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ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

HOW DOES DIETARY PATTERN INFLUENCE OUR HEALTH?

BESLENME ALIŞKANLIĞIMIZ SAĞLIĞIMIZI NASIL ETKİLER?

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Abstract

The paper aims to explain how dietary pattern support individuals' health status in Turkey. In order to show the effect of selected variables on health condition, Body Mass Index (BMI) is conducted as explained and health status variable. The analysis is also conducted by standing to benefit the 2008, 2010, 2012, 2014 and 2016 of Turkey Health Survey [2**] (THS) which is prepared by Turkish Statistical Institute. To show the influence of dietary habits on BMI, frequency of fruit and vegetable consumption is used as main explanatory variable. Moreover, some demographic variables such as age, gender, marital status etc. are employed. The Quantile Regression results show that increase in frequency of fruit and vegetable consumption leads to decrease in BMI, which means healthy dietary pattern has positive effect on our health status. It also indicates that there is a negative relationship between additional years of schooling and BMI. Our results reveal that single respondents are less prone to be overweight and obese.

Keywords: Obesity, Fruit and Vegetable Consumption, OLS Regression, Quantile Regression

JEL Classification: I12, I18, C21

Öz

Bu çalışma Türkiye'de bireylerin beslenme alışkanlıklarının sağlık statülerini nasıl desteklediğini açıklamayı amaçlamaktadır. Seçilmiş değişkenlerin sağlık durumu üzerindeki etkisini açıklamak için Vücut Kitle Endeksi (VKİ) sağlık statüsünü temsil eden bağımlı değişken olarak seçilmiştir. Analiz için Türkiye İstatistik Kurumu (TÜİK) tarafından hazırlanan 2008,2010,2012,2014 ve 2016 yıllarına ait Türkiye Sağlık Araştırması (TSA) kullanılmıştır. Bahsedilen etkiyi göstermek için meyve-sebze tüketim sıklığı ana açıklayıcı değişken olarak kullanılmıştır.Ayrıca yaş, cinsiyet, medeni durum gibi bazı demografik değişkenlerden de yararlanılmıştır. Kuantil Regresyon sonuçları meyve-sebeze tüketimindeki artışın VKİ'de düşüşe sebep olduğunu göstermektedir. Bununla birlikte okullaşma oranı ile VKİ arasında negatif ilişki bulunmuştur. Çalışmanın sonuçlarına göre bekar bireylerin fazla kilolu ve obez olma eğilimleri daha düşüktür.

Anahtar Kelimeler: Obezite, Meyve-Sebze Tüketimi, OLS Resgresyon, Kuantil Regresyon

JEL Sınıflandırması: I12, I18, C21

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** Turkey Health Survey (THS) is a micro data set conducted by Turkish Statistical Institute, http://www.tuik.gov.tr/UstMenu.do?metod=bilgiTalebi.

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1. Introduction

Obesity is measured with respect to individual's Body Mass Index. Over the past decade statistics shows that the number of obese or overweight people has increased dramatically (Calle et al., 1999). As expected, United States is the prominent instance of this issue. At the same time, obesity has an increasing trend as an issue in developing countries. In this context, we aim to underline the importance of healthy feeding in order to mitigate overweight problem for both developed and developing countries (Cobb-Clark et al., 2012). We know that regular consumption of fruit and vegetable is necessary to reduce body mass index, cardiovascular diseases, diabetes and other chronic disorders.

Excess weight is evaluated as a major risk factor for premature morbidity and mortality (Gutierrez-Pliego et al., 2016). Approximately 18,905 people of 22% of Turkish people are classified as obese according to data from the 2008-2016 Turkey Health Survey. On the other hand, 32% of those people are categorized as overweight. At the same time, obesity substantially increases morbidity and chronic health condition risk (Charlton et al., 2014). It is also an economic concern for societies that is people try to lose weight through diet plans and exercises programs.

According to report of United Nations Food and Agriculture Organization (2018) in 2018, Turkey is the leading country that has highest calorie intake per person in a day. In average, daily calorie intake of Turkish people is equal to 3706. This ratio is also higher than daily calorie intake per person that is 3682 in the US.

