Inequality Analyses of Obesity in Turkey

Hasan Giray Ankara

***Abstract*—This study aims to explore socioeconomic and regional variations of obesity among Turkish women at reproductive age (15-49). Using the data from Turkish Demographic and Health Survey, it identifies the socioeconomic determinants of obesity in different regions with different levels of development. Afterwards, it measures income-related obesity inequalities by employing concentration indices. Finally, it decomposes the measured inequalities and obesity gap between eastern and western Turkey into percentage contributions of socioeconomic covariates. Accordingly, age, ethnicity, education, income, marital status and employment are significantly associated with obesity in Turkey. Inequality analysis suggests that obesity is more concentrated among wealthier women in eastern Turkey whereas it is more concentrated among poorer women in western Turkey. Decompositions of the inequalities reveal that the inequalities are predominantly associated with wealth and ethnicity. The findings imply that eastern Turkey reflects the characteristics with of developing countries while western Turkey is closer to developing countries. Therefore, the study suggests that designing specific policies for regions with different levels of development will be useful in reducing the inequalities between eastern and western Turkey. In this respect, it is believed that policies dealing with the nutritional issues of eastern women and policies encouraging healthy behaviour of western women may be useful in reducing the inequalities between eastern and western Turkey.**

***Index Terms*—Decomposition, income, inequalities, obesity, socioeconomic, Turkey.**

I. Introduction

In this paper[1], socioeconomic and regional variations of obesity in Turkey will be investigated. Using data from the ninth wave of Turkish Demographic and Health Survey (TDHS) the effects of socio-economic factors on obesity in Turkey will first be explored. At the second step, the determinants of obesity in eastern and western Turkey will be examined separately. A separate treatment of these two regions is interesting, as there is a clear gap in the development of western and eastern Turkey [1], meaning that for the West one would expect results close to those usually obtained for developed countries, and for the East results close to those from developing countries. Third, income-related inequalities in obesity in Turkish society will be measured. Finally, the identified inequalities, and the obesity gap, between eastern and western Turkey will be decomposed in order to specify the association of each characteristics with inequalities between these regions.

Obesity is a chronic disease that occurs because of an imbalance between caloric intake and expenditure [2]. Concern about obesity has been growing since its prevalence worldwide has almost doubled over the last twenty years [2]-[5]. There are two reasons why the worldwide rise of obesity has triggered concerns: first, from an economic point of view, the increasing prevalence of obesity may increase social and economic costs that are generated by poor health among obese people (such as direct costs of healthcare, decreased productivity in labour market) [6]. Second, from a health perspective, there is a link betweeen excess weight and chronic diseases such as type-2 diabetes, cardiovascular diseases, hypertension, osteo-arthritis and various cancers [3], [4], [7].

A large number of studies have investigated the causes of obesity. In particular, economists have focused on socio-economic status as a determinant of obesity, in both developed and developing countries, and have generally obtained quite different results [3], [5], [6], [8]-[12]. Broadly speaking, obesity is more prevalent among lower socio-economic groups (than among their better-off counterparts) in developed countries, while in developing countries it is more prevalent among higher socio-economic groups [9], [13]-[16].

Mainly, two mechanisms have been suggested for the higher obesity rates of disadvantaged people in developed societies; poor dietary intake and lack of physical activity [2]-[4], [16], [17]. Accordingly, the people with lower socioeconomic status may lack of the resources to facilitate healthy diet [3], [4], [16], [18], [19]. In addition, their food consumption may be increased due to lowered costs of food (cheaper and easier to prepare and/or access) after technological improvements [2]. Further, they may also present psyhcosocial and/or cultural context that encourage unhealthy diet [4], [16]. Besides, it has been suggested that they may have (i) lower opportunities to support physical activity [4], [16], [17] and (ii) lesser knowledge about the benefits of exercise [16]. In addition, they may have relatively low physical activity at work due to technological increase [2].

On the other hand, two mechanisms have been suggested for the higher obesity prevalence among affluent people in developing societies. Accordingly, their higher obesity may due to their better accessibility to obtain adequate foods [16], [20]. Additionally, there may be cultural values favoring fatness; that is, obesity may be a sign of health, wealth, social prestige or sexual attractiveness in developing societies and therefore, people may demand more food as they get richer [16].

Empirical studies in developed societies evidence that individuals with higher socio-economic conditions enjoy relatively low obesity rates. Robert and Reither [4] investigated obesity in the United States and indicated that individuals with lower socio-economic status (SES) have higher rates of obesity. Wamala *et al*. [8], Kleiser *et al*. [5] and Roskam *et al*. [11] investigated the prevalence of obesity in Sweden, Germany, and nineteen European countries

Manuscript received August 30, 2015; revised October 20, 2015.

[1]This paper is derived from a study of the author's Ph.D. thesis called "Analyses of health and health related policies in Turkey".

H. G. Ankara is with the Department of Economics, Faculty of Economics and Administrative Sciences, Hacettepe University, Turkey (e-mail: hasangirayankara@hacettepe.edu.tr).

respectively. They found that individuals with higher SES and higher educational attainment have lower obesity rates. In addition, Wamala *et al*. [8] detected a positively related reproductive effect on obesity. MacFarlane *et al*. [10] examined obesity in Australia, and indicated that well-off individuals have lower obesity rates than their less-well-off counterparts. Further, they observed the positive effects of being married and increasing age on obesity [10].

The observed results of obesity investigations within countries that are in economic transition and have characteristics potentially similar to those of Turkey are somewhat confounded. Zhang [21] and Ma [22] examined obesity determinants in China, and found that individuals with higher SES have higher obesity rates. They also found that older, married and urban individuals have obesity rates relatively higher than those of their counterparts [21], [22]. Chhabra and Chhabra [23] investigated obesity in India, and indicated that well-off individuals have higher obesity rates. They also obtained results showing a positive age and urbanisation effect on obesity. Kain *et al*. [24] and Filozof *et al*. [25] identified the obesity determinants in Latin American countries and observed the positive effects of increasing age and living in urban areas on obesity in Brazil. In addition, they indicated that less-well-off individuals in Brazil have higher obesity rates than their better-off counterparts [24], [25]. Fernald [55] analysed obesity in Mexico and found that the individuals with higher SES have higher obesity rates.

The results explored by empirical studies in underdeveloped countries are clear, and confirm that individuals experiencing lower socio-economic conditions have lower obesity rates [9]. Steyn *et al*. [12], Dake *et al*. [20] and Khan and Kraemer [26] investigated obesity in Kenya and in Ghana and in Bangladesh respectively, and all found that individuals in higher SES groups have higher obesity rates than their less-well-off counterparts. Additionally, Dake *et al*. [20] and Khan and Kraemer [26] detected the positive effects of age, educational attainment, being married and reproductive history on obesity in Ghana and in Bangladesh. Finally, Iseri and Aslan [27] have also investigated obesity in Turkey. Using a sample consisting of male and female adults, they observed the significant impacts of age, gender and region on obesity.

This study is one of those that have been conducted outside of the developed Western world. Moreover, it is the only countrywide-representative study examining obesity inequalities in Turkey. The study aims to explore the socio-economic determinants of obesity in Turkey, and to ascertain how unequal Turkish people are in terms of obesity. It also proposes to decompose the income-related obesity inequalities and the obesity differences between eastern and western Turkey into the contributions of obesity determinants. To do this, it uses ordinary least squares (OLS) estimations at the first stage, and quantile regression techniques subsequently. To measure the level of inequality, the study calculates concentration indices using the approach of Kakwani *et al*. [28]. In order to decompose the income-related inequalities, it uses the approach of Wagstaff *et al*. [29]; that is the application of Oaxaca's technique [30] to the decomposition of concentration index [31]. Additionally, the study employs Oaxaca's technique [30] to decompose the obesity gap between eastern and western Turkey.

Accordingly, it is found that age, ethnicity, education, wealth, marital status and employment are significantly associated with obesity in Turkey. In addition, western Turkey is more likely to have characteristics close to those of developed countries, while eastern Turkey is closer to developing countries. As regards analysis of inequality, few income-related obesity inequalities in the whole Turkish population were detected. However, once the individuals are specified by regional disparities, it becomes obvious that obesity is more prevalent among higher socioeconomic groups in eastern Turkey, and among lower socioeconomic groups in western Turkey.

Also, wealth and ethnicity are the dominant contributors towards income-related obesity inequalities between these regions. Such inequalities may be attributable to the differences in the obesity determinants rather than to the inequality in these obesity determinants. In addition, the differences between the obesity rates of eastern and western Turkey may be attributable to the differences in their characteristics (composition effects) rather than to the differences in coefficients (structural effect). Composition effect is predominantly driven by differences in the distributions of age, ethnicity and education level, while respondents' ages at the time of the survey and at first marriage, marital status, wealth and number of children make the largest contributions to the structural effect.

The next section of the study provides a brief description of the data used. Section III describes the empirical work of the study and Section IV introduces the results. The study concludes with a summation of the findings.

II. Data

The study uses the ninth wave of the Turkish Demographic and Health Survey since it was the latest available wave at the time of empirical work of this study. This survey is a representative cross-sectional countrywide survey, which has been repeated every five years since 1968. The ninth wave of the survey, which was carried out in 2008, covers 10,525 households, with 7,405 individual interviews with ever-married women within the selected households [32].

