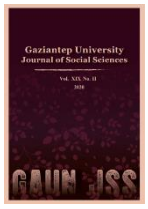

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Araştırma Makalesi ● Research Article

Effect of Socioeconomic Factors and Income Inequality to Obesity in Female in Turkey

Türkiye'de Kadınlarda Sosyoekonomik Faktörlerin ve Gelir Eşitsizliğinin Obeziteye Etkisi

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ÖZ

Bu çalışma, TÜİK "2008 Sağlık Anketi Verileri" kullanılarak kadınlarda obezitenin yaratmış olduğu eşitsizliği analiz etmektedir. Çünkü yetişkin kadınlarda gelir, eğitim ve meslek gibi farklı sosyoekonomik boyutlarda obezite yaygınlığı erkeklerden daha yüksek gözlenmiştir. Çalışmanın amacı Türkiye'de obez kadınlar arasında eşitsizliğe neden olan sosyo demografik değişkenleri bulmaktır. Türkiye'de sosyoekonomik değişkenlerle kadın obezite arasındaki ilişkiyi değerlendirmek için, probit model yaş, eğitim, gelir, yerleşim yeri, medeni durum, ve meslek gibi açıklayıcı değişkenler kullanılarak tahmin edilmiştir. Probit model sonuçlarına bağlı olarak, zenginlerle fakirler arasında kadın obezitesinin gelirle ilişkisini değerlendirmek için çeşitli yoğunlaşma indeksleri hesaplanmıştır. Obezitenin toplam yoğunlaşma indeksi 0.2186 bulunmuştur. Bu obezitede gelirle ilgili eşitsizliğin fakirler arasında yoğunlaştığını gösterir. Yoğunlaşma indeksi ölçümüne göre, yaş grupları, eğitim durumu, medeni durum ve meslek durumu, sosyoekonomik değişkenler kadın obezitesindeki eşitsizliğe katkıda bulunan en önemli faktörlerdir.

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ABSTRACT

This study analyses inequality created by obesity in adult females by using TurkStat "2008 Health Survey Data" since obesity prevalence among adult females observed higher than male counterparts at different socioeconomic dimensions such as income, education and occupation. This study is specifically aimed to find which socio demographic variables cause inequality among adult female obese in Turkey. In order to asses the relationship between socioeconomic variables and female obesity in Turkey, a probit model is estimated including explanatory variables age, education, income, location, marital status and occupation. Based on Probit model result, various concentration indexes are computed to evaluate income related distribution of female obesity between poor and rich. The total concentration index of obesity is found as 0.2186 which means income related inequality in obesity is concentrated among poor. According to the concentration index measure age groups, education status, marital status and occupation status are the most important contributing socioeconomic variables to inequality in adult female obesity in the country.

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GENİŞLETİLMİŞ ÖZET

İnsan ömrünün çok uzun olmadığı dönemlerde obezite güç, refah ve sağlık göstergesi iken, 1980'li yıllardan bu yana tedavi edilmesi gereken toplumsal boyuta ulaşan bir sağlık problemi olarak kabul edilmektedir. Obezite gelişmiş ve gelişmekte olan ülkeler için önemli sağlık problemlerinin başında yer almaktadır. Özellikle, çocuklar ve kadınlarda obezite yaygınlığı çok hızlı artış göstermektedir Genel olarak bakıldığında dünya genelinde olduğu gibi Türkiye'de de obezite yaygınlığı artış göstermektedir. Türkiye'de 2008 yılında yetişkin nüfusun % 16.2'si obez iken 2010, 2014 ve 2016 yılları için bu oran sırasıyla %18.8, %19,9 ve %19,6'dır. TÜİK Sağlık Araştırması verilerine göre, kadınlarda obezite yaygınlığının erkeklerde ise aşırı kilolu yaygınlığının yüksek olduğu hesaplanmıştır. Obezite problemi gelişmiş ve gelişmekte olan ülkelerde zenginler ile fakirler arasında sağlık eşitsizliğine neden olan önemli yapısal faktörlerden biridir. Aslında sağlıkta meydana gelen eşitsizlik sosyal sorunlar yaratır. Cinsiyet ayrımı obezite ve sosyoekonomik durum arasındaki ilişkide önemli bir faktördür. Örneğin kadınlarda mesleki statü, gelir ve eğitim düzeyi artıkça obezite oranı azalmaktadır. Bu olgu, meslek grubu, eğitim, gelir gibi sosyoekonomik statülerin çeşitliliği tarafından gözlemlenmektedir. Bu durum kadınlar için daha belirgin düzeydedir.

Gelir ve istihdam durumu gibi sosyo ekonomik durum değişkenlerinin cinsiyet, yaş, medeni durum ve eğitim ile ilişkili olması daha olasıdır. Bu nedenle, farklı gruplar arasında obezitenin sosyo-ekonomik değişkenler üzerinde yaratmış olduğu eşitsizliği incelerken bu değişkenlerin kontrol edilmesi gerekmektedir. Obezite, hem sanayileşmiş hem de gelişmekte olan ülkelerde yoksullar ve zenginler arasında büyük eşitsizliğe neden olmaktadır.

