BMI will increase. The second model indicates that having children at home will increase BMI. There is a positive significant effect of age on BMI; BMI will increase with age. Being married/living together only has an effect in the model without control variables, and the model with income. The effect is positive. Income has a very small significant effect on BMI in the model with income as control variable (results not shown). The effect is positive, indicating that the higher the income, the higher the BMI. The OLS with age, income, and level of education included gives no significant effect for income. The strong effect of age on BMI, and the relationship between age and income might cause this.

Table 3.2 shows the estimation results for the four groups separately. For each group (Dutch, Surinamese/Antillean, Moroccan, and Turkish) the OLS with age, income, and level of education included as described above were repeated to investigate differences between the groups in variables that affect BMI.

Table 3.2 about here

A significant effect for sex is only found for the Turkish respondents. The effect is negative, which means that agreeing with the findings from Table 3.2, Turkish males are heavier than Turkish females. Smoking has a significant negative effect on BMI for the native Dutch and the Surinamese/Antilleans respondents.

The four groups show different result for food habits. The Dutch group is the only group that shows a significant effect of delivery food on BMI. The effect of delivery food on BMI is positive, which means delivery food increases BMI. On the other hand, eating out decreases BMI. The Surinamese/Antilleans show the same negative significant relations between eating out and BMI, and show also a negative significant effect for takeaway food and BMI (results not shown). The Surinamese/Antillean model shows a large positive effect of ready-to-eat meals. This group shows an effect of eating fresh vegetables on BMI. Appendix I already showed that the Surinamese/Antilleans

eat fresh vegetables most frequently. The effect is negative, which signifies that BMI will decrease when more vegetables are consumed. Moroccans only show a significant negative effect of eating out on BMI (results not shown); other studied food habits do not affect BMI significantly. For Turks, BMI decreases with takeaway food (as also for the Surinamese/Antilleans), but increases with convenience food.

The effect of having children at home on BMI varies over the groups and over the models. In Table 3.2 only the Turks give a significant effect of having children at home on BMI, the effect is positive. Dutch and the Surinamese/Antilleans only give significant result for having children at home (results not shown). The Dutch model without control variables and the model with income included give a negative effect of children at home on BMI. If age is included in the Surinamese/Antillean model, having children at home affects BMI negatively. The above-mentioned effects suggest a very strong relationship of age on BMI, which is also shown by the fact that for all groups, all models give a significant positive effect of age on BMI, similar as in Table 3.1.

The Dutch, Moroccan, and Turkish models show a negative effect of income on BMI (results not shown). When age is included in the models, this income effect is not present, signifying the relationship between age and BMI to be so strong that it overrules the effect of income. Income and age also is related. It is remarkable that there is no effect from level of education in any of the models, whereas especially for males a negative effect of level of education on BMI was expected[5].

To measure the effect of sports on BMI, we have repeated the OLS regressions from Table 3.1 and 3.2. We did not include sports in all regressions, since it may be endogenously related to BMI (overweight people will have more difficulties doing sports). If the OLS regressions are repeated with sports included, the estimations do not change a lot, and sports is not significant in any of the groups (results not shown). When the OLS regressions are done with sports included and divided by sex, sports becomes significantly negative for Dutch and Moroccan males (results in Appendix II). When age is excluded from the OLS regressions (results not shown), sports becomes significantly negative for Moroccans, indicating an age-effect for sports for Moroccans. On the whole, the effect of sports on BMI is small. Apparently sports is neither a very good, nor a complete indication of physical activity. Sports does not give a complete insight in the people's physical activities. For example, physical activity during walking or home keeping is obviously excluded from sports.

[5] The effect of education on BMI may be completely overruled by the strong age-affect on BMI. We have checked whether a regression including level of education exclusively (as control variable) would give significant results for the effect of education on BMI. Only the native Dutch and Surinamese/Antillean respondents gave a (positive) significant result.

5. Conclusions and discussion

The purpose of this paper is to investigate differences in overweight between natives and immigrants in the Netherlands and to investigate the effects of food habits and socioeconomic status on overweight.