Obesity has been measured by Body Mass Index (BMI) and, separately, by respondents being obese. The first outcome variable, BMI, is equal to the weight of the individual (in kilograms) divided by the square of the height of the individual (in metres). It has been calculated by TDHS and ranges from 15.00 to 57.96 in the data. A dummy variable for being obese – defined as having a BMI score above 30 – is generated as the second outcome variable. Besides this, a range of determinants are considered in the models. A non-linear function of age is included in the models. Education is measured by four different dummy variables. 'No education' refers to women with no education at all. 'Primary education' indicates the first five years of education, 'secondary education' the next six years. Secondary education will be used as the reference category in the models. Finally, a dummy for higher education is generated for women who have received at least twelve years' education. To control for ethnicity, dummies are included for being Kurdish, for being Arab, and for being of another

non-Turkish background, with being Turkish as the base alternative. Marital status is measured by dummies for being married or widowed, with being divorced as the base alternative. It is important to note that the sample does not contain single, never-married women. A continuous variable to measure age at first marriage is also used in the models. Five regional dummies have been generated for northern, southern, western, eastern and central Turkey. Eastern Turkey is the reference category in the models. In addition, a dummy for living in an urban area has been generated, where urban refers to areas with a population of 10,000 or more.

The data set contains information on men's income, but using this variable to indicate women's income level would be problematic because of allocational issues especially in men-dominated societies. Instead, using a wealth score which is derived from household ownership of assets (such as a car, a TV, a computer) and housing characteristics (such as location of toilet, building materials, source of water, etc.) [32] will be a better indicator of wealth level of households. Such a score has been calculated by TDHS and it is used in the classification of wealth groups. There is information on five wealth groups in the data set, referring to the respective quintiles of the wealth score. The middle group is used as the reference group in the models.

TABLE I: SUMMARY STATISTICS

Summary statistics		
Variables	**Mean Levels**	
	East	**West**
Age	32.652	35.203
Age-squared	1134.56	1307.56
No Education	0.411	0.078
Primary Education	0.429	0.562
Higher Education	0.031	0.098
Kurdish	0.563	0.064
Arabic	0.036	0.001
Other Non-Turkish	0.003	0.018
Married	0.963	0.938
Widowed	0.017	0.024
Age At First Marriage	18.882	20.727
Urban	0.644	0.828
Poorest	0.412	0.072
Poorer	0.255	0.143
Richer	0.107	0.28
Richest	0.063	0.288
No Social Security	0.202	0.153
BAG-KUR	0.07	0.122
SIO	0.257	0.588
GreenCard	0.378	0.047
Private Organisations	0.009	0.015
Agricultural Sector	0.125	0.099
Industry Sector	0.005	0.044
Service Sector	0.071	0.2
Total number of children	3.615	2.037

At the time of the survey, five different public social security agencies were operating in Turkey. The *Social Insurance Organisation* (SIO), The *Social Insurance Agency of Merchants, Artisans and the Self-employed* (BAG-KUR), The *Government Employees' Retirement Fund* (GERF), The *Active Civil Servants Scheme* and *GreenCard.* In the data, the Active Civil Servants Scheme has been incorporated along with the Government Employees' Retirement Fund by the nature of the survey. It is important to keep in mind that GERF was the most privileged social security group, while GreenCard was the least beneficial one [33]-[37]. Additionally, BAG-KUR and SIO were more beneficial than GreenCard even though their benefits were limited (compared to those provided by GERF) [34], [37]. Individuals covered by the *Government Employees' Retirement Fund* are the base category, and dummy variables are generated for each of the insurance agencies. In addition, two dummy variables have been created to identify individuals with private insurance and no insurance at all.

Labour force status and occupation are measured by four dummy variables, for non-working individuals, individuals working in agriculture, individuals working in industry, and individuals working in service sectors respectively. Not working is used as the reference category in the models. Finally, a continuous variable has been generated for number of children ever born, since there is a notable literature about reproductive history [8], [20], [26].

III. METHODS

As a first step, BMI and the dummy for being obese are regressed on the socio-economic variables. As always, OLS estimates give the *ceteris paribus* effects of the explanatory variables on the conditional mean [38]. However, focusing only on average effects may hide important relationships between explanatory variables and outcomes elsewhere in the distribution [38]. Instead, quantile regressions techniques are able to describe the relationship of explanatory variables on the entire conditional distribution of the outcome variable (rather than the mean) and provide the possibility of testing whether variables have a heterogeneous or a constant effect on the outcome.

The quantile function, introduced by Koenker and Basset [39], can be shown as:

$$Q_\tau(Y_i|X_i) = F_y^{-1}(\tau|X_i) \quad (1)$$

where y_i is the dependent variable (BMI in this study), X is a vector of regressors, τ is the quantile and $F_y(y|X_i)$ is the distribution function of Y_i at y conditional on X_i. The quantile function solves the following minimisation problem:

$$Q_\tau(Y_i|X_i) = \arg\min_{q(x)} \mathrm{E}\,[p_t(Y_i - q(X_i))] \quad (2)$$

where p_t is an asymmetric weighting function. To get coefficients, a linear function $X_i'b$ for $q(X_i)$ will be subtracted:

$$\beta_t = \arg\min_b \mathrm{E}\,[p_t(Y_i - X_i'b)] \quad (3)$$

Following this, concentration indices were employed using

the outcome variables to identify income-related inequalities in health. The concentration index is an indicator of health inequality in relation to the socio-economic position of individuals [40]. It was introduced by Kakwani [41] and Wagstaff *et al*. [31]. The value of the concentration index is twice the area between the diagonal and the concentration curve which can be obtained by plotting the cumulative proportions of the population, ranked by socio-economic status, beginning with the most advantaged (well-off), against the cumulative proportions of the health variable [31], [41]. The concentration index takes values between -1 to 1. It takes positive values when health favours the well-off, and vice versa [42]. If the value of the concentration index is 0, this means that the health variable is equally distributed [42]. The concentration index can be calculated using the convenient regression approach of Kakwani *et al*. [28], as shown below:

$$2\sigma_R^2\left[\frac{H_i}{\mu}\right] = \alpha + cR_i + \varepsilon_i \qquad (4)$$

where R_i is the relative rank, H_i is the outcome variable under consideration, μ is the mean of the outcome variable, α is the intercept term, and σ_R^2 is the variance of the relative rank [28]. Relative rank is the proportion of income allocations and is constructed by sorting individuals according to income (in this paper, according to wealth score). The value of the concentration index is equal to c in (4).

Subsequently, income-related obesity inequalities have been decomposed using Wagstaff *et al*.'s [29] approach (as shown below), which is an application of the Oaxaca [30] decomposition technique to the concentration index formula suggested by Wagstaff *et al*. [31]:

$$y_g = X_g\beta_g + \varepsilon_g \ , \quad where\ E(\epsilon_g) = 0\ \ and\ \ g\,\epsilon\,\{w,e\} \qquad (5)$$

$$\Delta C = \sum_k \eta_{ke}(C_{ke} - C_{kw}) + \sum_k C_{kw}(\eta_{ke} - \eta_{kw}) + \Delta(\tfrac{GC_{\varepsilon t}}{\mu}) \qquad (6)$$

where y denotes the outcome variable (in this paper, BMI or being obese), X is a vector of characteristics, β is a vector of slope parameters including the intercept, ε is the error term, Δ denotes the first differences, η_k is the elasticity of y with respect to k regressor for regarding group (w, e), C represents the concentration indices for k regressors (hence C_{ke} means the concentration indices of k regressors for the east of the country and C_{kw} those for the west), $GC_{\varepsilon t}$ is the generalised concentration index for the error term, and μ is the mean of the outcome variable.

In addition, the obesity differences between eastern and western Turkey have been decomposed using two different procedures. Firstly, mean based decomposition, Oaxaca-Blinder decomposition [30], [43] has been performed. Given that E(ε)=0, the total difference in the mean outcome can be decomposed as:

$$\Delta y = E(y_w) - E(y_e) = E(X_w)\beta_w - E(X_w)\beta_e + E(X_w)\beta_e - E(X_e)\beta_e \qquad (7)$$

where $E(X_w)\beta_e$ is the unconditional counterfactual distribution of outcome at the mean. Hence the equation can be re-arranged as:

$$(X_w)[\beta_w - \beta_e] + \beta_e[E(X_w) - E(X_e)] \ = \hat{\Delta}_S^{\boldsymbol{\mu}} + \hat{\Delta}_X^{\boldsymbol{\mu}} \qquad (8)$$

where y is the outcome variable (in this paper, BMI or being obese), w denotes western Turkey, and e denotes eastern Turkey. Accordingly, the difference in obesity between eastern and western Turkey contains a part explained by group differences in the coefficients (including intercepts) – structural effect, $\hat{\Delta}_S^{\boldsymbol{\mu}}$, – and a part explained by group differences in the distributions of characteristics – composition effect, $\hat{\Delta}_X^{\boldsymbol{\mu}}$.[2] Because of the additive linearity assumption, structure and composition effects can be written in terms of sums over the explanatory variables [44]:

$$\hat{\Delta}_S^{\mu} = \left(\hat{\beta}_{w0} - \hat{\beta}_{e0}\right) + \sum_{k=1}^{P} \bar{X}_{wk}\left(\hat{\beta}_{wk} - \hat{\beta}_{ek}\right) \qquad (9)$$

$$\hat{\Delta}_X^{\mu} = \sum_{k=1}^{P} (\bar{X}_{wk} - \bar{X}_{ek})\,\hat{\beta}_{ek} \qquad (10)$$

where $\left(\hat{\beta}_{w0} - \hat{\beta}_{e0}\right)$ indicates the omitted group effect, $\bar{X}_{gk}$ and $\hat{\beta}_{gk}$ indicate the k^{th} element of $\bar{X}_g$ and $\hat{\beta}_g$ respectively. $(\bar{X}_{wk} - \bar{X}_{ek})\hat{\beta}_{ek}$ and $\bar{X}_{wk}\left(\hat{\beta}_{wk} - \hat{\beta}_{ek}\right)$ are the respective contributions of the k^{th} covariate to composition and structure effect [44].