Ampirik çalışmalara dayanarak, obezite ve sosyoekonomik durum değişkenleri arasındaki güçlü ilişkinin, obeziteyi hafifletmek için anti-politikalar üzerinde önemli etkileri olduğu söylenebilir. Son yıllarda obezite ile ilgili birçok çalışma obezite eşitsizliğine odaklanmış olsa da, Türkiye'de obezite eşitsizliğini inceleyen bir çalışmaya rastlanamamıştır. Bu nedenle, bu çalışmanın amacı literatürdeki bu boşluğu ülke bağlamında doldurmak ve uluslararası literatüre başka bir ampirik vaka çalışması ile katkıda bulunmaktır. Bu çalışma, kadın yetişkinlerde obezitede sosyo demografik değişkenlerin yanı sıra gelirle ilgili eşitsizliği de açıklamaya çalışmaktadır. Bu çalışmanın amacı kadınlarda obezitenin eğitim, meslek grubu, yaş, medeni durum gelir gibi değişkenler üzerinde yaratmış olduğu eşitsizliği ve eşitsizliğin derecesini yoğunlaşma indeksi yöntemi ile açıklamaktır.

Bu çalışmada TÜİK '2008 Sağlık Araştırma' verisi kullanılmıştır. Obezite yaygınlığı kadınlarda erkeklere göre daha yüksek olduğu için yetişkin kadınlar üzerinde sosyo ekonomik ve demografik değişkenler üzerinde obezitenin yaratmış olduğu eşitsizlik analiz edilmiştir. Türkiye'de kadınlarda sosyoekonomik değişkenler ile obezite arasındaki ilişkiyi değerlendirmek için yaş, eğitim, gelir, yer, medeni durum ve meslek değişkenlerini içeren bir probit modeli tahmin edilmiştir. Probit model sonucuna göre, kadın obezitesinin fakir ve zengin arasındaki gelire bağlı dağılımını değerlendirmek için çeşitli yoğunlaşma indeksleri hesaplanmıştır. Yoğunlaşma indeksi sonuçlarına göre, kadınlarda obeziteye en büyük katkı yaş değişkenlerinden, özellikle 25-34 yaş aralığından, işverenden ve medeni durumdan kaynaklanmaktadır. Sonuçlara göre kadınlarda obezite üzerinde gelirin yaratmış olduğu eşitsizliğin yönü zenginler lehinedir. Obezite zenginler arasında daha az yaygın olma eğiliminde olmakla birlikte, özellikle yaş grubu (25-34, 45-54) ve evli kadınlar gibi belirli gruplarda zenginler arasında oldukça dağınık eşitsizlik sergilemektedir. Ayrıca sonuçlara göre, obezite yaygınlığı ev hanımı, emekli ve mevsimsel işçi kadınlarda artış göstermektedir. Özellikle emekli kadın oranında yüzde 1'lik bir artış obez olma olasılığını %6 artırmakta ve fakir kadınlar üzerinde eşitsizliğe neden olmaktadır. Öte yandan, obezite üzerinde maaşlı kadınlar düşük eşitsizlik yaratmaktadır. Bu da kadınların işgücüne katılımı obezitede eşitziliği azaltır. Obezitenin toplam yoğunlaşma indeksi -0.2186'dır. Türkiye'de kadınlarda obezitenin yaratmış olduğu, düşük gelir gruplarında daha çok yoğunlaştığını ifade etmektedir.Obezite eşitsizliğine en önemli katkıda bulunan sosyo-demografik değişkenlerin yaş grupları (pozitif CI), eğitim durumu (negatif CI), medeni durum (negatif CI) ve meslek durumu (negatif CI) olduğu bulunmuştur. Gelirin obezite eşitsizliğine önemli bir katkısı söz konusudur. Gelir obezitede negatif (-0.0346) eşitsizlik yaratmıştır. Çalışmanın bulgularına göre obez olmanın yaratmış olduğu eşitsizlikte temel sorun olarak eğitim düzeyi ve gelir dağılımı görülmektedir.

Çıkan sonuçlara göre bütün eğitim düzeylerinde obez bireylerin düşük sosyoekonomik grupta yoğunlaştığı saptanmıştır. Eğitim düzeyinin yükseltilmesi bireyin sağlık bilincini artırmaktadır.

Çalışmanın en önemli bulgularından biri Türkiye'de obez olmanın yaratmış olduğu toplam eşitsizliğin düşük sosyoekonomik gruplarda yoğunlaşmasıdır. Bu durum da obezite Türkiye'de zenginler lehine (pro-rich) bir eşitsizlik yaratmaktadır. Obezite eğiliminin artacağı düşünüldüğünde obezitenin yaratmış olduğu sosyoekonomik eşitsizliğin azaltılması amaçlanmalıdır. Aslında bu sonuç gelecekte obezitenin düşük gelir grubu yerine yüksek gelir grubunda eşitsizlik yaratacağına da işaret etmektedir. Bireylerin sahip olduğu gelir düzeyine göre tüketecekleri gıdaların kalitesi de değişim göstermektedir. Örneğin, daha düşük gelirli aileler harcamalarında sebze ve meyveye yüksek gelirli ailelere göre daha az pay ayırmaktadır. Gelir arttığı zaman bireylerin ve hanelerin sebze ve meyve tüketimine ayıracakları pay da artacaktır. Bu çalışma ile elde edilen sonuçların ışığı altında, politika yapıcı sadece obezite prevalansını değil aynı zamanda dağılımını azaltmak için gelir-obezite ilişkisine odaklanabilir. Kadınların işgücü piyasasına katılımını destekleyen ve yaratan ortamlar sağlayan, kadınların yüksek öğrenim kazanımlarını arttıran politikalar ve sosyoekonomik grup arasında gelir eşitsizliğini azaltma politikaları, hem kadın obezitesi prevalansını hem de düşük sosyoekonomik statü grupları arasındaki yoğunlaşmayı azaltacaktır.

