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Factors Affecting Bread Wastage by Householdsin Kahramanmaras

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Abstract: The aim of the study is to find out the factors that affect the bread wastage by consumers in Kahramanmaras. Main material of this study is the survey data obtained from the questionnaires that were performed face-to-face with 384 consumers in 2013. Binomial Logit Model is used to estimate the factors affecting the bread wastage. According to results consumers buy average 2.38 loaves of bread per day, and 10% of these are surplus. They transform some part (71%) of the surplus bread into new products, and throw the remaining part (29%) away into waste, or give as animal feed to relevant people. According to results, gender, education, being housewife, bread consumption amount, preparing pastry, pie in the house was found statistically significant.

Keywords: Waste, bread, household, binomial logit, Kahramanmaras.

Kahramanmaraş İlinde Hanehalkı Ekmek İsrafını Etkileyen Faktörler

Öz: Bu çalışmada Kahramanmaraş ilindeki tüketicilerin ekmek israfını etkileyen faktörlerin ortaya konulması amaçlanmaktadır. Bu çalışmanın ana materyali 2013 yılında 384 tüketici ile yüz yüze yapılan anketlerden elde edilmiştir. Ekmek israfını etkileyen faktörlerin tahmininde Binomial Logit Model kullanılmıştır. Tüketiciler günde ortalama 2.38 ekmek almakta ve bunun %10'u artıyor. Artan bu ekmeğin bir kısmı (%71) yeni ürünlere dönüştürülürken geri kalan kısmı (%29) çöpe atılıyor ya da hayvan yemi olarak kullanılıyor. Analiz sonuçlarına göre yaş, eğitim, ev hanımı olma, ekmek tüketim miktarı, evde börek, kek hazırlama istatistiksel olarak önemli bulunmuştur.

Anahtar Kelimeler: İsraf, ekmek, hanehalkı, binomial logit, Kahramanmaraş.

1. Introduction

Bread, one of the essential nutrition that the human being needs to survive, has a significant place in nutrition and food culture (Akbay 2005). Having been invented in 2600's BC (Gül et al. 2003), bread has become different upon diversification of products brought depending on geographical and climate conditions of countries, and change with the education level of consumers, technology and consumer preferences. Following such diversification, bread has started to have been made of cereals e.g. oat, rye, corn beside the wheat. Cheese, potatoes, walnut, sesame, nigella, olive oil, soya, milk are added into bread together with lour. Bran of different cereals has added various tastes to bread in the world kitchen (Anonymous 2016).

The Association Internationale De La Boulangerie Industrielle (AIBI) states that Turkey produces 8.4 million tons of bread per year. According to the same report, annual consumption of bread per person was calculated to be 104 kg in Turkey while it was 32 kg in England, 42 kg in Slovenia, 55 kg in Russia, 56 kg in Germany and 95 kg in Bulgaria, 59 kg in the European countries (AIBI 2013). In some countries, low consumption of bread is the result

of that there are various products that may be substitution for the bread.

There are about 800 million people who are undernourished and cannot reach to bread, the most essential nutrition in the world (FAO 2015a). However, 1/3 of the goods manufactured as food throughout the world (1 trillion US$) are thrown away. 45% of the fruits and vegetables and 30% of the cereals that are produced are wasted (FAO 2015b). Bread is among the products which are made of cereals and are most wasted. In a study conducted in Holland, a person wastes 680 kg of bread during his life (EC 2015). In Turkey, 2.1 billion of bread was wasted and financial value of this is 500 billion US$ at 2013 (TMO 2015; Anonymous 2019).

Bread, such an important nutrient, is among the most wasted foods. Considering the growth of wheat, grinding it in the mill, making bread of it, and also the phases to which it is subjected to till it reaches to our tables as well as the expenditures, and then these all mean a huge cost for the national economy.