Afterwards, Recentered Influence Function Regression (RIFR) decomposition method [44] has been employed to understand the contributions of individual covariates at different quantiles. The RIFR estimates the marginal effects of a set of characteristics on an unconditional distributional statistic of an outcome variable [44].

In this chapter, the models for eastern and western Turkey are estimated by regressing the RIFR of BMI on the vector of covariates for each quartile[3]:

$$q_{r,\tau} = E_X\left[E\left[\widehat{RIF}\left(BMI_r; q_{r,\tau}\right)|X_r\right]\right]$$
$$= E[X_r]\hat{\delta}_{r,\tau}, \qquad r\,\epsilon\,\{West, East\} \qquad (11)$$

where

$$RIF(BMI; q_\tau) = q_\tau + \frac{\tau - 1[BMI \le q_\tau]}{f_{BMI}(q_\tau)} \qquad (12)$$

where q_τ is the quantile of BMI, $q_{r,\tau}$ is the unconditional quantile of BMI for eastern and western Turkey, $f_{BMI}(q_\tau)$ is the unconditional density of BMI at τth quantile, $1[BMI \le q_\tau]$ is an indicator function for whether outcome variable is smaller or equal to the τth quantile, X is the vector of covariates and $\hat{\delta}_{r,\tau}$ is the coefficient of the RIF regression that captures the marginal effect of a change in distribution of characteristic on the unconditional quantile of BMI. Therefore the difference between eastern and western Turkey

[2]These components are estimated using a specified STATA command called 'Oaxaca' [45].

[3]The estimations are performed using the STATA "rifreg" command which is available for download as an RIF-regression STATA ado file from Firpo *et al*.[44]: http://faculty.arts.ubc.ca/nfortin/datahead.html.

at the τth quantile of BMI can be decomposed into composition and structural effects as follows:

$$\hat{\Delta}^{\tau}_{BMI} = \left[\widehat{RIF}\left(BMI_W; q_{W,\tau}\right) - \widehat{RIF}\left(BMI_E; q_{E,\tau}\right)\right] \quad (13)$$

$$= \bar{X}_E\left(\hat{\delta}_{W,\tau} - \hat{\delta}_{E,\tau}\right) + \left(\bar{X}_W - \bar{X}_E\right)\hat{\delta}_{E,\tau} \quad (14)$$

$$= \hat{\Delta}^{\tau}_{S} + \hat{\Delta}^{\tau}_{X} \quad (15)$$

then structural and composition effect can be written in terms of the sum of contribution of each covariate as:

$$\hat{\Delta}^{\tau}_{S} = \left(\hat{\delta}_{w0} - \hat{\delta}_{e0}\right) + \sum_{k=1}^{P} \bar{X}_{wk,\tau}\left(\hat{\delta}_{wk} - \hat{\delta}_{ek}\right) \quad (16)$$

$$\hat{\Delta}^{\tau}_{X} = \sum_{k=1}^{P} \left(\bar{X}_{wk} - \bar{X}_{ek}\right)\hat{\beta}_{ek,\tau} \quad (17)$$

where $\left(\hat{\beta}_{w0} - \hat{\beta}_{e0}\right)$ indicates the omitted group effect, $\bar{X}_{gk\tau}$ and $\hat{\beta}_{gk\tau}$ indicate the k^{th} element of $\bar{X}_g$ and $\hat{\beta}_g$ at τ quartile respectively. $(\bar{X}_{wk} - \bar{X}_{ek})\hat{\beta}_{ek,\tau}$ and $\bar{X}_{wk,\tau}\left(\hat{\beta}_{wk} - \hat{\beta}_{ek}\right)$ are the respective contributions of the k^{th} covariate to composition and structure effect at $\boldsymbol{\tau}$ quartile [44].

IV. Results

A. Determinants of Obesity

1) Determinants of obesity: Entire population

The results are presented in Table II. BMI and being obese are positively associated with age. Age-squared has statistically significant impact on BMI (while it has no effect on being obese), suggesting a positive non-linear relationship between age and BMI. There is a clear gradient with education; BMI scores and the prevalence of being obese tend to decrease with increasing years of education. This may be because education promotes healthy behaviour that reduces the risk of obesity [46]. The result confirms the findings of the literature for developed countries [9,11]. BMI scores and obesity prevalence are lower among Non-Turkish women (apart from Arabic individuals) compared to Turkish women. Married women have higher BMI scores and higher obesity prevalence than their divorced counterparts. In addition, early-married women have even slightly higher obesity rates. This may be related to the role theory–marital causation model [47]-[50], which suggests that married people are more likely to be obese. According to the model, this may be because: single people may have poorer dietary intake and may control their weight so as to attract a mate, and once they get married weight control may be less important to them [51], [52].

Urban women have higher BMI scores and obesity prevalence than their counterparts in rural areas. This may be because both eating habits and physical activities. Hence it may be the case if urban women are more likely to have calorie intense food intake (i.e., a diet that is high in saturated fat such as fast-food) and/or rural women do not have proper food intake [2]. Additionally, it may also be possible if rural women have higher physical activity (by doing agricultural work which is labour intense) and urban women have relatively low physical activity [2], [23]. This confirms the findings of the literature on developing countries [21], [23]-[25], while rural women in developed countries have higher obesity rates than urban women [53], [54]. BMI is also considerably affected by wealth; the gradient is U-shaped. For instance, the least advantaged groups have lower BMI scores and lower obesity prevalence than the reference category (middle wealth group). In other words, individuals with lower SES have lower obesity rates. On the other hand, the most advantaged groups also have lower BMI scores and lower obesity prevalence than the reference category; for example, individuals with higher socioeconomic status have lower obesity rates. These results depict the effects of wealth on obesity in developing and developed countries respectively.

All the social security categories have lower BMI scores than the most advantageous social security group (GERF-base alternative). In addition, the women with the least beneficial social security scheme (GreenCard) and no social security at all have a lower prevalence of obesity than the reference (the most privilege category-GERF). These results are close to those of the literature on developing countries. All the working women have lower BMI scores and lower obesity prevalence than non-working women, which shows the negative effects of occupation on obesity. This may be because of the physical (in)activity of (non-) working women. Finally, number of children is positively associated with BMI (while it seems to have virtually no effect on being obese), which confirms the results observed for the impacts of reproductive history on obesity [8].

In sum the findings mostly show similarities with the literature for the countries in economic transition [21]-[25], [55]. Increasing effects of age and marital status on obesity confirm the existing literature for both developing and developed societies, since their effects do not vary upon development [10], [20]-[26]. In addition to these, the findings for urbanisation [21], [23]-[25] and social security [12], [26], [55] are in line with those obtained for developing societies, suggesting that urbanised and affluent women have relatively high obesity. Contrastingly, the findings for education confirm the literature from developed societies, that is better educated individuals have lower obesity [9], [11]. Interestingly, the effects of wealth confirming the findings not only from developing societies, but also from developed societies have been observed.

In addition, quantile regressions have been performed for BMI to ascertain the effects of obesity determinants in different quartiles. The results of quantile regressions are presented by quantile regression diagrams for each explanatory variable below. Accordingly, grey-shaded areas illustrate the confidence intervals of the estimated quantile regression coefficients. Horizontal straight lines depict the OLS coefficient estimates. Vertical axes show the coefficient estimates of named explanatory variable over the BMI distribution. Horizontal axes illustrate the quantiles of the variable of interest (BMI). Hence, 0.2th quantiles on the horizontal axes imply the first twenty per cent of BMI distribution (i.e. the weakest twenty per cent of all observations). For each explanatory variable, the point estimates can be interpreted as the effects of a one unit

change of the variable on the variable of interest (BMI for relevant study) holding the other variables fixed [56]. Therefore, it can be understood that there seems no significant differences from the results obtained from OLS estimations.