Our results show that immigrants have a higher BMI than the native Dutch. With respect to gender, the regression with dummies for ethnicity shows that males are heavier than females. These findings also support earlier research (Pinhey *et al*., 1997; Van Lenthe *et al*., 2000). Seidell *et al*. (1995), on the other hand, found that the prevalence of obesity is higher among females than among males. The following could have caused the differences between these investigations. Pinhey *et al*. investigated an Asian-Pacific population in the United States, while Seidell *et al*. and Van Lenthe *et al*. investigated the Dutch population. Seidell *et al*. investigated obesity (BMI ≥30), whereas Van Lenthe *et al*. looked at the development of BMI in 6 years. It is true that the prevalence of obesity (BMI ≥30) is higher among females in the Netherlands, whereas the prevalence of overweight (BMI ≥25) is higher among males in the Netherlands (Health Council of the Netherlands, 2003).

Food habits partly explain differences in overweight between the groups. Both takeaway food and delivery food give the expected positive effect on BMI for the native Dutch respondents, but give the opposite significant effect for Turkish. The latter may be caused by the difference in kinds of takeaway food and delivery food the Turkish eat. The native Dutch (probably mainly the ones with lower incomes) might choose for 'fatter', less healthy takeaway food and delivery food than the Turks do. Eating out is mainly significant for Dutch (males), but the effect on BMI is negative instead of positive. An explanation can be twofold: mainly people with higher incomes (who are already more aware of a 'healthy diet') will go eating out, and once people go eating out, they might choose more exclusive restaurants that serve lower caloric menus than 'cheaper' restaurants (since healthy food is expensive). People with higher education and higher incomes buy better quality food and will therefore have lower prevalence for overweight, while people with lower incomes will buy (more) cheaper, less healthy food and have higher prevalence for overweight (Hulshof *et al*., 2003). Lower educated people may also have a lower time preference for eating food (Cornelisse-Vermaat *et al*., 2003). This confirms the idea that in western countries, people with lower incomes are overweight, while in non-western countries people with higher incomes are overweight. As it comes to food habits, Moroccan respondents show the least significant results; only eating out has a small negative effect on BMI. While the native Dutch and Turkish respondents show significant results for delivery food, takeaway food, and eating out, the Surinamese/Antillean respondents mainly show significant results for eating fresh vegetables and ready-to-eat meals, indicating cultural differences in food habits. The Surinamese/Antillean respondents eat fresh vegetables the most frequently and show a significant negative effect for vegetables on BMI, complying with the idea of eating fresh vegetables to be a healthy food habit.

In all groups, *age* and *smoking* strongly affect BMI. While age increases BMI, smoking decreases BMI. The effect is so strong that it overrules the effects of income and of being married/living together. The effect of *children living at home* is small in all groups and gives the opposite result than expected for Turks. For Turks BMI increases with children living at home, indicating that their lifestyle changes into one that adds weight after children are born.

On the basis of literature, socioeconomic status will affect BMI negatively. Yet, the Turks show a small positive significant effect for *income* on BMI, indicating that for Turks BMI increases with income. Surinamese/Antillean women show a significant negative effect for income on BMI. Only Dutch women and Surinamese/Antillean men show an effect of *level of education*. The effect for Dutch women is negative, whereas the effect for Surinamese/Antillean men is positive. These outcomes show the existence of cultural differences in the way people accept overweight. Somewhat contradictory is the fact that for Surinamese/Antillean males, BMI increases with level of education (which usually is an indication of higher income), while for Surinamese/Antillean women BMI decreases with income (usually connected with a higher level of education).

In the literature, *physical activity* is negatively associated to overweight. Yet, in our sample the effects of sports on BMI were very small, indicating that sports is not a complete measure for physical activity. Nevertheless, if sport is not a complete criterion for physical activity, it does give some indication about people's lifestyle and pattern of physical activity. About half of our sample does not do sports, which corresponds to the 50 percent of physical inactive people from the literature (Ooijendijk *et al*., 2002) who do not meet the guideline of 30 minutes of moderately intensive physical activity per week. All immigrant groups do sports less frequently than the native Dutch, but especially Turkish respondents should be encouraged to do more sports, since they have the lowest participation in sports. This could be an indication that in the cultures of immigrants, doing sports is less important. There may also exist a relation between sports and socioeconomic circumstances. People with lower incomes have less money to take part in organized sport activities.