The main concentration of this paper is to answer the question that whether overweight or obese people eat different from thinner people or is there any difference between obese and normal people dietary pattern? We intend to explore the effect of eating habits of Turkish people. Actually, we wonder if people who eat more fruit and vegetable are healthier than those who eat lesser amount. Because of data limitation, we exclude risky healthy factors that influence health condition like smoking, alcohol consumption and etc., however, the importance of these factors on health condition should bear in mind.

This paper organized into four sections. The following section presents literature review. Descriptive statistics and graphical illustrations of the study are presented in section 3. Section 4 introduces methodology used in the accounting of this paper. Concluding remarks are given in the section 5.

2. Literature Review

Karaoglan and Tansel (2017) investigate the factors that may affect the obesity in Turkey by using Quantile Regression methodology. Education, labor market outcomes, marital status income, age and gender are used as control variables. In order to conduct this analysis, Turkey Health Survey for the year 2008, 2010 and 2012 are used. They have concentrated body mass index of individuals as interested variable. According to the results of Quantile Regression, individual's body mass

index tends to decrease with additional years of schooling which means highly educated people are more aware of dangers of obesity. Further, it is coincided in the same study that females are more obese than those of males. Namely, gender has a negative effect on respondents' body mass index. Inverted U-shaped relation occurs when age is analyzed. Stated in other words, being overweight and obese are more likely to be higher at elder ages. Also, single respondents' body mass index is lower relative to widowed or divorced respondents. Maybe the most important finding of Karaoglan and Tansel's (2017) study is that obesity has an increasing trend in Turkey over during interested years.

Another study of Tansel and Karaoglan (2014), which uses same survey (TSH), shows us how the variations in health behaviors occur in an empirical way. As an econometric methodology, probit models are conducted. In this study, health status of respondents is thought in terms of smoking, body mass index, fruit and vegetable consumption. The results show that education has strongest effect on health behaviors of individuals in Turkey. One of the most important point, which is also related with our concern, is that highly educated people consumes more fruit and vegetable than people who has low level education. Stated in other words, less educated individuals prefer to consume less fruit and vegetable than university graduates (Tansel and Karaoglan, 2014). We can conclude that the main finding of this study is major factor that mitigates the probability risky healthy behavior is education.

According to Azagba and Sharaf (2012), studies that measure the link between consumption of fruit and vegetable and body weight should be inconclusive because most of them use linear regression methods. Using Canadian Community Health Survey (2004), potential heterogeneous association between fruit and vegetable intake and body mass index is estimated by Azagba and Sharaf. In the methodology of *Fruit and Vegetable Consumption and Body Mass Index: A Quantile Regression Approach,* the main focus is consumers' optimal choice on what to consume. The results show that the study population is slightly overweight with the mean BMI is 26,5. The frequency of fruit and vegetable intake has negative effect and significant association with body mass index (Azagba and Sharaf, 2012). Especially, at higher points of conditional BMI distribution, the consumption of fruit and vegetable increases.

Lin and Morrison (2002) find the differences between the amounts of fruits eaten by normal weight, overweight and obese people. However, any robust correlation could not be coincided between body mass index and vegetable consumption. One of the critical point is that fruit consumption can vary by weight status but it is not possible to say same thing for vegetable consumption in USA (Lin and Morrison, 2002). For this reason, it is claimed that fruit consumption is better predictor of body mass index than vegetable.

The hypothesis of Goss (2003) is that consumption of three or more fruits and vegetables per day is significantly correlated with lower body mass index regardless of smoking or physical activity. The results show that there is a statistical difference in lowest body mass indexes eating more fruits and vegetables compared to those highest body mass indexes. Additionally, education

about importance of increased fruit and vegetable consumption can be the single most important intervention that may impact those who are overweight and obese (Goss, 2003).

There is another dimension in the existing literature that body mass index is analyzed in the context of income level of individuals. It is assumed that mortality or morbidity rates are conversely related to income level (Jolliffe, 2010). In the study, age, age square, race and education level are used as explanatory variables in the conditional Quantile regression. According to results,

In the study of Colon-Ramos et al. (2014), negative binomial regression is conducted as a methodology. Sex, education, age and household income are collected as socio-economic and demographic variables. As diet-related variable, the frequency of fruit and vegetable intake is asked. The results show that fruit and vegetable intake, controlling for sex and education, is statistically associated with intake at the bivariate level (Colon-Ramos et al, 2014).