In the national and international studies conducted, the factors affecting the bread wastage were found to be as follows: consumers' income (Anonymous 2015a), bread diversity (Ekmekçi Bal et al. 2013; Gündüz et al. 2013), high quantity of bakeries, supernumerary employment, getting stale of white bread in a short time, habit of consuming fresh bread (Dölekoğlu et al. 2014; Onurlubaş and Altunışık 2019), methods for utilizing the staled bread (Anonymous 2016), food wastage (Yildirim et al. 2016) and not knowing the storage conditions (Anonymous, 2015b; Ertürk et al. 2015), negligence and lack of knowledge of consumers and manufacturers (TMO 2015). However, the effect of socio-demographic and economic characteristics of the consumer on the consumption of bread was not taken into account. The objective of this study is to find out the factors that affect the bread wastage by consumers in Turkey.

2. Material and Methods

Main material of this study is the survey data obtained from the questionnaires that were performed face-to-face with consumers living in Turkey in the year 2013. The sample size was determined by using the proportional sampling method *(1)* (Newbold 1995; Miran 2013).

$$n = \frac{N * p * (1-p)}{(N-1) * \sigma_p^2 + p * (1-p)} \quad (1)$$

In the formula, n: Sample size, N: Number of individuals in the population (500950), σ_p^2: Variant of the proportion, p: Possibility of bread wastage by consumers (0.5). According to equation number of households to be surveyed was determined as 384 with 95% confidence interval and 5% deviation of the mean.

Binomial Logit Model

In the case that the dependent variable in econometric studies is qualitative, the limited dependent variable regression models are used. In these models, dependent variable means the existence or non-existence of an event. In the occurrence and non-occurrence situations of the event, the dependent variable gets the values "1" and "0", respectively (Yavuz 2001; Gujarati 2006). For the estimation of such type of models, Linear Probability Model, Logit Model or Probit Model can be used. It is highly reliable that the estimated probability of the Probit and Logit models gets low between the intervals of 0-1 while that of the Linear Probability Model may get lower beyond the limits 0-1. The Binomial Logit Model was created as an alternative to the Probit model that was derived in order to settle the problems encountered in the linear probability model. Process followed in this model is identical with the one in the Probit model *(2)*. The only difference between them is that while the Probit model is derived from normal distribution, the Logit model is derived from the logistic distribution:

$$P_i = E(Y = 1 \mid X_i) = \alpha + \beta X_i$$

$$P_i = E(Y_i = 1 \mid X_i) = \frac{1}{1 + e^{-(\alpha + \beta X_i)}} = \frac{1}{1 + e^{-Z_i}} \quad (2)$$

Where P_i means the probability of bread wastage by the i^{th} individual when giving information about the explanatory variable (X_i)

(Sarımeşeli 2000; Gujarati 2006).

In the study, the factors affecting the bread wastage were tried to be estimated. Dependent variable means the bread wastage status. Explanatory variables used in the study are given in Table 1.

3. Results

Wastage of bread, a substantial and easily-accessible food being rich in nutrients, can be defined as buying it more than the need and throwing the remaining amount away into waste, or using it as animal feed, in other words, using it beyond its purpose of use. According to results, 52% of the consumers having participated into the survey in Turkey were male, and the mean age was 36.39 years (Table 1). 76% of consumers were married and average household size was 4.45. 25% of the consumers within the study were housewife, 57% of the consumers were graduated from high-school and 15% from university. Share of the households who had cardiac diseases, vascular occlusion, cholesterol, diabetes, etc. was found to be 42%.

Body Mass Index (**BMI**) is calculated by dividing the body weight (kg), height by its square in meter. Accordingly, the BMI groups are as follows: 20-24.9: healthy weight, 25-29.9: Overweight, 30-34.9: Moderately obese and 35: Severely obese (Anonymous 2015c). In this study BMI values of the surveyed attendees were found to be between 16.04 and 50.78 with the average of 26.95 (Table 1).