TABLE II: RESULTS OF THE REGRESSIONS FOR OBESITY

	Obesity			
	BMI		Being obese	
	coef.	Robust S.E	coef.	Robust S.E
Age	0.411***	0.063	0.017***	0.005
Age-squared	-0.002**	0.001	0.000	0.000
No Education	1.720***	0.257	0.130***	0.022
Primary Education	1.368***	0.174	0.092***	0.014
Higher Education	-0.546**	0.274	-0.037	0.023
Kurdish	-1.168***	0.209	-0.088***	0.019
Arabic	0.223	0.391	0.016	0.035
Other Non-Turkish	-1.965***	0.648	-0.113**	0.054
Married	1.542***	0.373	0.102***	0.031
Widowed	1.269**	0.635	0.066	0.052
Age At First Marriage	-0.139***	0.018	-0.010***	0.002
Southern Turkey	-0.081	0.219	-0.034*	0.02
Central Turkey	0.036	0.211	-0.001	0.018
Northern Turkey	0.008	0.258	-0.006	0.022
Western Turkey	-0.238	0.208	-0.025	0.018
Urban	0.321*	0.173	0.008	0.015
Poorest	-1.004***	0.237	-0.082***	0.021
Poorer	-0.488**	0.193	-0.047***	0.017
Richer	-0.663***	0.201	-0.047***	0.017
Richest	-1.062***	0.234	-0.072***	0.02
No Social Security	-0.940***	0.275	-0.058**	0.024
BAG-KUR	-0.375	0.274	0.000	0.024
SIO	-0.339	0.236	-0.02	0.02
GreenCard	-0.988***	0.287	-0.065***	0.025
Private Organisations	-1.677***	0.59	-0.067	0.052
Agricultural Sector	-0.362*	0.203	-0.013	0.018
Industry Sector	-0.986**	0.439	-0.115***	0.039
Service Sector	-0.547***	0.197	-0.058***	0.017
Total number of children	0.102**	0.048	0.005	0.004
Cons	18.235***	1.075	-0.124	0.091
R-squared	0.23		0.15	
Num.of.obs	6796		6796	

2) Determinants of obesity: East and west comparison

There is a clear gap between the developments of western and eastern Turkey. Ersungur *et al.* [1] investigated the development of the regions of Turkey by generating a development index (using per capita GDP, banking, urbanisation, schooling, healthcare, investment, employment and export rates), and observed that western Turkey constitutes the most developed part of Turkey, whereas eastern Turkey forms the least developed part. Since OLS estimations detect the average effects of explanatory variables, combining the observations from these two regions of Turkey will be tricky. Pooling the observations from different areas may lead us to observe the characteristics of both developed and developing countries. Therefore, the models are split into two different sample sets: (i) eastern samples and (ii) western samples. One might expect that western Turkey would reflect characteristics close to those of developed countries whereas eastern Turkey might depict characteristics similar to those of developing countries.

TABLE III[4]: ESTIMATIONS FOR BMI: EAST AND WEST

	BMI			
	East		West	
	coef.	Robust S.E	coef.	Robust S.E
Age	0.564***	0.106	0.446***	0.136
Age-squared	-0.004**	0.002	-0.002	0.002
No Education	1.639***	0.391	1.177*	0.668
Primary Education	1.204***	0.347	1.012***	0.341
Higher Education	-0.183	0.684	-0.485	0.45
Kurdish	-1.061***	0.271	-0.498	0.563
Arabic	-0.429	0.656	-5.918***	0.692
Other Non-Turkish	0.171	1.232	-1.664*	0.877
Married	0.907	0.81	1.812***	0.639
Widowed	1.193	1.381	0.652	1.072
Age At First Marriage	-0.179***	0.032	-0.146***	0.036
Urban	0.389	0.293	0.525	0.447
Poorest	-1.432***	0.381	0.106	0.648
Poorer	-0.408	0.351	-0.655	0.427
Richer	-0.698	0.453	-0.732**	0.367
Richest	-1.204**	0.567	-1.551***	0.399
No Social Security	-0.547	0.502	-0.773	0.597
BAG-KUR	0.66	0.587	-0.345	0.574
SIO	0.457	0.466	-0.345	0.492
GreenCard	-0.257	0.491	-0.534	0.813
Private Organisations	-0.674	0.973	-0.711	1.271
Agricultural Sector	-0.475	0.328	-0.213	0.538
Industry Sector	-2.599**	1.029	-1.300**	0.543
Service Sector	-0.382	0.501	-0.317	0.329
Total number of children	0.002	0.07	0.15	0.131
Cons	17.295***	1.877	17.130***	2.284
R-squared	0.25		0.21	
Num.of.obs	1960		1752	

The results are presented in Tables III & IV. Age is positively associated with obesity in both western and eastern

[4]The average effects of social security variables are significantly different from those obtained for whole population (shown in Table II); this is mainly because of their average effects in northern Turkey which are not presented in this study.

Turkey, and has larger estimated marginal effect in the latter. Obesity is negatively correlated with years of education. Kurdish women living in western Turkey have relatively higher BMI scores and are more likely to be obese than their counterparts in eastern Turkey. Marital status has significant and positive impacts on obesity in both regions, and has even more effects in western Turkey. Obesity rates are higher among early-married samples, and the effects of age at first marriage on obesity are relatively higher in eastern Turkey. Less-well-off women in eastern Turkey have relatively lower obesity prevalence and lower BMI scores than their counterparts in western Turkey. By contrast, better-off women in western Turkey have relatively lower obesity prevalence and lower BMI scores than their counterparts in eastern Turkey. This again evidences the similarity between western Turkey and developed countries, while eastern Turkey exhibits the characteristics of developing countries. In addition, all the working categories in eastern Turkey have relatively lower obesity prevalence, and lower BMI scores, than their counterparts in western Turkey. Finally, the number of children ever born has positive and stronger effects on being obese in western Turkey than in the eastern part.

TABLE VI: INCOME RELATED INEQUALITY BETWEEN EASTERN AND WESTERN TURKEY

	Concentration Indices		**Contributions**					
	West	**East**	**Obese**			**BMI**		
			El. Dif.	**CI Dif.**	**Total**	**El. Dif.**	**CI Dif.**	**Total**
Age					**-0.42%**			**-4.83%**
Age	0.015	0.012	*23.54%*	*-6.49%*	17.05%	*4.57%*	*-7.18%*	-2.61%
Age-squared	0.024	0.021	*-18.99%*	*1.52%*	-17.47%	*-4.33%*	*2.11%*	-2.22%
Education					**0.93%**			**1.80%**
No education	-0.495	-0.272	*-48.63%*	*25.17%*	-23.46%	*-38.59%*	*20.09%*	-18.50%
Primary education	-0.157	0.075	*-0.37%*	*18.86%*	18.49%	*0.96%*	*16.05%*	17.01%
Higher Education	0.618	0.758	*6.05%*	*-0.16%*	5.89%	*3.39%*	*-0.11%*	3.29%
Ethnicity					**25.67%**			**17.58%**
Kurdish	-0.397	-0.239	*42.50%*	*-17.42%*	25.08%	*30.04%*	*-12.65%*	17.39%
Arabic	0.708	-0.33	*-1.14%*	*2.45%*	1.31%	*-0.82%*	*2.13%*	1.31%
Other races	-0.297	0.529	*-0.62%*	*-0.10%*	-0.72%	*-1.17%*	*0.05%*	-1.12%
Marital Status					**0.51%**			**0.53%**
Married	-0.001	0.003	*0.26%*	*0.46%*	0.72%	*0.13%*	*0.54%*	0.66%
Widowed	-0.098	-0.122	*-0.12%*	*-0.09%*	-0.21%	*-0.07%*	*-0.07%*	-0.14%
Age at first marriage	0.027	0.025	*-4.65%*	*0.83%*	**-3.83%**	*-1.39%*	*0.76%*	**-0.63%**
Urban	0.094	0.256	*-4.46%*	*1.82%*	**-2.64%**	*-2.24%*	*5.44%*	**3.19%**
Wealth					**56.46%**			**66.00%**
Poorest	-0.928	-0.587	*61.11%*	*-24.24%*	36.86%	*74.22%*	*-26.96%*	47.26%
Poorer	-0.71	0.08	*-0.96%*	*-13.84%*	-14.79%	*1.13%*	*-11.02%*	-9.89%
Richer	0.146	0.767	*3.70%*	*-3.90%*	-0.20%	*2.50%*	*-6.19%*	-3.70%
Richest	0.709	0.938	*36.13%*	*-1.55%*	34.59%	*34.63%*	*-2.31%*	32.32%
Soc. Security Status					**9.64%**			**10.31%**
No social security	-0.304	-0.175	*-0.43%*	*-0.90%*	-1.33%	*-0.27%*	*-1.90%*	-2.16%
Bag-Kur	0.106	0.448	*0.21%*	*3.72%*	3.94%	*1.24%*	*2.11%*	3.35%
SIO	0.053	0.32	*3.15%*	*6.55%*	9.71%	*2.25%*	*4.19%*	6.44%
GreenCard	-0.654	-0.329	*-2.00%*	*-0.18%*	-2.18%	*6.36%*	*-4.23%*	2.13%
Private insurance	0.345	-0.054	*-0.75%*	*0.25%*	-0.50%	*0.21%*	*0.33%*	0.54%
Employment Status					**2.76%**			**2.55%**
Agricultural Work	-0.576	-0.45	*3.85%*	*-0.82%*	3.02%	*2.97%*	*-1.00%*	1.96%
Indsutrial Work	-0.023	0.114	*-0.28%*	*-0.27%*	-0.55%	*-0.13%*	*-0.24%*	-0.38%
Service sector	0.241	0.292	*0.77%*	*-0.47%*	0.29%	*1.15%*	*-0.19%*	0.96%
Number of children	-0.082	-0.137	*9.29%*	*1.62%*	**10.92%**	*3.43%*	*0.07%*	**3.50%**

B. Inequality Analyses

1) Concentration indices

It seems that income-related obesity inequalities are not significant when the individuals from developed (West) and developing (East) regions are combined. However, once the individuals are separated on regional basis, it becomes obvious that obesity distribution is pro-rich in eastern Turkey while it is pro-poor in western Turkey. In other words, obesity is more concentrated among wealthier individuals in eastern Turkey, while in western Turkey it is more concentrated among poorer individuals. These findings confirm that western Turkey is more likely to have the characteristics of developed countries, while the characteristics of eastern Turkey are closer to those of developing countries. Since the value of the concentration index depends upon the mean of the outcome variable, it is difficult to make a direct comparison between concentration indices of the outcome variables with different means [40]. Hence, to eliminate the difficulty of directly comparing the concentration indices, the value of the concentration index will be multiplied by the mean of the outcome variable. Thereby, it can be understood that income-related inequality in obesity is higher in eastern Turkey than in western Turkey.