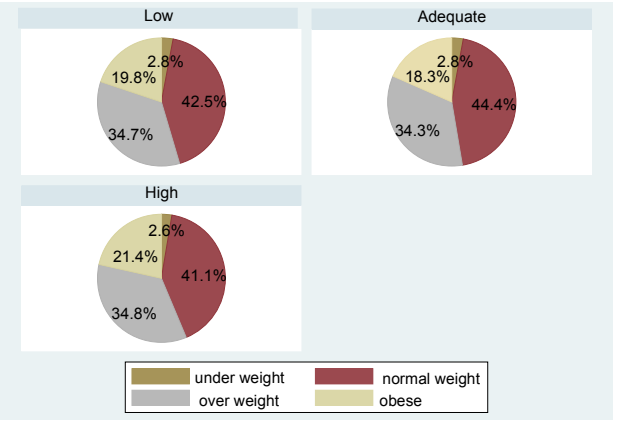
Another study that uses bivariate association between body mass index and fruit and vegetable intake is "*Consumption Frequency of Foods Away from Home Linked with Higher Body Mass Index and Lower Fruit and Vegetable Intake Among Adults: A Cross-Sectional Study*" which is written by Seguin et al. (2015). Body mass index is used as health outcome measure and fruit and vegetable intake is classified as dietary variable. Parallel with the studies mentioned above, gender, income, marital status and physical activity employed as socio-economic and demographic profile of sample. According to results, it is founded that increase in consumption food away from home leads to increase body mass index of individuals (Seguin et al., 2015). Stated in other words, people who have their meal away from home tend to consume fewer fruits and vegetables.

3. Descriptive Statistics

In order to get clearer picture of individuals' health condition, the descriptive statistics for different BMI groups are presented in following figures in this section. We define weight categories by using BMI intervals for respondents of TSH. According to this classification underweight respondents' BMI are lower than 18 and people who have BMI between 18 and 25 are in normal weight category. BMI, from 25 to 30, shows us overweight individuals. Lastly, BMI which is higher than 30 gives us obesity information.

Figure 1 gives us information about Body Mass Index of respondents according to their fruit/vegetable consumption. There is no significant variation of the proportion of fruit/vegetable consumption given groups with respect to their Body Mass Index. For example, while the share of obese respondents who never consume fruit or vegetable is equal to 24.22%, the 23.15% of obese people consumes fruit or vegetable 1 or more in a day.

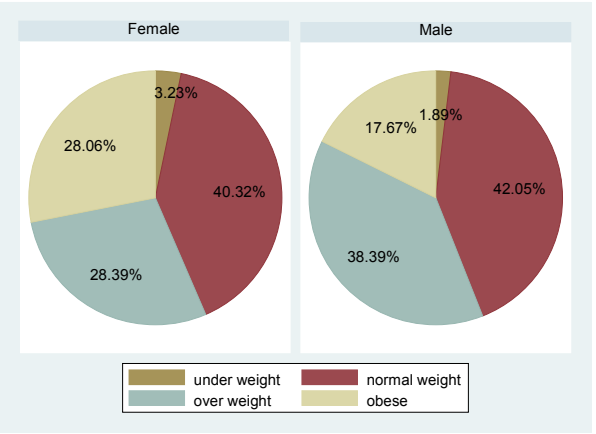
Figure 1: Body Mass Index According to Fruit/Vegetable Consumption



Source: Author's calculation using 2008, 2010, 2012, 2014 and 2016 Turkey Health Survey (THS).

A comparison of respondents' BMI with respect to their gender is presented by Figure 2. We observe that the share of obese females is higher than the share obese males; however, the proportion of overweight women is lower than the proportion of overweight men. A brief summary is that there is 11 percent difference between men and women in the obese category. While %28 of females are obese, %18 of males' body mass index exceeds 30. This observation is parallel with the observation of Tansel and Karaoglan's (2017) study. In addition, males seem to be more normal weight than females in related years. Further, the number of underweight respondents is negligible for both categories. The share of underweight females and males are only %3,23 and %1,89 respectively.