Table 1. Socioeconomic characteristics of consumers
Tablo 1. *Tüketicilerin sosyoekonomik özellikleri*

	Minimum	Maximum	Mean	Std. Dev.
Gender [Female:0, Male:1]	0	1	0.52	0.500
Age	17	81	36.39	12.226
Civil Status [Single:1, Married:0]	0	1	0.24	0.427
Household size	1	10	4.45	1.491
Education [year]	0	20	8.22	3.983
Primary School	0	1	0.25	0.434
Elementary School	0	1	0.32	0.466
High School	0	1	0.18	0.382
University	0	1	0.15	0.359
Persons with cont. disease in family	0	1	0.42	0.495
BMI	16,04	50,78	26.95	6.827
Housewife [%]	0	1	0.25	0.434
Income [$]	0	5494,51	758.07	973.093
Monthly food expense	0	1648,35	237.85	301.157
Bread consumption amount [loaves/day]	0,1	5	2.38	1.030
Surplus amount of bread [%]	0	0,50	0.10	0.152
Bread wastage	0	1	0.29	0.456
Packed flour consumption [$/month]	0	16,48	2.46	4.756
Non-packed flour consumption [$/month]	0	13,74	1.50	4.805
White bread consumption	0	1	0.88	0.331
Preparing pastry, pie at house [freq./month]	0	30	1.78	1.887

In the research area, share of the food expenditure in total income was 31.4%. Consumers would buy average 2.38 loaves of bread per day, and surplus 10% of it. They would transform some part (71%) of the surplus bread into new products, and throw the remaining part (29%) away into waste, or give as animal feed to relevant people (Table 1). Daily consumption of bread per household in Turkey is 3.64 loaves, and 2.90% of it is wasted. Use of bread beyond its purpose of use, in other words, not using it as human food but animal feed, is considered as wastage of bread. Amount of bread wasted into waste before it reaches to customer or by using it animal feed is 3 million loaves per day in the year 2012, and constitutes 3.1% of the total production. Previous studies show that 90% of the wasted bread (2.9%) in Turkey is used as animal feed (Anonymous, 2015b).

Average monthly household expenditure is 2.46$ for packed flour and 1.50 $ for non-packed flour. Almost 90% of consumers prefer white bread. When the surveyed attendees would prepare pastry, pie, flatbread, etc. that may be substituted for bread in their houses, their consumption of bread would decrease. There are both types of consumers, in one of which they would never prepare pastry, pie, flatbread, and in the other, they would prepare such products each day. Frequency of preparing pastry, pie, flatbread in their houses was determined to be average 1.78 per month (Table 1).

In Table 2, analysis results of the Binomial Logit Model are given. In Table 2, the model was found statistically significant (X^2:29.57; p:0.000). In the model, genders, education, being housewife, bread consumption amount, preparing pastry, pie in the house were found statistically significant. Consumers' age, monthly food expenditure and preparing bread in the house were found not to be statistically significant.

According to result, males waste less bread compared to females. This was found to be statistically significant ($p<0.10$). According to marginal effects, men waste 9.92% less bread compared to women. Males and females with low physical work need 150-300g and 100-200g bread per day, respectively (Kurter et al. 2011). Because males consume much bread compared to females, they do not surplus or surplus little and do not waste the bread they buy daily

A statistically significant relation between the bread wastage and education was found ($p<0.05$). There is a positive relation between level of education and bread wastage. According to marginal effects, as the education level of consumers' increases 1 year, the bread wastage increases by 1.24%. In other saying, the more educated the people, the more wastage occurs. With increase of education, they spend much time for the social life, and spend much of their times out of their home. As the time spend out of home increase, foods obtained out of home also increase, and thus, the food bought for home goes bad and is wasted, not consumed. Quickly stale bread, which is included into this group of food, is wasted much. Women have taken much part in business life with the education increasing, and also increased their out-of-home consumption in order to save time. In a study conducted by Cekal (2008), it was found that as the level of education increases, consumer knowledge about nutrition also increases, and since this situation increases the working opportunities of women and affect their out-of-home consumption positively, these all have increased also food wastage.