2) Decomposition of income related obesity inequalities

Table VI decomposes the income-related obesity inequalities between eastern and western Turkey into the contributions of regressor variables (in percentages). Each variable's contribution can be interpreted as follows: if the distributions of related variable were equal in eastern and western Turkey, or if the related variable had zero elasticity, the income-related inequalities would be that much higher (or lower).

Accordingly, wealth and ethnicity are the dominant contributors to income-related obesity inequality. Respondents' ages (at the time of the survey) along with age at first marriage, urbanisation, marital status and employment status make minor contributions. In general, the elasticity differences between eastern and western Turkey dominate the inequality differences; that is, differences in obesity determinants, rather than differences in the inequality in obesity determinants, account for the rise of income-related inequalities in obesity between these regions.

Lower education is relatively more concentrated among the poor in the west than in the east. By contrast, higher education is relatively more concentrated among the rich in eastern Turkey than it is in western Turkey. Hence it can be said that higher education levels are more prevalent among western women than among their eastern counterparts. Even the contributions of educational variables on the inequalities are evident; they are offset by one another, and the total contributions are negligible. As regards ethnicity, only the contributions made by Kurdish ethnic origin are considerable, since other contributions are fairly small. Being Kurdish notably increases income-related obesity inequalities, such a rise being attributable to the differences in the distributions of Kurdish women in these regions. This was expected, since Kurdish women are more concentrated in the east (approximately 9% in the west, 85% in the east – also see Fig. 3), and those living in the west have higher BMI levels (on average) than their counterparts in the east (Fig. 2).

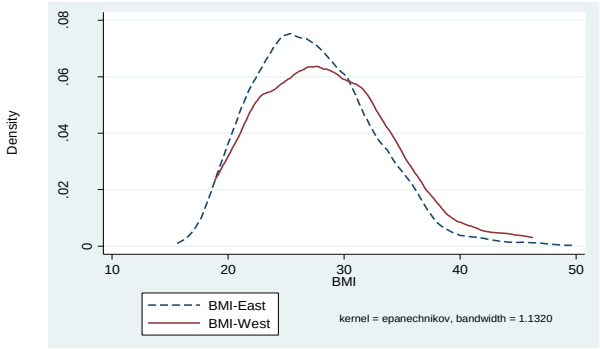

Fig. 2. BMI distribution — East and west.

In addition, wealth contributes more than 50 per cent to income-related obesity inequalities, and again the rise is predominantly due to the differences in the partial associations between wealth (as a determinant of obesity) and obesity rather than to the differences in income inequalities. This may be related to food intake, if it is the case that eastern women cannot afford food as well as western women. Social security status makes some contribution to the total; however, individual insurance schemes do not (apart from *Social Insurance Organisation*) make a notable contribution. The contribution of *Social Insurance Organisation* may be attributable to inequalities relating to being insured by *Social Insurance Organisation*, this being relatively more pro-rich in eastern Turkey. Finally, number of children contributes 10 per cent towards being obese, this contribution being formed by the differences in the impacts of number of children on obesity. This was expected, since there is a clear gap between the two regions in terms of number of children (Fig. 3).

3) Decomposition of obesity gap

Although there is no significant difference, western women are more likely to be obese than eastern women, as their probability of being obese, and their BMI scores, are relatively higher on average (mean levels are shown in Table VII).

The results of aggregate decomposition are introduced in Table VIII. Accordingly, the Oaxaca-Blinder decomposition [30],[43] suggests that the differences both in the mean characteristics (composition effect) and coefficients (structural effect) play role in the obesity difference between eastern and western women. However, these effects are counterbalanced by the interaction effect; that has an unambiguous interpretation as it counts not only the differences in residuals but also the interaction between differences in characteristics and coefficients. Eventually, the differences in the mean characteristics of eastern and western women are more important for their obesity difference. Similar to the mean, the interaction effect counterbalances the effects of characteristics' and coefficients' differences across all quartiles. However, the differences in the characteristics of eastern and western women explain higher proportion of total difference at all quartiles. Further, the effects are the relatively higher at higher quantiles, implying that the differences at higher quantiles of obesity distribution explain larger proportion of total obesity difference between eastern and western Turkey.

As for detailed decomposition, the results are presented in Table IX for the mean and Table X for different quartiles. Each characteristic's/coefficient's contribution to the differences regarding outcome can be read as follows: the BMI score of eastern women or the probability of their being

obese would be that much higher (or lower if the sign is negative) if they had the same characteristics/coefficients as their counterparts in western Turkey.

At the mean, the differences between the obesity rates of eastern and western women may be attributable to the differences in their characteristics (composition effects) rather than to the differences in the coefficients (structural effect). The composition effect (the endowments columns in Tables IX & X) accounts for the differences in the distribution of characteristics and is predominantly driven by the differences in the distributions of age, ethnicity and education level. Such contributions of age and education are unsurprising, since there are clear gaps between the age and education levels of women in eastern and western Turkey (Table I shows the mean levels, and Fig. 3 shows the distributions), according to the increasing effect of increasing age and the decreasing effect of education on obesity. As regards ethnicity, the total contribution stems almost entirely from the differences in the distributions of Kurdish people. The contribution of being Kurdish is unsurprising, since Kurdish people are more highly concentrated in eastern than in western Turkey (Fig. 3 shows the distribution). Similar to their contributions at the mean, the differences in age, education and ethnicity distributions make the largest contributions at all quartiles. Their composition effects vary at different quartiles.

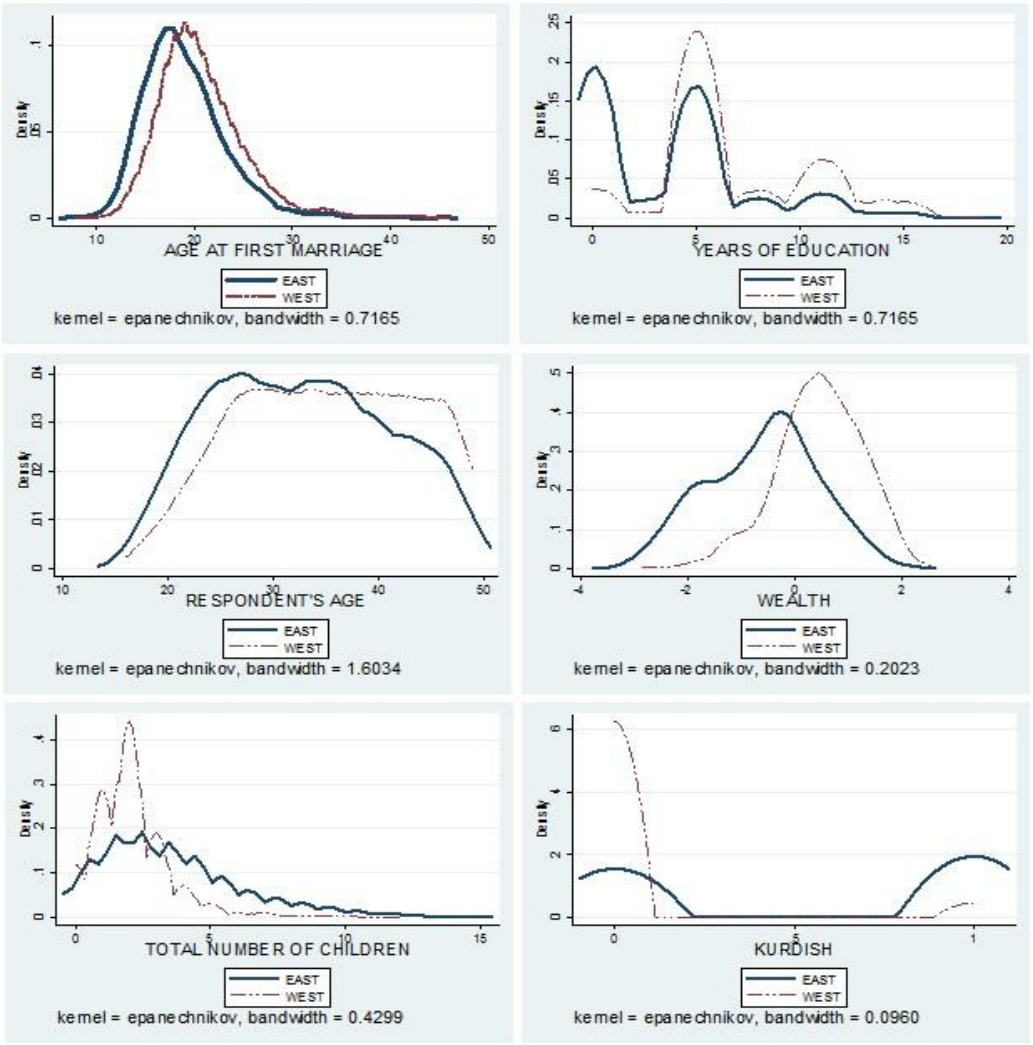

Fig. 3. Differences in the distributions: East — West.