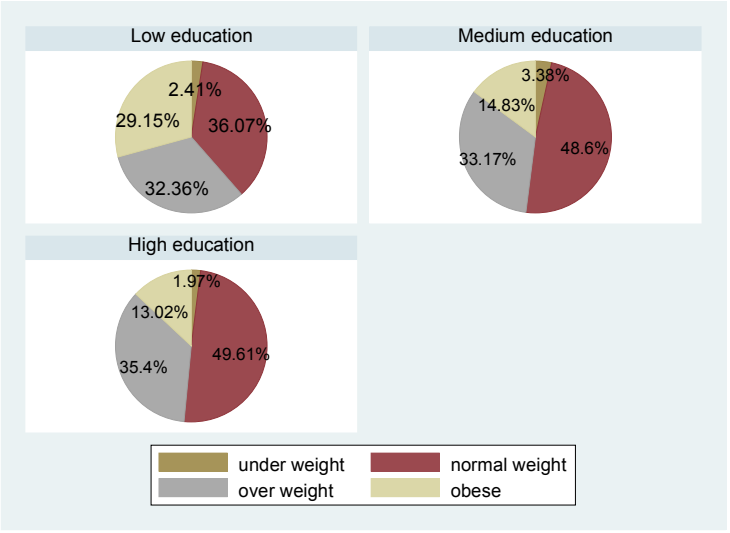
Figure 2: Body Mass Index According to Gender



Source: Author's calculation using 2008, 2010, 2012, 2014 and 2016 Turkey Health Survey (THS).

Figure 3 depicts how individuals' Body Mass Index differs with reference to their education level. According to our observation, average years of schooling of obese respondents is lower than remaining groups, which means that there could be a negative association between high level of education and being overweight or obese. Almost 30% percent of people who have low-level education are obese. Besides, the proportion of normal weight respondents takes its highest value in high education category. However, a person whose body mass index is between 25-30 mostly belongs to same group.

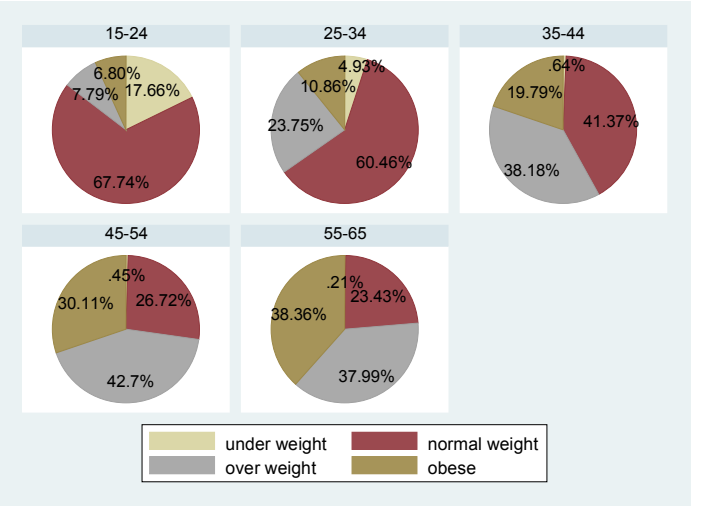
Figure 3: Body Mass Index According to Education Level



Source: Author's calculation using 2008, 2010, 2012, 2014 and 2016 Turkey Health Survey (THS).

Using Turkey Health Survey, we define five sub-age groups in order to understand the effect of age on BMI. These sub-categories are 15-24, 25-34, 35-44, 45-54 and 55-64. According to figure 4, the prevalence of obesity increases as the individuals gets older. This means that there is a significant variation in the weight ranges with respect to age group. As expected, obese respondents belong to 55-64 age groups. The thing that needed to be underlined is that underweight takes its highest value at 15-24 age groups.