There is a negative relation between being housewife and bread wastage. Housewives waste less bread compared to the others ($p<0.05$). It was observed that housewives would waste 15.12% less bread compared to the others. Housewives spend their much time at home and therefore, they can utilize their time much for making canned foods, drying, transforming stale bread into new products. For instance, they can make new foods e.g. meatball, dessert, etc. using the staled bread.

Moreover, there is a positive relation between bread wastage and bread consumption as expected. In other words, as the amount of bread bought daily increases, the bread wastage increases, too ($p<0.05$). According to marginal effects, as the consumption of bread increases by 1 unit (loaves), bread wastage also increases by 4.86%. Previous researchers showed that one of

the most significant reasons of bread wastage is the redundant purchase of bread (Dölekoğlu et al. 2014; Anonymous 2015a; Anonymous 2015b; Kurter et al. 2011; Anonymous 2015d; TMO 2015). Redundant bread bought by household is either thrown away to the waste or given to relevant persons in order for them to be utilized as animal feed. Such bread not transformed into another product and not used for the purpose is wasted.

There is a negative relation between bread wastage and preparing pastry, pie at home ($p<0.10$). According to marginal effects, as the frequency of preparing pastry, pie at home increases by 1 unit, then the bread wastage decreases by 1.10%.

Table 2. Factors affecting bread wastage (Dependent variable: Wasting bread:1, Others:0)
Tablo 2. *Ekmek israfını etkileyen faktörler (Bağımlı değişken: Ekmek israf eden:1, Diğer:0)*

	Estimated Parameter Values for Binomial Logit Model			Marginal effects and statistical values of variables in model		
Wastage	Coefficient	Standard Error	p	Partial Effect	Standard Error	p
Constant	-1.2878**	0.6497	0.0475			
Gender	-0.5137*	0.2716	0.0586	-0.0992*	0.0521	0.0566
Age	-0.0095	0.0112	0.3961	-0.0018	0.0022	0.3964
Education	0.0761**	0.0364	0.0365	0.0124**	0.0070	0.0375
House wife	-0.8537**	0.3607	0.0179	-0.1512**	0.0568	0.0078
Food expense	0.0002	0.0004	0.6486	0.0000	0.0000	0.6486
Bread consumption	0.2527**	0.1211	0.0369	0.0486**	0.0234	0.0378
Frequency of preparing pastry, pie at home	-0.0574*	0.0322	0.0743	-0.0110*	0.0062	0.0754
Preparing bread at home	-0.0364	0.0948	0.7008	-0.0070	0.0182	0.7008
Log likelihood function	-217.89138					
Chi squared	29.57267***					

***, **, * Significance at 1%, 5%, 10% level

4. Discussion

Bread, which is the most produced and consumed by human being, is also the most wasted food. Redundant bread production, in other saying that the supply is not adjusted according to the demand, bread is not packed, not kept at bakeries under appropriate conditions, then these all cause bread wastage at the production phase. Bread is wasted during production because consumers purchase bread more than they need, they wish to consume hot and fresh bread, they don't know how to store bread, they are aware of how to recover the staled bread.

The objective of this study was to find out the factors that affect the bread wastage by consumers. Accordingly, 384 consumers living in Turkey were surveyed in the year 2013. In order to find out the factors affecting the bread wastage using the obtained data, the Binomial Logit analysis was conducted. According to results, genders, education, being housewife, bread consumption amount, preparing pastry, pie in the house were found statistically significant.

Giving the staled bread to pets, street animals or livestock, which is a common attitude, is not considered wastage in society. However, 4 kg of concentrate feed can be bought at the price of 1 kg bread, and in the case that the bread produced as human food is used as animal feed, then flour and the labour, costs and time spend during production of bread are also wasted. For this reason, it should be first explained to consumers what the bread wastage is. Moreover, seminars should be held regarding the methods for storing bread and recovering the staled bread, and the contributions to economy that is provided by not wasting bread. Training courses can be organized

in schools to prevent bread waste and create awareness.

In order to create awareness in the society, education should be given on this matter. Such education should be supported with policies that will make change in humans' behaviours against food and bread wastage.

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