It is obvious that the effects of education and ethnicity are the highest at the last quartile implying that they explain more of the difference at higher BMI scores. Unexpectedly, the differences in the income distributions make a lower contribution (in total) both at the mean and different quartiles. This is due to the adverse effects of categorical income variables (i.e. some income variables are offset by one another). However, what seems obvious is that if eastern women had the same level of wealth as western women, their obesity would be slightly higher; by contrast, if they had the same level of education, their obesity rates would be remarkably lower. If the development gap between these two regions is taken into the consideration, these results again confirm that eastern Turkey has characteristics similar to those of developing countries while western Turkey is closer to developed countries.

Another issue is early marriage in eastern Turkey, which matters somewhat as regards obesity differences between eastern and western Turkey (Table I shows the mean level, and Fig. 3 shows the distribution). Eastern women marry approximately two years earlier, on average, than western women, and such a difference makes notable contributions to the overall composition effect. In addition, the effects of early marriage slightly increase at higher quantiles of obesity distribution. That number of children would make a notable contribution was expected, since there is a great deal in the

literature about the increasing effect of reproductive history on obesity [20],[26] and there is a clear gap in the number of children between the two regions (Fig. 3). However, the expected contribution of number of children to the composition effect could not be observed either at the mean or different quartiles (apart from the first quartile).

As regards structural effect (the coefficient columns in Table IX & X), this accounts for the differences in the effects of determinants rather than for the distributions of determinants. Respondent's age (at the time of the survey), marital status, make the largest contributions to the structural effect. Further, age and marital status have the largest contributions at all quartiles. Their effects decrease at higher quantiles, referring that they explain more of the differences at the lower quantiles of obesity distribution. Besides, the differences in the coefficients of wealth (for BMI only), number of children, age at first marriage, social security, ethnicity and education variables between eastern and western Turkey also make notable contributions to the difference in obesity rates between the regions.

In addition, wealth and social security explain more of the differences at the lower quantiles of obesity, by contrast age at first marriage and education explain more of those at the higher quantiles. According to OLS estimations, respondent's age (at the time of the survey) and age at first marriage have a relatively greater effect on obesity in eastern Turkey – that is, one year of change in respondents' ages (age at first marriage) increases (decreases) obesity relatively more in eastern Turkey than in western. Thus, if the impacts of age (age at first marriage) on obesity for eastern women were the same as those for western women, the obesity rates of eastern women would be significantly lower (higher). By contrast, marriage has a relatively greater effect on obesity in western Turkey – that is, in western Turkey married women have higher obesity rates relative to those of divorced women than do married women in the east. The difference in the coefficients of marriage contributes remarkably to the difference in obesity between these regions. A change in the number of children (ever born) increases obesity rates relatively more in the West than in the East. If obesity were equally affected in both regions by having one more child, eastern women would have significantly higher obesity rates.

TABLE VII: MEAN LEVELS OF BEING OBESE AND BMI

Mean Levels		
	Obese	**BMI**
East	0.32	27.8
West	0.34	28.15

In summary, respondent's age (at the time of the survey) makes important contributions to both composition and structure effect. In addition to age; ethnicity and education make the largest proportions of the composition effect, while marital status and number of children make up the larger portion of the structural effect. Categorical income variables make considerable contributions to both composition and structural effects; however, the total contributions made by wealth are not greatly significant, since wealth variables are offset by each other. Finally, urbanisation, social security status and employment status make minor contributions to both composition and structural effect.

TABLE VIII: AGGREGATE DECOMPOSITIONS OF OBESITY DIFFERENCES

Aggregate Decompositions of obesity differences

Oaxaca-Blinder Decomposition (Oaxaca, 1973)

Difference attributable to:	**BMI**		**Obese**	
	mean	**%change**	**mean**	**%change**
Characteristics	0.857	246.22%	0.065	412.80%
Coefficients	0.418	120.04%	0.038	239.08%
Interaction	-0.927	-266.26%	-0.087	-551.88%
Total Difference	0.348	100.00%	0.016	100.00%

RIFR Decomposition (Firpo *et al.*, 2009)

Difference attributable to:	**BMI**					
	Q25	**%change**	**Q50**	**%change**	**Q75**	**%change**
Characteristics	0.568	808.80%	0.958	3152.11%	0.921	186.32%
Coefficients	0.208	295.84%	0.339	1116.12%	0.445	90.00%
Interaction	-0.705	-1004.64%	-1.266	-4168.23%	-0.872	-176.32%
Total Difference	0.07	100.00%	0.03	100.00%	0.494	100.00%

TABLE IX: MEAN-BASED DECOMPOSITION: BEING OBESE AND BMI

	Mean-based Decomposition							
	Obese				BMI			
	Endowments		Coefficients		Endowments		Coefficients	
Age	**0.047**	**72%**	**-0.407**	**-1074%**	**0.683**	**80%**	**-1.541**	**-369%**
Age	*0.079*	*121%*	*-0.758*	*-2002%*	*1.394*	*163%*	*-3.273*	*-783%*
Age-squared	*-0.032*	*-49%*	*0.351*	*928%*	*-0.711*	*-83%*	*1.732*	*415%*
Education	**-0.032**	**-49%**	**-0.025**	**-65%**	**-0.398**	**-46%**	**-0.281**	**-67%**
No education	*-0.043*	*-66%*	*-0.015*	*-40%*	*-0.546*	*-64%*	*-0.19*	*-45%*
Primary education	*0.012*	*18%*	*-0.008*	*-22%*	*0.16*	*19%*	*-0.082*	*-20%*
Higher Education	*-0.001*	*-2%*	*-0.001*	*-3%*	*-0.012*	*-1%*	*-0.009*	*-2%*
Ethnicity	**0.046**	**71%**	**0.028**	**74%**	**0.547**	**64%**	**0.116**	**28%**
Kurdish	*0.046*	*70%*	*0.039*	*102%*	*0.529*	*62%*	*0.317*	*76%*
Arabic	*0.001*	*2%*	*-0.01*	*-27%*	*0.015*	*2%*	*-0.196*	*-47%*
Other races	*0*	*0%*	*0*	*0%*	*0.003*	*0%*	*-0.005*	*-1%*
Marital Status	**-0.001**	**-1%**	**0.113**	**298%**	**-0.015**	**-2%**	**0.862**	**206%**
Married	*-0.001*	*-2%*	*0.114*	*300%*	*-0.023*	*-3%*	*0.871*	*209%*
Widowed	*0.001*	*1%*	*-0.001*	*-2%*	*0.008*	*1%*	*-0.009*	*-2%*
Age at first marriage	**-0.023**	**-35%**	**0.088**	**233%**	**-0.331**	**-39%**	**0.623**	**149%**
Urban	**0.002**	**2%**	**0.017**	**45%**	**0.072**	**8%**	**0.088**	**21%**
Wealth	**0.015**	**23%**	**0.004**	**12%**	**0.14**	**16%**	**0.546**	**131%**
Poorest	*0.027*	*42%*	*0.019*	*50%*	*0.487*	*57%*	*0.634*	*152%*
Poorer	*0.004*	*6%*	*-0.008*	*-22%*	*0.046*	*5%*	*-0.063*	*-15%*
Richer	*-0.005*	*-7%*	*-0.003*	*-8%*	*-0.121*	*-14%*	*-0.004*	*-1%*
Richest	*-0.011*	*-17%*	*-0.003*	*-8%*	*-0.271*	*-32%*	*-0.022*	*-5%*
Soc. Security Status	**0.019**	**30%**	**-0.037**	**-98%**	**0.294**	**34%**	**-0.427**	**-102%**
No social security	*0.001*	*1%*	*-0.002*	*-6%*	*0.027*	*3%*	*-0.046*	*-11%*
Bag-kur	*0.004*	*6%*	*-0.003*	*-7%*	*0.034*	*4%*	*-0.07*	*-17%*
SIO	*0.015*	*23%*	*-0.019*	*-50%*	*0.152*	*18%*	*-0.206*	*-49%*
GreenCard	*0*	*0%*	*-0.014*	*-37%*	*0.085*	*10%*	*-0.105*	*-25%*
Private insurance	*0*	*0%*	*0.001*	*2%*	*-0.004*	*0%*	*0*	*0%*
Employment Status	**-0.014**	**-22%**	**0.005**	**14%**	**-0.138**	**-16%**	**0.044**	**11%**
Agricultural Work	*0.001*	*1%*	*0.003*	*8%*	*0.012*	*1%*	*0.033*	*8%*
Indsutrial Work	*-0.007*	*-11%*	*0*	*0%*	*-0.101*	*-12%*	*0.007*	*2%*
Service sector	*-0.008*	*-12%*	*0.002*	*6%*	*-0.049*	*-6%*	*0.005*	*1%*
Number of children	**0.006**	**9%**	**0.087**	**229%**	**0.004**	**1%**	**0.553**	**132%**
Constant			**0.164**	**432%**			**-0.165**	**-39%**
Total	**0.065**	**100%**	**0.038**	**100%**	**0.857**	**100%**	**0.418**	**100%**