The past decades, the population in the Netherlands has been ageing. Therefore, the prevalence of overweight might increase rapidly, especially considering the strong positive relation between age and BMI. There is a strong relation between the prevalence of obesity and cardiovascular disease, coronary artery heart disease, diabetes, and cancer (National Institutes of Health, 1985). Overweight leads to higher expenditures on national health care, mainly due to the extra costs of chronic diseases caused by overweight (like diabetes) (Sander and Bergemann, 2003). Recently, we have estimated that in the Netherlands, the extra national health expenditure due to overweight is 200 million to 4 billion Euro per year, which is 1 to 5 percent of the national health expenditure (Cornelisse – Vermaat *et al*., 2003; Groot and Maassen van den Brink, 2002; and Visscher *et al*., 2002). These extra costs caused by overweight are not yet represented by higher health insurance contributions. It is important to avoid getting overweight, or to encourage people to lose weight if necessary. The Dutch government should develop prevention programs to keep a large part of the

Dutch population from becoming (more) overweight, especially among those already overweight. Immigrants in particular should be encouraged to lose weight, since they have a higher risk of becoming overweight. The government could encourage more healthy diets by subsidizing healthy food (like fruit and vegetables) and by putting higher taxes on high-caloric foods.

The respondents reported their weight and height measurements themselves. Literature shows that when respondents have to indicate their height and weight themselves, overweight people tend to *underestimate* their weight, while thin people tend to *overestimate* their weight (Nieto-Garcia *et al*., 1990, Sarlio-Lähteenkorva and Lahelma, 1999, Visscher *et al*., 2002). This process may have biased the data on BMI; the prevalence of overweight might actually be slightly higher. In addition, future studies should examine also other measurements indicating overweight. Body weight is correlated with fat-percentage, but also with fat-distribution, which can be measured with the waist-hip ratio. Also fluctuations in weight at different points in time seem to be important (Mathus-Vliegen, 1998).

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Table 2.1 Distribution of variables used in analyses

Variable	Dutch	Surinamese/ Antillean	Moroccan	Turkish
BMI	N=683	N=681	N=422	N=688
Mean	24.87	25.28	24.80	25.51
S.D.	4.43	4.38	4.03	4.33
Min.	16.36	15.81	15.67	14.69
Max.	64.49	51.61	40.40	44.44
Takeaway-food per month	N=688	N=696	N=440	N=601
Mean	2.13	2.73	2.65	3.12
S.D.	2.76	3.87	5.66	4.8
Min.	0	0	0	0
Max.	31	10	70	38
Delivery food per month	N=668	N=683	N=431	N=559
Mean	0.62	0.62	0.61	0.80
S.D.	2.90	1.95	1.85	2.15
Min.	0	0	0	0
Max.	30	30	20	28
Eating out per month	N=689	N=690	N=440	N=548
Mean	1.41	1.22	1.14	1.68
S.D.	2.61	3.10	2.73	4.55
Min.	0	0	0	0
Max.	25	60	31	60
Ready-to-eat meals	N=700	N=698	N=443	N=674
Seldom/never	69.9%	86.1%	77.7%	78.6%
1–5 times per month	23.9%	10.7%	15.8%	16.5%
5–10 times per month	4.0%	2.1%	3.2%	2.8%
> 10 times per month	2.3%	1.0%	3.4%	2.1%
Fresh vegetables	N=701	N=701	N=447	N=697
Seldom/never	1.1%	1.6%	0.4%	1.4%
1–2 times per week	8.6%	7.1%	6.5%	12.2%
2–4 times per week	26.5%	18.5%	20.6%	24.4%
> 4 times per week	63.8%	72.8%	72.5%	62.2%
Smoking	N=701	N=701	N=449	N=699
Yes	34.0%	27.4%	18.7%	44.5%
No	66.0%	72.6%	81.3%	55.5%
Gender	N=701	N=700	N=447	N=700
Female	63.3%	57.6%	47.4%	45.0%
Male	36.7%	42.4%	52.6%	55.0%
Married/cohabiting	N=701	N=700	N=449	N=699
	67.9%	52.4%	71.9%	78.7%
Children at home	N=701	N=701	N=449	N=700
	41.8%	49.2%	62.6%	74.0%

Table 2.1 (continued)