Introduction

Obesity has become global epidemic issue and the prevalence of obesity has been increasing both in developing and developed countries for more than 30 years. In particular, the prevalence of obesity for children and female adult has been very fast. The World Health Organization (WHO) reported that there were approximately 1.5 billion overweight adults (aged 20+) and 500 million obese adults (200 million males and 300 million females) in the world as of 2008 (WHO, 2012). In 2016, more than 1.9 billion adults were overweight. Of these over 650 million were obese. Overall, about %13 of the world's adult population (% 11 of men and %15 of women) were obese (WHO, 2019). According to The Organization for Economıc Co-Operatıon and Development (OECD) report (2017), ABD (%38.2) is the country with the highest obesity prevalence among OECD countries. This is followed by Mexico (%32.4), New Zealand (% 30.7), Bulgaria (%30) and Australia (%27.9). As observed in the worldwide, prevalence of obesity is rapidly increasing in Turkey as well. Based on "2008 health survey" conducted by TurkStat, sum of obesity and overweight prevalence was 47.2 percent among adult population in Turkey. The ratio of overweight plus obesity among male and female adults were 49.2 (%12.3 obese) and 45.2 (%18.8 obese) respectively. The prevalence of obesity among female adults varies from rural to urban area (rural - % 19.6 versus urban- %15.7). Survey results indicate that obesity prevalence among females is higher than men at countrywide, urban and rural level (TurkStat, 2011). Turkey is now the most obese nation in Europe, as the country has an obesity rate of 32.1 percent. In 2016, the rates for overweight and obesity were % 63 and % 21.9 among men and % 54.3 and % 24.5 among women (www.who.int, 2019).

Obesity seriously increases the health risk such as increases number of diseases and has strong negative impacts on health conditions such as cardiovascular disease, hypertension, Type II diabetes (WHO, 2000). Furthermore, increasing prevalence of obesity causes a great public burden and affects health cost through direct and indirect cost.

Effective interventions to control or manage obesity will necessarily rely on complex process that determines body composition, including excess adiposity in population. The reasons behind the increasing prevalence of obesity are commonly cited as malnutrition, participation of female into labour market, technological changes, biological factors, culture, environmental factors, and socio demographics (Wolf, 2002). There is plenty of empirical evidence demonstrating socioeconomic status (SES) influences to energy balance of individual (energy intake minus energy expenditure) and body fat storage if energy surplus exist. Repeated findings also demonstrated disproportionally high rates of obesity among minority and low income groups (Zhang and Wang, 2004). Among high income countries, overweight and obesity are now dramatically on the rise in low-and middle-income class, particularly in urban locations (WHO, 2012).

According to the WHO, obesity problem is one of the important structural factors to cause health inequality between poor and rich. Consequently, inequality in health creates social problems. The WHO reported that health inequality can be defined as differences in health status or in the distribution of health determinants among different population groups or strata. Gender are found to be important factors important factor in the relationship between obesity and socioeconomic status. Specifically obesity rate is decreasing if income, education and occupation status of female is increasing. Lower female participation rate to labour force than male counterpart is one of the factors which cause health inequality too. According to household employment survey data (HES), female participation rate to the labour force in Turkey slightly increased from 21.6 percent in 2008 to 26.5 percent in 2011

which is far away from average (62 percent) of the OECD countries (TurkStat, 2012a). In Turkey %49.8 of population is female in 2018. And female participation rate to the labor force increased to %52.8 in 2017. According to the results of the household labor force survey; In 2017, the ratio of employed persons (15 years and above) in Turkey was %28.9 for women (TurkStat, 2019). The lower education level is one of the main factors behind very low rate of female participation into labour force. Strong positive relation between education attained by individuals and their income level increase the inequality induced by gender (Candaş and Buğra, 2010). This situation is regarded as an essential structural problem in Turkey. Employment rate of illiterate female and university-higher degree owned females were measured as 4.2 and 60 percent respectively in 2008. This situation remained similar in 2011. However, the female employment rate was measured as 6.8 and 60.1 percent respectively for illiterate and higher educated strata in 2011 (TurkStat, 2012b). Similar results seen in 2017. According to labor participation rate of female's education levels, females participate more in the labor force, as the education level increases. Employment rate of illiterate female and university-higher degree owned females were measured as 15.9 and 72.7 percent respectively in 2017 (TurkStat, 2018).

There are now substantial evidence at worldwide which indicate socioeconomic gradient in obesity. The incidence of obesity tends to fall if socioeconomic status increases. This phenomenon is observed by variety of socioeconomic status measures such as income, education and occupation. This situation becomes more pronounced for females (Madden, 2010).

The socioeconomic status (SES) variables such as income and employment status are more likely to be correlated with gender, age, marital status and education. Therefore it is necessary to control these variables when studying the SES inequality of obesity among different groups. Previous studies suggest that demographic factors such as gender, age, marital status and ethnicity have impact on prevalence of obesity (Sundquist and Johansson 1998; Kumanyika, 1987). It was found by previous studies that education related inequality in obesity is the most effective variable for females (Mackenbach et al., 2008).