TABLE X: RIFR DECOMPOSITION: BMI

	RIFR Decomposition: BMI					
	Characteristics			Coefficients		
	0.25	0.5	0.75	0.25	0.5	0.75
Age	**95.08%**	**79.94%**	**90.32%**	**-2028.04%**	**-2793.45%**	**-827.91%**
Age	448.36%	220.34%	88.32%	-5360.12%	-5886.37%	-1461.74%
Age-squared	-353.28%	-140.40%	2.00%	3332.08%	3092.92%	633.82%

Education	**-42.17%**	**-44.05%**	**-70.88%**	**-10.87%**	**-63.89%**	**111.83%**
No education	-74.58%	-65.83%	-74.40%	-22.12%	-56.22%	75.54%
Primary education	27.82%	19.17%	15.12%	21.74%	-2.11%	31.40%
Higher Education	4.58%	2.61%	-11.59%	-10.50%	-5.56%	4.89%
Ethnicitiy	**64.43%**	**58.70%**	**95.57%**	**16.06%**	**133.60%**	**44.28%**
Kurdish	57.74%	55.65%	92.11%	209.59%	195.83%	80.43%
Arabic	2.02%	2.83%	1.62%	-188.05%	-61.24%	-35.02%
Other races	4.68%	0.22%	1.84%	-5.48%	-0.99%	-1.13%
Marital Status	**-2.72%**	**-3.90%**	**-0.42%**	**506.48%**	**447.96%**	**461.31%**
Married	-3.04%	-4.73%	-1.18%	502.22%	443.00%	461.57%
Widowed	0.32%	0.83%	0.76%	4.26%	4.96%	-0.26%
Age at first marriage	**-35.29%**	**-39.47%**	**-44.88%**	**-24.06%**	**399.45%**	**328.94%**
Urban	**25.02%**	**9.06%**	**-0.50%**	**-26.38%**	**96.80%**	**97.45%**
Wealth	**27.40%**	**17.38%**	**14.69%**	**426.92%**	**323.86%**	**-40.60%**
Poorest	90.93%	73.91%	46.98%	433.21%	313.13%	28.41%
Poorer	8.01%	5.34%	3.85%	-2.28%	8.45%	-55.45%
Richer	-12.18%	-17.16%	-13.34%	-9.28%	0.26%	1.10%
Richest	-59.35%	-44.71%	-22.79%	5.27%	2.01%	-14.67%
Social Security Status	**31.78%**	**35.16%**	**42.98%**	**154.60%**	**-48.09%**	**24.03%**
No social security	4.03%	4.60%	4.67%	-20.66%	-2.29%	24.44%
Bag-kur	-0.91%	4.11%	3.20%	10.67%	-21.13%	-0.68%
SIO	25.03%	6.42%	10.49%	-19.43%	-52.43%	-20.44%
GreenCard	2.40%	20.98%	26.29%	196.26%	28.67%	16.58%
Private insurance	1.23%	-0.94%	-1.67%	-12.24%	-0.90%	4.13%
Employment Status	**-17.45%**	**-17.02%**	**-36.64%**	**17.87%**	**24.80%**	**29.68%**
Agricultural Work	1.28%	1.45%	2.31%	-1.50%	25.99%	17.42%
Indsutrial Work	-5.05%	-11.94%	-24.42%	2.29%	1.83%	3.61%
Service sector	-13.67%	-6.53%	-14.53%	17.08%	-3.02%	8.65%
Number of children	**-46.09%**	**4.18%**	**9.75%**	**-281.11%**	**-10.52%**	**197.90%**
constant				**1348.55%**	**1589.48%**	**-326.89%**
Total-percentage	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Total-absolute value	0.568	0.958	0.921	0.208	0.339	0.445

V. Discussion

The aim of this study has been to investigate the determinants of obesity in Turkey and to measure the level of income-related obesity inequality. Investigating the inequalities in Turkey is novel for literature about the inequalities in developed and developing countries, since Turkey bears the characteristics of both developed and developing countries [57].

Age, ethnicity, education, income, marital status and employment are significantly associated with obesity in Turkey. Increasing age of respondents is associated with increases in obesity. As regards the effect of marital status, obesity rates are higher among married women, particularly so among early-married women. This may be related to the role theory–marital causation model [47]-[50] suggesting lower obesity rates of single people which is related to their poorer dietary intake and weight control with the aim of attracting a mate [51], [52]. In addition, increasing educational attainment is associated with decreases in obesity, as in developed countries. This may be because the promotional effect of education on healthy behaviour reduces the risk of obesity. Urban women have higher obesity rates than their counterparts in rural areas. This may be related to dietary habits since urban women are more likely to have mass produced foods (which are high in saturated fat) [2], and so they may have higher obesity than rural women. All working women have lower obesity rates than non-working women (potential housewives), probably because of physical (in)activity.

Additionally, two-way wealth effects on obesity are observed. That is, the results indicate that (i) lower socioeconomic groups have higher obesity rates, and that (ii) higher socioeconomic groups have higher obesity rates. This may be due to the pooling of individuals from different regions with different levels of development. In addition, regional effects on obesity were not clear. Hence, the individuals have been separated and different models have

been constructed for eastern and western Turkey since they are referred to as the least and the most developed parts of Turkey respectively [1]. As a result, it is understood that higher socioeconomic characteristics are associated with higher obesity rates in eastern Turkey (the least developed part) while they are related to lower obesity rates in western Turkey (the most developed part). Therefore, it is shown that western Turkey has the characteristics close to developed countries whereas eastern Turkey resembles developing countries.

In addition, inequality analysis suggests that obesity is more concentrated among wealthier women in eastern Turkey whereas it is more concentrated among poorer women in western Turkey. This confirms the fact that eastern Turkey reflects the characteristics with of developing countries while western Turkey is closer to developing countries in this respect. Decomposition of income related inequalities between eastern and western Turkey indicates that the inequalities are predominantly associated with wealth and ethnicity. Wealth effects (on income related inequalities in obesity) are mainly due to the differences in the partial associations between wealth and obesity. This may be related to food intake if it is the case that eastern women cannot afford food as easily as western women. Therefore it is believed that policies dealing with the nutritional issues of eastern women may be useful in reducing the inequalities between eastern and western Turkey.

Another interesting result is that differences in the partial associations of being Kurdish and having obesity between eastern and western Turkey have significant effects on income related inequalities between these regions. This may be related with their food intake again if it is the case that Kurdish women in western Turkey have calorie intense diets (such as fast food) and/or Kurdish women in eastern Turkey do not have a proper food intake. Accordingly, in addition to the policies dealing with the nutritional issues of eastern women, policies which encourage healthy behaviour of western women may also be helpful in reducing the inequalities in obesity.

Therefore the study indicates that designing specific policies for regions with different levels of development will be useful in reducing the inequalities between eastern and western Turkey.

REFERENCES

[1] M. Ersungur *et al*., "Türkiye'de bölgelerin sosyo-ekonomik gelişmişlik sıralamasi: Temel bileşenler analizi," *İktisadi Ve Idari Bilimler Dergisi*, vol. 21, pp. 55-66, 2007.

[2] D. M. Cutler *et al*., "Why have Americans become more obese," *Journal of Economic perspectives*, vol. 17, no. 3, pp. 93-118, 2003.

[3] P. Moreira and P. Padrao, "Educational, economic and dietary determinants of obesity in Porteguese adults: A cross-sectional study," *Eating Behaviours*, vol. 7, pp. 220-228, 2004.

[4] A. Robert and E. Reither, "A multilevel analysis of race, community disadvantage, and body mass index among adults in the US," *Social Science and Medicine*, vol. 59, pp. 2421-2434, 2004.

[5] C. Kleiser, A. Rosario *et al*., *Potential Determinants of Obesity Among Children and Adolescents in Germany: Results from Cross-Sectional KiGGS Study*, BMC Public Health, vol. 9, no. 46, 2004.

[6] A. Ljungvall and U. G. Gerdtham, "More equal but heavier: A longitudinal analysis of income-related obesity inequalities in an adult Swedish cohort," *Social Science and Medicine*, vol. 70, pp. 221-231, 2010.