Net income level (of respondent) p/m	N=356	N=435	N=228	N=343
<Dfl. 500 (€227)	5.3%	2.1%	4.4%	4.7%
Dfll.500-Dfl.2000 (€227-€908)	25.3%	17.5%	23.2%	21.9%
Dfl.2000-Dfl.3500 (€908-€1588)	43.8%	50.4%	55.3%	62.6%
Dfl.3500-Dfl.5000 (€1588-2269)	18.0%	20.5%	14.0%	7.3%
Dfl.5000-Dfl.8000 (€2269-€3630)	4.8%	7.4%	2.6%	2.6%
>Dfl.8000 (€3630)	2.8%	2.1%	0.5%	0.9%
Age	N=701	N=699	N=444	N-700
Mean	46.7	41.83	33.90	33.13
S.D.	16.85	13.72	12.44	10.93
Min.	18	18	18	18
Max.	90	88	81	75
Level of education	N=700	N=689	N=397	N=691
Elementary school	9.3%	9.1%	12.6%	29.1%
Initial professional education	18.0%	11.8%	7.1%	21.1%
Lower gen. secondary education	12.0%	13.9%	11.1%	10.0%
Higher gen. secondary education	5.3%	4.9%	9.8%	6.8%
Grammar school	4.7%	3.6%	4.8%	2.3%
Interm. vocational education	22.9%	24.1%	24.7%	18.5%
BSc/BA	20.6%	24.4%	15.1%	7.7%
Msc/MA	6.6%	6.7%	7.1%	2.0%
other	0.7%	1.5%	7.8%	2.5%

Table 2.2: BMI distribution of women and men in the Netherlands in percentages

WOMEN	Dutch (N=424)	Turkish (N=373)	Surinamese/ Antillean (N=383)	Moroccan (N=187)
BMI < 18.50	2.4	4.5	2.6	4.3
18.50 ≥ BMI < 25.00	58.7	47.5	51.2	56.1
BMI ≥ 25.00	38.9	48.0	46.2	39.6
TOTAL	100	100	100	100

MEN	Dutch (N=256)	Turkish (N=311)	Surinamese/ Antillean (N=294)	Moroccan (N=232)
BMI < 18.50	0	1.0	1.0	2.2
18.00 ≥ BMI < 25.00	52.0	45.0	54.8	55.6
BMI ≥ 25.00	48.0	54.0	44.2	42.2
TOTAL	100	100	100	100

Table 2.3 Frequencies of sports in ethnic groups (in percentages)

	sample	Dutch	Surinamese/ Antilleans	Moroccans	Turks
Do sport	52.3	57.1	55.2	52.3	44.7
≤ 1 time/w	36.5	37.0	32.6	37.9	39.4
2-3 times/w	40.8	45.3	43.5	34.9	36.2
> 3 times/w	22.7	17.7	23.8	27.2	24.4

Table 3.1 Parameter estimates of BMI with dummies for Turks, Surinamese/Antilleans, and Moroccans with the Dutch as reference group (t-values in parentheses)

	OLS with age	**OLS with income, age, and level of education**
intercept	20.884	20.694
	*(29.372)***	*(27.886)***
Turkish	1.382	1.424
	*(5.199)***	*(5.331)***
Surinamese/	0.854	0.872
Antillean	*(3.650)***	*(3.703)***
Moroccan	0.929	0.874
	*(3.288)***	*(2.985)***
female	-0.141	-0.124
	(-0.777)	*(-0.653)*
takeaway-food	-0.006	-0.009
	(-0.244)	*(-0.367)*
delivery food	0.040	0.034
	(0.951)	*(0.787)*
eating out	-0.078	-0.078
	*(-2.856)***	*(-2.839)***
convenience food	0.162	0.188
	(1.450)	*(1.680)**
ready-to-eat meals	0.053	0.096
	(0.360)	*(0.638)*
fresh vegetables	-0.307	-0.333
	*(-2.351)***	*(-2.536)***
smoking (y/n)	-0.547***	-0.484**
	(-2.884)	*(-2.534)*
married/ cohabiting (y/n)	0.241	0.284
	(1.118)	*(1.306)*
children at home (y/n)	0.681	0.628
	*(3.261)***	*(2.974)***
income		0.001
		(0.752)
age	0.100	0.100
	*(14.540)***	*(13.990)***
level of education		-0.001
		(-0.111)
#observations	2169	2119
Adj. R^2	0.117	0.116
F statistic	21.597	18.336

** p< .10 ** p< .05 *** p<.01*

Table 3.2 Parameter estimates of BMI for Dutch, Surinamese/Antilleans, Moroccans, and Turks (t-values in parentheses)