Obesity cause large inequality between poor and rich both in industrialized and developing countries. Many international organizations and the governments aim to reduce inequality between rich and poor regarding the health sector (Kakwani et al., 1997). Obesity has been increasing at all income groups for at least 40 years. Particularly, gradient of obesity is rapidly increasing among the higher income groups. In the developed countries like US, obesity risk among adults is higher in the lowest SES than the higher SES. Therefore, change of obesity rate is important (Clarke et al., 2009). It was observed that obesity prevalence has been increasing among the lowest socio-economic groups in many countries. So there are transitions from inverse inequality to regular inequality. It means that obesity has been seen higher level at lower socioeconomic groups instead of higher socioeconomic groups (Van Oort et al., 2005).

In health economics literature, concentration index (CI) is a widely used tool to determine the degree of health inequality relative to income or socio economic effect. Inverse association between social class and obesity was found in the literature (Sobal, 1991). The studies analysed relationship between inequality in obesity and socio-demographic variables include gender, age, marital status, income, education, employment status, family size and ethnic groups (Table 1).

Tablo 1: Previous Studies on Obesity Concentration Index

Author	Data set	Years/Methods/Country	Variables
Zhang and Wang,2004	NHANES III	1988-1994/CI	Gender, age, ethnicity
Zhang and Wang, 2007	NHANES	1971-2002/CI/US	Age, race, income, gender
Costa-Font and Gil,2008	SNHS	2003/CI/Spain	Age, gender, education, income, region
Nikolaou et. al, 2008	ECHP	1998-2001/CI/10 members of European Union	Age, gender, education, marital status, employed status,
Madden, 2010	Slan survey*	2002,2007/CI/Ireland	Age, gender, income, smoking status, education, marital status, economic status
Vallejo-Torres et. al.2010	Health survey for England	1998-2006/ CI-CCI/England	Nine regions, age, lifestyle, health status, socioeconomic status
Ljungvall et al., 2010	Swedish survey of living condition	1980-81,1988-89,1996-97/CI/Swedish	Age, income, education, employed, marital status, having children,
Zhang et al., 2011	PSID	1986-2007/CI/US	Age, income, race, education, family members
Bilger et al.. 2017	NHANES I-II-III	1971-74,1976-80,1988-94;1999-2012/USA	Age, ethic group, gender, marital status, education, income group
Najafi et al. 2018	PERSIAN	2014/CI/Iran	Age, gender, marital status, education, economic status, household size, smoking,
Hwang et al. 2019	KNHANES	1998-2015/CI/Korea	Gender, age, education, income, employment, maritial status,general health status

Notes: CI: Concentration index, CCI: Corrected Concentration index, SNHS: Spanish National Health Survey,* survey of lifestyle, attitudes and nutrition in Ireland, PSID: Panel study of income dynamics, NHANES: National Health and Nutrition Examination Surveys, ECHP: European Community Household Panel, KNHANES: Korea National Health and Nutrition Examination Survey, PERSIAN: Prospective Epidemiological Research Studies in Iran

Hatemi et al. (2003) and Yumuk (2005) such this study focused on Turkey's specific regions. This studies don't reach a general conclusion about the determinants of obesity in Turkey. Their results are only regional. Tansel and Karaoğlan's (2014) study is the first study to examine the determinants of health-related behaviors using Turkstat Health Survey Data. Later Tansel and Karaoğlan (2016) examined the causal effect of education on health behavior and body mass index (BMI) the same data set in their studies. Cesur et al. (2014) tested the causal effect of education on health behaviors and health outcomes. Karaoğlan and Tansel's (2019) study is the most comprehensive study on both years and observation basis because of using 2008, 2010 and 2012 Turkstat health survey. Quantile regression method was used in this study. It was concluded that the level of education in each quantile has statistically significantly negative association with obesity. As a result, education has a reducing effect on obesity. The other study which is conducted by İpek (2019) used 2014-2016 Turkstat Health survey data. it is analyzed with order probit model to determine whether individual's overweight or obesity affect socioeconomic factors or not. According to the results of the analysis, it shows that women are twice as likely to be obese compared to men,

and married people to singles. literatur reviwe revealed that this study is one of the fundamental study using the concentration index method in this field in Turkey.

Based on empirical evidence, strong relation between obesity and SES variables has important implications for anti-policies to alleviate obesity. Although, during recent years, many studies on obesity issues have focused on inequality in obesity, there has not been found any study examined the inequality of obesity in Turkey. Therefore, the aim of this study is to fill this gap in literature in the country context and to contribute international literature with another empirical case study. The present study tries to explain income related inequality in obesity among female adults. The study aims to explain how such inequality in female obesity can be explained through decomposition of the CI by education, occupation, age, marital status and income variables. In the next section, different definition of CI, econometric specification of the empirical model, data and estimation procedure is explained. The results obtained by estimated empirical model are discussed in the third section. Final section concludes key findings and recommends policies for intervention.