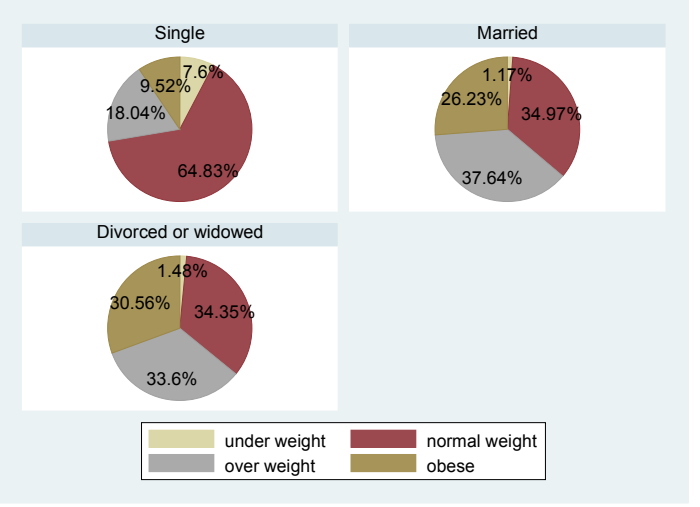
Figure 4: Body Mass Index According to Age Group



Source: Author's calculation using 2008, 2010, 2012, 2014 and 2016 Turkey Health Survey (THS).

The last figure shows the differences of individuals' BMI among marital status. The majority of single respondents can be classified as normal weight and underweight. However, in the group married and divorced or widowed, the shares of overweight and normal weight respondents are very close. Additionally, obese and overweight individuals consist of the majority of the respondents. In all figure, the distribution of underweight individuals does not alarming.

Figure 5: Body Mass Index According to Marital Status



Source: Author's calculation using 2008, 2010, 2012, 2014 and 2016 Turkey Health Survey (THS).

4. Data & Estimation Methodology

4.1. Data

In our study, the data set Turkey Health Survey (THS), which is conducted by Turkish Statistical Institute, is used for the years 2008, 2010, 2012, 2014 and 2016. In these surveys, informative questions about individuals' health are asked for three different age groups; 0-6, 7-14 and 15 or above. As expected, answers of the questions that related to 0-6 and 7-14 age groups are generally given by their parents. The group that we aim to focus on is 15 or above and the appended data set includes 77,463 individuals. On the other hand, we restrict our sample to those 15-65 years so as to minimize factors that can bias our results.

The explained variable of this research is Body Mass Index (BMI) that is observed by dividing weight (in kilograms) by the square of height (in meters). Besides, respondents whose BMI is equal to 18 or below are evaluated as underweight. Normal weight is represented by BMI which is between 18 and 25. If individual's BMI is ranging from 25 to 30, respondent is classified as overweight. Lastly, BMI which is higher than 30 gives us signal of obesity. Also, our dependent variable is a continuous variable.

We define independent variable fruit-vegetable consumption that we consider the effect of it on health status. As a categorical variable, it is equal to 0 if respondent has low level fruit or vegetable consumption (never or less than 1 in a week). It is equal to 1 if individual eats fruit or vegetable in adequate level (1-6 in a week). The value 2 tells us fruit or vegetable consumption is high (1 or more portion in a day).

Gender, age, marital status and education level are employed as demographic information of individuals for this study. For example, we define gender as a dummy variable that is equal to 0 if the individual is female (reference category), 1 if the individual is male. On the other hand, age is a continuous explanatory variable. Education level of respondents in surveys is categorized as low (reference category), medium and high level education. Reference category gives the educational information of individuals' that has primary and secondary level education. Following category includes respondents that graduate from high school. Further, the last category consists of highly educated respondents. Additionally, marital status is grouped as single (reference category), married and divorced or widowed.

The model that we design as follows;

$$Q_{BMI,\mu} = \beta_0 + \beta_1(\mu) fv\_cons_i + \beta_2(\mu) gender_i + \beta_3(\mu) age_i + \beta_4(\mu) educ_i + \beta_5(\mu) marital\_status_i + D(\mu) year + \varepsilon_i \quad (1)$$