	Dutch	**Surinamese/ Antilleans**	**Moroccans**	**Turks**
intercept	22.910	21.539	21.282	19.874
	*(14.802)***	*(15.950)***	*(14.326)***	*(15.873)***
female	-0.418	0.364	0.127	-0.658
	(-1.063)	*(1.047)*	*(0.304)*	*(-1.777)**
takeaway food	0.087	-0.022	0.015	-0.052
	(1.242)	*(-0.469)*	*(0.349)*	*(-1.332)*
delivery food	0.129	0.068	0.032	-0.142
	*(1.690)**	*(0.816)*	*(0.297)*	*(-1.706)**
eating out	-0.191	-0.050	-0.095	-0.032
	*(-2.702)****	*(-0.911)*	*(0.253)*	*(-0.831)*
convenience food	0.148	0.050	-0.136	0.506
	(0.651)	*(0.250)*	*(-0.550)*	*(2.362)***
ready-to-eat meals	-0.247	0.898	-0.212	-0.017
	(-0.871)	*(2.660)****	*(-0.700)*	*(-0.060)*
fresh vegetables	-0.259	-0.484	-0.166	-0.204
	(-0.922)	*(-1.960)***	*(-0.552)*	*(-0.874)*
smoking (y/n)	-0.803	-0.869	-0.119	0.010
	*(-2.214)***	*(-2.341)***	*(-0.243)*	*(0.028)*
married/ cohabiting (y/n)	0.275	-0.139	0.718	0.428
	(0.691)	*(-0.376)*	*(1.213)*	*(0.839)*
children at home (y/n)	-0.074	0.575	0.087	1.213
	(-0.185)	*(0.117)*	*(0.157)*	*(2.435)***
income	0.001	-0.001	0.001	0.001
	(0.261)	*(-0.264)*	*(0.523)*	*(1.120)*
age	0.075	0.101	0.107	0.123
	*(5.919)****	*(7.523)****	*(5.379)****	*(6.609)****
level of education	-0.043	0.018	0.002	-0.006
	*(-1.942)**	*(1.317)*	*(0.187)*	*(-0.556)*
#observations	640	641	351	484
Adj. R^2	0.086	0.120	0.131	0.193
F statistic	5.661	7.714	5.074	9.916

** p< .10 ** p< .05 *** p<.01*

Appendix I Food habits per BMI group per ethnicity (in percentages)

WOMEN	Dutch	Turkish	Surinamese/ Antillean	Moroccan
18.50 > BMI ≤ 24.99	(N=249)	(N=177)	(N=196)	(N=105)
> 1× per month takeaway food	64.5	77.0	68.2	59.2
> 1× per month delivery food	14.3	28.9	27.5	25.2
> 1× per month eating out	56.1	50.7	52.6	50.5
> 1× per week convenience food	60.6	41.7	44.4	39.4
> 1× per month ready-to-eat meals	26.9	22.4	11.3	27.9
> 4 × per week fresh vegetables	66.3	62.6	75.0	71.2
BMI ≥ 25.00	(N=165)	(N=179)	(N=177)	(N=74)
> 1× per month takeaway food	57.0	75.4	58.9	45.1
> 1× per month delivery food	11.9	25.0	20.6	17.1
> 1× per month eating out	37.2	39.5	30.8	25.4
> 1× per week convenience food	57.6	45.5	36.9	39.7
> 1× per month ready-to-eat meals	33.0	15.9	16.9	12.3
> 4 × per week fresh vegetables	74.5	53.6	76.8	70.3

MEN	Dutch	Turkish	Surinamese/ Antillean	Moroccan
18.50 > BMI ≤ 24.99	(N=133)	(N=140)	(N=161)	(N=129)
> 1× per month takeaway food	73.3	70.4	72.7	63.0
> 1× per month delivery food	21.9	27.3	26.6	23.8
> 1× per month eating out	71.5	53.2	51.9	43.3
> 1× per week convenience food	60.3	44.5	40.6	36.9
> 1× per month ready-to-eat meals	40.6	24.6	14.9	27.5
> 4 × per week fresh vegetables	58.6	67.4	68.4	74.4
BMI ≥ 25.00	(N=123)	(N=168)	(N=130)	(N=98)
> 1× per month takeaway food	57.5	66.0	60.2	43.7
> 1× per month delivery food	14.0	23.0	15.9	16.1
> 1× per month eating out	63.6	51.5	46.5	31.2
> 1× per week convenience food	55.1	41.7	34.4	30.2
> 1× per month ready-to-eat meals	33.5	21.7	14.0	13.4
> 4 × per week fresh vegetables	47.2	66.1	69.2	69.4