Methodology

The concentration index quantifies the degree of income related inequality in health variables in health economics literature (Kakwani, Wagstaff and van Doorslaer, 1997; Wagstaff, van Doorslaer and Paci, 1989). Wagstaff, van Doorslaer and Paci (1989) was the pioneers of the methodology. Concentration index has been used for different issues including studies to measure and to compare the degree of income related inequality in child mortality (Wagstaff, 2000), child malnutrition (Wagstaff, van Doorslaer and Watanabe, 2003) and health care utilization (van Doorslaer et al., 2006). The application of the CI to socioeconomic disparity in obesity was introduced by Zhang and Wang (2004). The index measures the relationship between bivariate variable and fractional ranked variable (Van Doorslaer and Koolman, 2004). Following Wagstaff, Paci and van Doorslaer (1991), the CI was employed as a measure of income related health inequality. The CI is a bivariate measure of inequality which measure inequality with respect to one variable (for the present study, obesity in females) such as follows;

$$CI = \frac{2 * Cov(h_i, r_i)}{\mu_h} \quad (1)$$

Where $\mathbf{h_i}$ is the value of health variable (obesity) for $\mathbf{i^{th}}$ individual then if $\mathbf{r_i}$ is the fractional rank of $\mathbf{i^{th}}$ individual in the income distribution and $\boldsymbol{\mu_h}$ is the mean of the health variable or obesity in the present case (Kakwani et al., 1997).

The index can takes on a value from -1 to 1, where negative (positive) value indicates that the health variables (obesity) is concentrated among the relatively poor (rich). Since obesity can be regarded as a reflection of ill-health, a negative value of CI will indicate a situation favouring the better-off and so could be regarded as pro-rich inequality (Madden, 2010). To summarize to this situation, if CI<0, health inequality is concentrated on poor, if CI>0, health inequality is concentrated on rich (Chen and Roy, 2009).

Wagstaff, van Doorslaer and Watanabe (2003) introduced a methodology that the index can be decomposed into the factors contributing income related health inequality. The contribution of each factor to the index is the product of the sensitivity of health status with respect to that factor and the degree of income related inequality in that factor. Following Wagstaff, van Doorslaer and Watanabe (2003), linear additive regression model of health (y) can be written as follows;

$$y = \alpha + \sum_k \beta_k x_k + \varepsilon \quad (2)$$

where y=1 (if individual **i** is obese), ε is the random error term, x_k is a set of determinants of obesity (Table 2) and β_k the estimated parameters in equation (2). It can be calculated probability of being obese for adult female as follows;

$$p(y = 1) = \alpha + \sum_k \beta_k x_k \quad (3)$$

In this study, a probit regression model is estimated to obtain the probability of being obese for adult female. The linear marginal effects are used for the decomposition analysis.

The CI for obese female (y) can be written as follows:

$$CI = \sum_k (\beta_k \bar{x}_k/\mu) CI_k + GC_\varepsilon/\mu \quad (4)$$

Where μ is the mean of y, $\bar{x}_k$ is the mean of x_k, CI_k is the concentration index for x_k (defined analogously to CI) and GC_ε is the generalized concentration index for the error term from the underlying regression (Madden, 2010). The term in brackets in eq. (4) expresses the elasticity of the probability of y (obesity) with respect to x_k (evaluated at the population or sample mean). Thus, this estimated elasticity with respect to determinant **k** can be defined as:

$$\eta_{\hat{k}} \equiv \hat{\beta}_k \bar{x}_k/\mu \quad (5)$$

The analysis above refers to the situation where the health variable is continuous. In the case of the incidence of obesity (**y**) is a binary variable which takes on values of 0 or 1. In this case normalization must be applied to the CI (since the bounds would not be changed between -1 and 1). Wagstaff (2005) defined a normalization index such as $CI_n = CI/(1-\mu_h)$ while Erreygers (2009) suggested the following formulae for normalization;

$$CCI = \frac{4\mu_h}{a-b} * CI \quad (6)$$

Where μ_h is mean health status, variables **a** and **b** represents the maximum and minimum levels of health condition (in our case 1=obese, zero otherwise).

Data

TurkStat "2008 Health Survey" is the first large-scale and representative country-wide data to measure prevelance of obesity and allow to various quantatitative analysis about health status of the nation (TurkStat, 2010). This data set was used because it was the most comprehensive and the first published data sets for Turkey. Health survey data-2008 was used for this study that is the fist and the most comprehensive set of data for Turkey. The health survey data consists of 7910 household and 12,402 adults including 6277 adult female. The body mass index (BMI)[1] approach is used to calculate adult obesity for female (age ≥ 15 years old), then the probit model is specified as a function of the explanatory variables given in Table 2.

Tablo 2: Variable Definition

Variables Name	Explanation of Variables
Body Mass Index (BMI)	Weight in kilograms divided by height in meters squared

[1] We calculated body mass index (BMI) for each women as follows weight (kg)/height (m^2). We used the definition of obesity recommend by WHO in which women with BMI≥30 are obese (WHO, 1998).