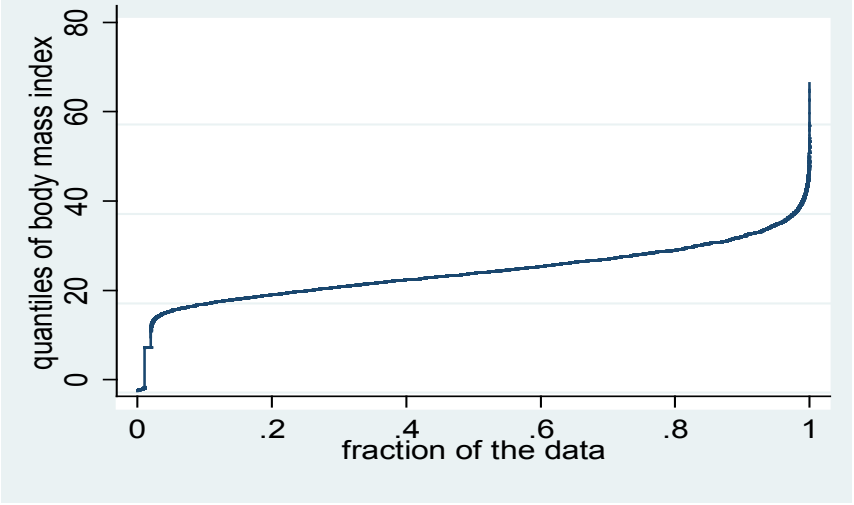
In the equation given above, μ shows the μ^{th} quantile of body mass index distribution. Stated in other words, $Q_{BMI,\mu}$ indicates respondents' BMI in the μ^{th} quantile. The fv_cons_i shows fruit/vegetables consumption frequencies such as low, adequate and high level. Remaining variables indicate socioeconomic and demographic categories.

4.2. Methodology & Estimation Results

We hypnotize that people has a dietary pattern that incorporates fruit and vegetable keep their weights at healthy level. So, it is expected that there is negative relationship between body mass index and fruit-vegetable consumption. In order to measure this assertion, we employ Quantile regression that gives more comprehensive picture of the effect of independent variables on dependent variable (Cameron and Trivedi 2005). Instead of estimating the model with average effects, using OLS linear model, the Quantile regression produces different effects along the distribution or quantiles of the dependent variable. Stated in other words, we try to describe the distribution of dependent variables by using quantiles. Additionally, we conduct an OLS regression that has an important advantage to shows conditional mean (Wooldridge, 2012).

Figure 6 depicts the fraction of the body mass index by different quantiles. Horizontal axis shows the quantiles of the dependent variable. And, vertical axis shows its values that vary between zero and sixty-seven. According to figure, individuals' BMI varies in different quantiles. For examples, respondents have higher BMI for quantiles of ninety. Also, respondents have lower BMI in the lower quantiles. In the higher quantiles dependent variable rapidly increases.

Figure 6: Fraction of the Dependent Variable by Quantiles



Source: Author's calculation using 2008, 2010, 2012, 2014 and 2016 Turkey Health Survey (THS).

BMI quantile regression and the OLS estimates for the full sample are reported in Table 1. The Quantile regression is estimated for the 25th, 50th and 75th quantiles of the body mass index distribution. Our estimations give the controlled associations between each control variable and individuals' BMI at different quantiles. Quantile regression allows us to examine the heterogeneous responses of individuals' BMI to the model covariates at different tails of the BMI distribution.

According to results, there is negative relationship between fruit/vegetable consumption and BMI of respondents. Similar to our study, Azagba and Sharaf (2012) also find that the frequency of fruit and vegetable intake has negative effect on BMI in Canada. Fruit and vegetable consumption is statistically significant in all categories at every quantiles and OLS regression except for 25th quantile. In particular, fruit/vegetable intake increases at higher points of the conditional BMI distribution. For example, while the coefficient of is higher at quantile 75th, it is lower at quantile 25th. This means that a rise in calorie intake from fruit and vegetable can be a supportive dietary strategy to control weight and mitigate the risk for obesity especially for the overweight.

In terms of other control variables, the results show differences across the quantiles of the BMI distribution. Age has a positive relationship with BMI. Except for 75th quantile, the male coefficient is positive and significant at remaining quantiles and OLS regression, indicating that males have higher BMI compared to females.

As expected, increase in education level leads to decrease in BMI. At every quantile, especially highly educated people have lower BMI with respect to low educated individuals. Additionally, being married is statistically significant and positive association with BMI. We can reach same results that there is a positive relationship for being divorced or widowed. Additionally, year dummies are statistically significant both in OLS and at quantiles estimations. Lastly, year dummies that we add in estimation are generally significant.