[7] J. E. Manson, P. J. Skerrett, and W. C. Willett, "Epidemiology of health risks associated with obesity," *Eating Disorders and Obesity: A Compre Hensive Handbook*, pp. 422-432, 2002.

[8] S. P. Wamala, A. Wolk *et al*., "Determinants of obesity in relation to socioeconomic status among middle-aged Swedish women," *Preventive Medicine*, vol. 26, pp. 734-744, 1997.

[9] L. McLaren, "Socioeconomic status and obesity," *Epidemiol*, vol. 29, pp. 29-48.

[10] A. MacFarlane, G. Abbott *et al*., "Socidemographic and behavioural correlates of weight status among women with children living in socioeconomically disadvantaged neighbourhoods," *International Journal of Obesity*, vol. 33, pp. 1289-1298, 2009.

[11] A. J. R. Roskam *et al*., "Comparative appraisal of educational inequalities in overweight and obesity among adults in 19 European countries," *International Journal of Epidemiology*, vol. 39, pp. 392-404, 2010.

[12] N. Steyn, J. Nel *et al*., "Dietary, socical and environmental determinants of obesity in Kenyan women," *Scandinavian Journal of Public Health*, vol. 39, pp. 88-97, 2011.

[13] M. E. Moore, A. Stunkard, and L. Srole, "Obesity, social class, and mental illness," *JAMA*, vol. 181, pp. 962–966, 1962.

[14] P. B. Goldblatt, M. E. Moore, and A. J. Stunkard, "Social factors in obesity," *JAMA*, vol. 192, pp. 1039–1044,1965.

[15] P. J. Brown and M. Konner, "An anthropological perspective on obesity," *Annals of the New York Academy of Sciences*, vol. 499, pp. 29–46, 1987.

[16] J. Sobal and A. J. Stunkard, "Socioeconomic status and obesity: A review of the literature," *Psychol Bull*, vol. 105, pp. 260–275, 1989.

[17] WHO. (2000). Obesity: Preventing and managing the global epidemic URL. [Online]. Available: http://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en

[18] J. Sobal and C. M. Cassidy, "Dieting foods: Conceptualizations and explanations," *Ecology of Food and Nutrition*, vol. 20, pp. 89–96, 1987.

[19] I. H. Yen and G. A. Kaplan, "Poverty area residence and changes in physical activity level: Evidence from the alameda county study," *Am J Public Health*, vol. 88, pp. 1709–1712, 1998.

[20] F. A. A. Dake *et al*., "Sociodemographic correlates of obesity among Ghanaian women," *Public Health Nutrition*, vol. 14, no. 7, pp. 1285-1291, 2010.

[21] L. Zhang, "A multilevel study of effects of socioeconomic status, income inequality, and the built environment on adult obesity in China," PhD, Urbana, Illinous, University of Illinois at Urbana, 2012.

[22] B. Ma, "Socioeconomic status and obesity gradient over age: New evidence from China," *Frontiers of Economics in China*, vol. 7, no. 1, pp. 70-93, 2012.

[23] P. Chhabra and S. K. Chhabra, "Distribution and determinants of body mass index of non-smoking adults in Delhi, India," *Health Population Nutrition*, vol. 25, no. 3, pp. 294-301, 2007.

[24] J. Kain *et al*., "Obesity trends and determinant factors in Latin America," *Cad. Saude Publica*, vol. 19, no. 1, pp. 77-86, Ria de Janeiro, 2003.

[25] C. Filozof *et al*., "Obesity prevalence and trends in Latin American countries," *Obesity Reviews*, vol. 2, pp. 99-106, 2001.

[26] M. M. H. Khan and A. Kraemer, "Factors associated with being underweight, overweight and obese among ever-married non-pregnant urban women in Bangladesh," *Singapore Med*, vol. 50, no. 8, 2009.

[27] A. Iseri and N. Arslan, "Obesity in adults in Turkey: Age and regional effects," *European Journal of Public Health*, vol. 19, no. 1, pp. 91-94, 2008.

[28] N. Kakwani, A. Wagstaff *et al*., "Socioeconomic inequalities in health: Measurement, computation and statistical inference," *Journal of Econometrics*, vol. 77, pp. 87-103, 1997.

[29] A. Wagstaff, E. V. Doorslaer, and N. Watanabe, *On Decomposing the Causes of Health Sector Inequalities with an Application to Malnutrition Inequalities in Vietnam (Policy Research Working Paper Series*, The World Bank, 2001.

[30] R. L. Oaxaca, "Male-female wage differentials in urban labor markets," *International Economic Review*, vol. 14, pp. 693-709, 1973.

[31] A. Wagstaff, P. Paci, and E. V. Doorslaer, "On the measurement of inequalities in health," *Soc Sci Med*, vol. 33, pp. 545–557, 1991.

[32] TDHS, *Turkish Demographic and Health Survey*, Ankara, Hacettepe University Institute of Population Studies.

[33] Y. Liu, Y. Celik, and B. Sahin, *Turkiye'de Saglik ve Ilac Harcamalari*, Suvak, 2005.

[34] A. Buğra and Ç. Keyder, "The Turkish welfare regime in transformation," *Journal of European Social Policy*, vol. 16, pp. 211–228, 2006.

[35] M. Tatar, H. Ozgen, B. Sahin, P. Belli, and P. Berman, "Informal payments in the health sector: a case study from Turkey," *Health Aff (Millwood)*, vol. 26, pp. 1029–1039, 2007.

[36] M. S. Yardim, N. Cilingiroglu *et al*., "Catastrophic health expenditure and impoverishment in Turkey," *Health Policy*, vol. 94, pp. 26-33, 2010.
[37] B. Erus and N. Aktakke, "Impact of healthcare reforms on out-of-pocket health expenditures in Turkey for public insurees," *Eur J Health Econ*, vol. 13, pp. 337–346, 2012.
[38] M. Binder and A. Coad, "From average Joe's happiness to miserable Jane and cheerful john: Using quantile regressions to analyze the full subjective well-being distribution," *Journal of Economic Behaviour and Organization*, vol. 79, pp. 275-290, 2011.
[39] R. Koenker and G. J. Bassett, "Regressions quantiles," *Econometrica*, vol. 46, pp. 33-50, 1978.
[40] G. Erreygers, "Correcting the concentration index," *Journal of Health Economics*, vol. 28, no. 2, pp. 504-515, 2009.
[41] N. Kakwani and W. Bank, *Income Inequality and Poverty: Methods of Estimation and Policy Applications*, Published for the World Bank, Oxford University Press, 1980.
[42] E. V. Doorslaer, A. Wagstaff *et al*., "Income-related inequalities in health: some international comparisons," *Journal of Health Economics*, vol. 16, no. 1, pp. 93-112, 1997.
[43] A. S. Blinder, "Wage discrimination: Reduced form and structural estimates," *Journal of Human Resources*, pp. 436-455, 1973.
[44] S. Firpo, N. M. Fortin, and T. Lemieux, "Unconditional quantile regressions," *Econometrica*, vol. 77, pp. 953–973, 2009.
[45] B. Jann, "The blinder-oaxaca decomposition for linear regression models," *Stata Journal*, vol. 8, pp. 453–479, 2008.
[46] J. Sobal, "Obesity and socioeconomic status: A framework for explaining relationships between physical and social variables," *Medical Anthropology*, vol. 13, pp. 231-247, 1991.
[47] M. E. Hardy and M. E. Conway, *Role Theory: Perspectives for Health Professionals*, New York, Appelton-Century-Crofts, 1978.
[48] B. J. Biddle, *Role Theory: Expectations, Identities and Behaviours*, New York, Academic Press, 1979.
[49] B. J. Biddle, "Recent developments in role theory," *Ann. Rev. Sociol*, vol. 12, no. 67, 1986.
[50] J. Sobal *et al*., "Marital status, fatness and obesity," *Social Science and Medicine*, vol. 25, no. 7, pp. 915-923, 1992.
[51] L. Verbrugge, "Marital status and health," *J. Marriage Fam*, vol. 5, 1979.
[52] R. Stuart and B. Jacobson, *Weight, Sex and Marriage*, New York, Fireside, 1987.
[53] J. E. Jackson *et al*., "A national study of obesity prevalence and trends by type of rural county," *J. Rural Health*, vol. 21, pp. 140-148, 2005.
[54] T. F. Borders *et al*., "Gender-spesific disparities in obesity," *J. Commun. Health*, vol. 31, pp. 57-68, 2006.
[55] L. Fernald, "Socioeconomic status and body mass index in low income mexican adults," *Social Science and Medicine*, vol. 64, pp. 2030-2042, 2007.
[56] K. Roger and K. Hallock, "Quantile regression: An introduction," *Journal of Economic Perspectives*, vol. 15, no. 4, pp. 43-56, 2001.
[57] Ministry of Health, *Obesity prevention and Control Program of Turkey: 2010-2014*, 2010.

Hasan Giray Ankara was born in Merzifon, Turkey. Hasan completed his Ph.D. in health economics at Newcastle University in 2015, his M.Sc. in health economics at University of York in 2010 and his B.Sc. in economics at Gazi University in 2008.

He is a research associate in the Department of Health Administration at Hacettepe University, Ankara, Turkey. His research interests are economics of health, health related policies and health tourism as well as applied econometrics and their applications in health.