Gender (female)	Equal to 1 if female, 0 otherwise
LN (Income)	LN (monthly household income)
Age Categories (35-44)	
15-24	Equal to 1 if 15-24 age groups, 0 otherwise
25-34	Equal to 1 if 25-34 age groups, 0 otherwise
45-54	Equal to 1 if 45-54 age groups, 0 otherwise
55-64	Equal to 1 if 55-64 age groups, 0 otherwise
65+	Equal to 1 if 65+ age groups, 0 otherwise
Education (Secondary School)	
Non literate	Equal to 1 if non literate, 0 otherwise
Primary School	Equal to 1 if primary school, 0 otherwise
High School	Equal to 1 if high school, 0 otherwise
Higher Education (university and post-graduate)	Equal to 1 if university and post-graduate, 0 otherwise
Marital Status (Single)	
Married	Equal to 1 if married, 0 otherwise
Widowed and divorced	Equal to 1 if widowed and divorced, 0 otherwise
Occupational Status (Others)	
Housewife	Equal to 1 if housewife, 0 otherwise
Retired	Equal to 1 if retired, 0 otherwise
Seasonal worker	Equal to 1 if seasonal worker, 0 otherwise
Employment Status (Others)	
Employer	Equal to 1 if employer, 0 otherwise
Salaried	Equal to 1 if salaried, 0 otherwise
Location (Rural)	Equal to 1 if person is living in Urban location, 0 otherwise

Note: in the parenthesis are base categories

Monthly household incomes was used for measuring of SES. The decomposition method needs a continuous measure of income instead of stratified income. The data set of TurkStat "2008 Health Survey" includes only place of household regarding ten different monthly income strata rather than continuous income variable, therefore we need to use an appropriate approach to obtain continuous income variable from the categorical income. Instead of simply taking the mid-point of each income bracket to obtain continuous variable, the interval regression model is assumed more appropriate approach and become customary to apply in health economic studies to obtain continuous income variable (Costa-Font and Gil, 2008; Clarke and Van Ourti, 2010). In the current study, an interval regression is estimated with explanatory variables including age, rural/urban dummy, education status (illiterate, primary school, high school and higher education), marital status, occupational and employment status to obtain a continuous household income variable (see Appendix). The explanatory variables used to estimate the probit model for female obesity in Turkey are: i) logarithmic value of household income ii) six age categories (15-24; 25-34; 35-44; 45-54; 55-64; 65+) to measure inequality in each age group and to determine how distribution of obesity prevalent among them, iii) five education level categories to measure of the effects associated with the generation of health knowledge, iv) four occupational status and three employment status categories to measure the effect of female participation in labour force on obesity, therefore education and occupational status can be regarded as additional socio-economic control variables, v) three marital status categories to measure the effect on female obesity. Marital status variables are relevant at least for two reasons. Firstly female physical appearance is an important lifestyle signal when female is married or single. The other reason that female changes to everyday life when they start to living with someone else. Therefore diet and lifestyle behaviours are adjusted which effects weight of individual. vi) two resident location (urban and rural) categories in order to control for differences associated with cultural eating patterns between urban and rural.

The descriptive statistics of the explanatory variables are presented in the Table 3. As seen from the descriptive statistics, female obesity prevalence in Turkey is 18.84 percent as of 2008.

Tablo 3: Descriptive Statistics of Independent Variables

Variables	Observation Number	Percent of obese adult females (%)
Age		
15-24	1316	2.43
25-34	1508	9.95
35-44	1304	22.93
45-54	986	32.96
55-64	621	35.10
65+	542	29.15
Location		
Urban	4619	18.81
Rural	1658	18.88
Education Status		
Non Literate	1270	27.56
Primary School	2562	25.25
Elementary education	911	7.57
High School	1032	7.27
Higher (Tertiary) Education	502	8.17
Marital Status		
Single	1348	2.97
Married	4273	22.28
Widowed and divorced	656	28.96
LN (Mean Income; TL)	6277	6.50**
Occupational Status		
Housewife	3895	22.57
Seasonal Worker	44	27.27
Retired	256	27.34
Others	2082	10.61
Employment Status		
Salaried	1641	13.53
Employer	30	13.33
Others	4606	20.76
Total Observation	**6277**	**18.83***

*Percentage of obese adult females in total observation. ** Sample mean value of income is 978.107 TL.

Results and Discussion

Table 4 reports the coefficients of the explanatory variables and marginal effect of each variable of the estimated Probit model as specified in the equation (3). Dependent variable of the model is classified as 1182 obese female (18.83 percent) and 5095 non-obese including rest of the weight classes. Then, the dependent variable is transformed into categorical variable (1=obese; 0 otherwise). LR test rejects the hypothesis that all variables except constant term equal to zero since probability value of LR test (0.00) is less than critical value 0.05. The Pseudo R^2 coefficient is found low (0.1410) which suggest goodness of full model. One of the main issues in the empirical studies of obesity is possible endogenetiy between income and obesity. Previous studies generally regarded income as endogeneous and function of obesity (Cawley, 2004; Schmeiser, 2008). Empirical evidence indicates that generally obesity affects income inversely or negative direction. There are also evidence that income and obesity affect each other simultaneously. Although the focus of this study is the examination of the relationship between socio-demographic variables and obesity rather than

income and obesity relationship itself, endogeneity of income is tested by Hausman specification test and null hypothesis (no endogeneity) can not be rejected. However, probability value of Hausman statistics is found as 0.1994 which is higher than critical value at either 1 or 5 percent levels. Therefore, it is concluded that there is no endogenity problem between income and obesity in the present study.