Table 1: OLS and Quantile Regression Results

Variable	OLS	Q25	Q50	Q75	BSQR_50
Age	0.69***	0.06***	0.08***	0.09***	0.081***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Fruit/Veg. Cons.					
adequate	-0.19***	-0.045	-0.15***	-0.13*	-0.15***
	(0.053)	(0.057)	(0.058)	(0.074)	(0.058)
high	-0.34***	-0.130*	-0.17***	-0.18**	-0.17***
	(0.065)	(0.069)	(0.070)	(0.092)	(0.071)
male	-0.12***	0.64***	0.30***	-0.38***	0.30***
	(0.035)	(0.037)	(0.038)	(0.048)	(0.036)
medium educ	-0.46***	-0.16***	-0.40***	-0.59***	-0.40***
	(0.041)	(0.044)	(0.044)	(0.057)	(0.043)
high educ	-0.60***	-0.10*	-0.54***	-0.91***	-0.54***
	(0.053)	(0.057)	(0.058)	(0.074)	(0.053)
married	2.31***	2.03***	2.25***	2.40***	2.25***
	(0.047)	(0.050)	(0.051)	(0.065)	(0.049)
divorced/widowed	1.38***	1.07***	1.40***	1.68***	1.40***
	(0.079)	(0.084)	(0.086)	(0.110)	(0.099)
Year					
2010	0.25***	0.12*	0.24***	0.33***	0.24***
	(0.063)	(0.067)	(0.068)	(0.087)	(0.058)

2012	-0.22***	-0.04	0.25***	0.31	0.25***
	(0.053)	(0.057)	(0.058)	(0.074)	(0.051)
2014	0.78***	0.38***	0.65***	0.86	0.65***
	(0.062)	(0.066)	(0.067)	(0.086)	(0.062)
2016	0.85***	0.24***	0.67***	1.07***	0.67***
	(0.067)	(0.072)	(0.073)	(0.093)	(0.071)
Pseudo R^2	0.1368	0.0928	0.0989	0.0972	0.0989
N	82978	82978	82978	82978	82978

Source: Author's computations using 2008, 2010, 2012, 2014 and 2016 Turkish Health Survey. *** indicates 1% level of significance, ** indicates 5% level of significance, * 10% indicates level of significance. Standard errors in the parenthesis.

5. Conclusion

The question we interested that how eating habits affect our health condition. In order to find the answer of the question we conduct a quantile analysis by using both some selected socioeconomic determinants such as gender, age, education level, marital status and fruit/vegetable consumption. We also calculate body mass index (BMI) as explained variable of respondents by using their height and weight information. We exclude risky health behaviors and income due to the inappropriate structure of surveys. Quantile Regression is used as a methodology and in order to obtain estimation that is more consistent, we employed bootstrapped techniques (Koenker and Hallock, 2001).

For the period 2008 and 2016, the mean BMI is 27.19, which indicates that the respondents of our survey are slightly overweight. According to Turkey Health Survey (THS), while the average value of females' BMI is 27.53, males' BMI is 26.80 on average. On the other hand, in Turkey, the mean of fruit and vegetable consumption is between 4 or 6 portion in a week.

Similar to previous studies, QS results suggest that the BMI of individuals increases with fruit and vegetable consumption. Especially, there is a strong association between high level of fruit/vegetable consumption and low body mass index. OLS results also support that calorie intake from fruit and vegetables in both adequate and high level provides better health status.

As expected, with the increasing age, BMI of respondents is rising. We also conclude that education has considerable effect on the health status. In comparison, highly educated people have lower body mass index, which means that they have better health condition than people who has low education. Moreover, the negative affect of high education increases from 25^{th} to 75^{th} quantile. Our deduction from this result is that well educated people are more aware of the obesity as a dangerous.

Another result is that while females tend to be more obese in higher quantiles, they are less obese in lower quantiles. The coefficients of marital status variable show that single individuals have lower body mass index than married, divorced or widowed individuals. To sum up, having a poor diet or balanced diet is one of the important factors that affect our health status in a good or bad

way. Existing evidence in the research materializes the healthy eating promotes to have lower body mass index.

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