Tablo 4: Results of the Probit Model for Obese Adult Females

Variables	Coefficient	Marginal effect (%)
Constant	-1.6542 (-9.81)*	
Age (15-24)	-0.9154 (-9.08)*	-15.13
Age (25-34)	-0.4749 (-7.85)*	-9.20
Age (45-54)	0.2366 (4.04)*	5.57
Age (55-64)	0.2454 (3.56)*	6.04
Age (65+)	0.0991 (1.23)	2.28
Location (Urban, D=1)	0.0904 (1.88)***	1.96
Illiterate	0.2928 (3.36)*	7.13
Primary School (5 years)	0.2939 (3.72)*	6.73
High School	-0.2388 (-2.47)*	-4.86
Higher Education	-0.2544 (-2.15)**	-5.02
Married (D=1)	0.2917 (3.18)*	6.12
Widowed and divorced	0.3487 (3.20)*	8.91
LN (Income)	0.0471 (2.53)**	1.05
Housewife	0.1643 (3.00)*	3.58
Seasonal Worker	0.3642 (1.66)***	9.67
Retired	0.2790 (2.71)*	7.06
Salaried	-0.1254 (-2.13)**	-2.70
Employer	-0.3051 (-1.00)	-5.71
Pseudo R^2	0.1410	
LR χ^2	856.51 (prob:0.00)	
Wald Test	619.42	

Note: Omitted categories : female aged 35-44, with secondary school, single female, others in employment and occupation status. In the pranthesis are t statistics and respectively *, ** and *** indicates that estimated coefficient are significant at 1%, 5%, and 10% level.

All but two estimated (age 65+ and employment) coefficients are statistically significant. The estimated coefficients have a sign as expected and their magnitudes are reasonable within variable group. Comparing reference age group (35-44) or omitted age category, the impact of age variable on obesity is positive among upper middle age groups

(45-54 and 55-64) and negative among lower age groups (15-24 and 25-34). Prevalence of obesity is much higher in upper socioeconomic status group in developing countries. The main reason behind this is urbanization (Cabellero, 2007; Rmling et al., 2011). The present analysis indicates that the impact of income and urbanization on female obesity is positive. As secondary education is taken reference group, obesity prevalence is increasing (decreasing) among female adults if attained education level of female adult person is less (higher) than the reference group. Marital status is found to be a significant variable on obesity. Furthermore, married and widowed status of female is positively associated with obesity. Another important variable on obesity is employment status of female. According to the model results, housewife and retired status have positive impact on obesity while salaried person and employer status have negative impacts.

The results show that probability of being obese increase with logaritmic household income, upper-middle age groups (45-54 and 55-64), illiterate and primary school education levels, being housewife, seasonal worker, living in urban location and retirement while it decreases with young age brackets (15-25 and 25-34), higher education levels and being salary earner and employer status. The probability of being obese increases at 6.04 percent point with 55-64 age groups relative to omitted group (35-44). According to estimation result, probability of being obese person increases at 6.12 percent point with marriage as compared to single status.

As previously mentioned, these estimates (results of probit model) are used to calculate and decompose the CI of the probability of obesity. The results for CI indicate the degree of income related socioeconomic effects of obesity.

Tablo 5: Elasticities and Obesity Concentration Index

Variables	**Elasticity**	**CI**	**Contribution**	**Total Aggregate**		
				CI	CI (Normalized)	Errayger
Age (15-24)	-1.0194	0.0201	-0.0205			
Age (25-34)	-0.6058	0.0995	-0.0603			
Age (45-54)	0.1974	0.0695	0.0137			
Age (55-64)	0.1289	0.0414	0.0053			
Age (65+)	0.0455	0.0452	0.0021	0.2757	0.3397	0.2077
Location (Urban, D=1)	0.3533	0.0007	0.0003	0.0007	0.0009	0.0005
Illiterate	0.3146	-0.0101	-0.0032			
Primary School	0.6371	-0.0999	-0.0637			
High School	-0.2085	-0.0456	0.0095			
Higher E.	-0.1081	-0.0868	0.0094	-0.2425	-0.2987	-0.1826
Married	1.0545	0.0252	0.0266			
Widowed and Divorced	0.1935	-0.1809	-0.0350	-0.1557	-0.1918	-0.1172
Ln Income	1.6255	-0.0346	-0.0562	-0.0346	-0.0426	-0.0261
Housewife	0.5414	0.0011	0.0006			
S. Worker	0.0135	0.0064	0.0001			
Retired	0.0605	-0.1448	-0.0088	-0.1373	-0.1692	-0.1034
Salaried	-0.1741	-0.0001	0			
Employer	-0.0078	0.0750	-0.0006	0.07503	0.0924	0.0565
Sum				-0.2186		
Residual (Total CI-Sum)				-0.0507		
Total CI (normalized)					-0.2693	-0.1646

The elasticities of each of the explanary variables used in the probit model with respect to obesity for female, the CI for each variable and the contribution of each variable to the total concentration index, Erreygers (2009) and Wagstaff (2005) normalized concentration index values are presented in Table 5. The elasticities are calculated by equation (5) using parameters from probit model (Table 4). Although the highest elasticities are found with respect to household income, young age group (15-24) and married female which are 1.63, -1.02 and 1.05 respectively, the relative contribution of age cohorts variabels to overall index are great than marital status variables. According to the CI, the biggest contribution to obesity among female comes from age variables, particularly 25-34 years old bracket , employer and marital status. Relatively high magnitute of elasticity for married women show that prevalence of obesity shifts from single to married status. It can be observed from the table that the youngest age group (25-34) and employer variables make the highest contribution to the over all index with 0.099 and 0.075 respectively. These values show that young and employer female obese concentrated among high socioeconomic status group. On the other hand, the greatest negative contribution to obesity comes from widow female (-0.1809) and retired female (-0.1448) which means widow and retired female are concentrated among lower socioeconomic status strata. The elasticity of the obesity with respect to income is found positive which means that rate of being obese will increase as monthly income of female increases. If it is returned to the CI definition in equation (1) and checked it carefully, it can be seen that value of the CI is a function of co-variance between obesity prevalence and income rank and divided by female obese population mean. It can be observed that the CI increases with co-variance and declines with increasing mean of obesity variable. Therefore, it is logical to think that increases of obesity prevalence cannot be compensated by income increases if income is unequally distributed among population. The total CI of the probability to being obese with respect to income is negative (-0.0346) and statistically significant indicating that there is a pro-rich income inequality among female adult obesity in Turkey. This result is consistent with previous studies such as the study conducted by Costa-Font and Gil (2008).

The total concentration index of obesity (BMI≥30) and normalized index by Erreygers (2009) and non-normalized index developed by Wagstaff (2005) are -0.2186, -0.2693 and -0.1646 respectively. These index values are lower than the values found in Irish female population (-0.5961 and -0.2760) in 2002 and in 2007 respectively (Madden, 2010). The lowest value of the index means that obesity prevalence is strongly associated with SES.

The CI values with respect to ages indicate positive association between SES and obesity in all age groups though there are strong disparities across age groups. The results reported in Table 5 show that income related inequality in obesity exist in all age groups for females although the degree of inequality varies across age groups. The highest inequality in obesity is found within 25-34 age group. So CI of obesity in the 25-34 and 45-54 age groups are considerably higher compared to other age groups.

Age variables are the highest contributing variables to total CI with a value of 0.2757 which is interpreted as pro-poor inequality in obesity. The education status variables follow age variables with value of -0.2425 which indicates negative association between SES and obesity for education status. The negative sign of this index value indicates impact of education on obesity concentrated in the lower socioeconomic groups. The highest inequality in obesity comes from primary school level. This variables contribute to pro-rich inequality among adult female obesity in Turkey.

The marital status contribution to total inequality or concentration index is found -0.1557. This value can be interperated as divorced female concentrated among the poorest

starata of population. The contribution of occupational status to total inequality on obesity is found as -0.1373. But, being housewife has positive contribution to the CI and being retired has negative contribution to the CI value which indicates obese housewife concentrated among rich strata while retired obese concentrated among poor strata of adult female obese.

Conclusion

This study aimed to analyse inequality in obesity for adult female since obesity prevalence among female observed higher than male counterpart in Turkey from TurkStat "2008 Health Survey". This phenomenon is observed for a variety of measures of socioeconomic status such as income, education and occupation for females. This study is specifically aimed to find which socio demographic variables cause inequality among adult female obese in Turkey. In order to asses relationship between socio-demographic variables and female obesity in Turkey, a probit model is estimated including explanatory variables age, education, income, location, marital status and occupation. It is found that obesity prevalence among adult female has generally statistically significant relationship with socio-demographic variables. The analysis results show that these variables significantly contribute to increase in obesity among female adults. According to the result, the income related inequality in obesity among Turkish female is pro-rich. Although obesity tends to be less common among rich, it exhibit highly dispersed inequality among rich at particular groups especially age group (25-34, 45-54) and married female person. According to the model results, obesity prevalence increases with being housewife, retired women/being retired and being seasonal worker. Especially, a 1 percent increase at the ratio of retired women leads to being obese at 6 percent point and creates inequality among poor females. On the other hand, salaried female creates low inequality in obesity which means female participation into labour force reduces inequality in obesity. According to the model result the total concentration index of obesity is -0.2186 which means inequality in obesity is concentrated among poor. It is found that age groups (positive CI), education status (negative CI), marital status (negative CI) and occupation status (negative CI) are the most important contributing socio-demographic variables on inequality in obesity. These results support policies aimed to increase female participation into labour force and increase education status of female. Income is another important contributor to inequality in obesity. Study results indicate that income creates negative inequality (-0.0346) in obesity among females.

In the light of the results are obtained by this study, policy maker may focus on income-obesity relationship for not only reducing prevalence of obesity but also its distribution. The income affects individual's choice (healthy vs. unhealthy food), lifestyle and behaviour. Similarly, occupation status of female affects her lifestyle, habits of nutrition and physical activity. Therefore, interventions try to reduce the cost of health choices reduce both prevalence of obesity and income-related inequality in obesity. Policies supporting and creating enable environment for female participation into labour market, enhancing higher education attainment of female and policies for reducing income inequality among socioeconomic group will reduce both prevalence of female obesity and also its concentration among poor socioeconomic status groups.

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Tablo Appendix 1: Interval Regression Estimation for Household Income

Variables	Coefficient	Std. Error	Z
Constant	707.229	31.54	22.42
Age	52.567	6.68	7.87
Location (Urban, D=1)	289.532	18.41	15.72
Illiterate	-344.043	30.34	-11.34
Primary School (5 years)	-130.262	25.40	-5.13
High School	219.573	28.06	7.83
Higher Education	762.317	37.23	20.47
Marital Status	-28.956	15.25	-1.90**
Housewife	-74.432	18.83	-3.95
Seasonal Worker	-427.739	100.24	-4.27
Retired	92.589	43.55	2.13

Salaried	75.349	21.23	3.55
Employer	457.533	116.19	3.94
Sigma	591.1882	6.21	
LR χ^2	1978.38 (prob:0.00)		

** indicates coefficient is significant at 5% level.