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Research Article

The effect of bags law on environmental behavior and habits-Mersin example

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ABSTRACT

The use of plastic bags (PB) has increased continuously over time because of their multipurpose property. Due to its environmental effects, Türkiye has approved a new law to limit the use of plastic bags. According to the approved Turkish plastic bags law (PBL), plastic bags of 15 microns or more are prohibited from being given to the customer free of charge. The new law's effects were investigated by applying a face-to-face survey consisting of 13 questions to 1537 people in four districts close to Mersin city center. In addition to that, field surveys were managed to the common markets in the target area. From the target sample, 159 males and 128 females had not bought the PB after the law. Whereas 184 males and 178 females had bought PB for 10 times or more. The monthly income has a weak correlation with the plastic bags purchasing times. Families with 1-3 capita, 4-6 capita, and larger families who never bought plastic bags have moderate negative correlations. Families with 4-6 capita and larger families have a significant strong positive correlation at the ($P<0.01$). It was found that people aged 50 years and over who participated in the survey were less aware of the negative impact of bag use on the environment than younger ones. Garbage plastic bag consumption has not increased as expected. The managed field surveys proved that. The results from the surveys showed a decrease in PB consumption with a ratio between (60-80%)..

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INTRODUCTION

Plastic Bags (PB) was designed for the first time by StenGustafThulin. It was patented and commercialized in 1965 [1]. It aimed to facilitate the transportation products from market to the destination. The single-use average time was 12 min [2]. Shopping bags were used over the world because of their thin-film structure, waterproof, lightweight, and cheap (free in markets). Many expressions are describing plastic bags Types. Some of these are listed in Table 1 [3].

From the first day, the demand for plastic bags has increased due to their practicality. The expansion in the large shopping center also increased the demand by providing free-of-charge plastic bags to ensure customer satisfaction. Approximately 0.5-1.0 bags are consumed in a year in the world. This means that 1.4-2.7 billion bags are used in a day and more than one million bags in 1 minute

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Table 1. Plastic bags type's definitions [3]

Shopping plastic bags (SPB)	It obtained from seller at the market point to carry products. It formed partially or completely from polymers.
HDPE bag	High-density polyethylene (HDPE) bags, and in general it has a thickness less than 35 microns. It is often referred to as supermarket style bags, single bags, disposable plastic bags, and lightweight plastic shopping bags. Generally used in supermarkets or grocery stores.
Boutique bag	It made from Low-density polyethylene (LDPE) bags. It normally has printed trademarks and usually supplied from clothes and electrical markets.
Green bags	Reusable "green" bags. They are durable bags made of polypropylene and designed for multiple uses.

[4]. PB consumption is higher in countries with high income levels. However, in low-income countries, the negative effects of insufficient and excessive use of laws are greater [5]. It has been determined that the annual per capita consumption of plastic bags is 1370 in Hong Kong, 286 in the USA, 263 in Israel, 252 in Taiwan, 235 in Japan and 223 in China [6]. In addition, it has been reported that before 2019, the amount of plastic bag production in Türkiye was 35 billion pieces per year and that one person used an average of 440 plastic bags per year [7]. As a result, a tremendous quantity of naturally non-recycled plastic bags was thrown. When the contribution of non-recycled plastic bags on environment pollution became significant, many governments had been forced to arrange legally the uses of plastic bags [8].

The arrangement procedure had taken three shapes; the first one related to imposing taxes on the disposal of plastic bags; the second is related to charging the plastic bags; the last one related to collecting or exchanging the plastic bags for fees. Many governments applied the first vision [9, 10]. In the beginning, the applied tax reduced the using of plastic bags [11, 12]. Despite the high taxes, the decreasing in using plastic bags did not continue, since the people returned to their habits [13, 14]. Prohibitions and exchanging the plastic bags for fees have been more effective in reducing bag use. In 1994 Denmark introduced a tax law on plastic bags disposal [15]. Countries followed two main policies in reducing the use of plastic bags. While developed countries chose to tax, developing countries preferred to prohibit. The benefit of taxation policy is revenue generation, public awareness and growth of recycling. The prohibition policy aims at a cleaner environment, tourism attraction, environmentally friendly shopping and reducing the ecological footprint [16]. In 1998 India followed Denmark in enacting legal laws [17]. The emerged effects of plastic on the environment led many countries to introduce legal regulation [15].

The first conference related to environmental issues was held in Bern in 1913. The European environmental advisory board was organized in 1965 at the United Nations building [18, 19]. The first international conference on environmental rights was held in Stockholm in 1972 by the United Nations [20].

In Türkiye, the first environmental regulations were included in Municipalities Law No.1580 [21] and Public Health law No.1593 [22] in 1930. These laws include regulations on the waste collection, storage, and protection of the environment and human health. Article 56 of the 1982 Constitution states that people have the right to live in a healthy and sustainable environment, and the state and citizens have to develop and protect the environment [23]. Environmental Law No. 2872 was approved in 1983. In 1991, the control of the effects of the solid waste on the environment began with the Regulation on Solid Waste Control [24]. Until these days, many legislation were regulated, developed, and implemented with consistency with European Union Legislation. After the scientific demonstration of the negative effects of plastics on the environment, many countries such as the Republic of Türkiye had adopted regulations that limit the use of plastic bags.

Arı and Yılmaz (2017) examined the attitudes of 321 people living in Eskişehir, a metropolis in Türkiye, towards the use of plastic and cloth bags. The study conducted during the period when nylon bags were free showed that environmentally conscious consumers tended to use cloth bags instead of plastic bags [25]. The research conducted with 434 people in Gümüşhane, a small province in eastern Türkiye, revealed that after the regulation, consumers reduced the use of plastic bags, but they also had doubts about their sustainability [26]. After the implementation of the bag law in 2019, a questionnaire was applied to 363 university personnel in Isparta. All the findings have shown that the plastic bag pricing in effect contributes to the goals and targets of reducing bag consumption to a certain extent [27]. This research was carried out after the bag law was enacted. In addition, face-to-face questionnaire was applied to 1537 people. In addition, Mersin is a coastal city and the inhabitants of Mersin show a more cosmopolitan structure. All these details add originality to this work.

To reduce the use of plastic bags and plastic packaging, the approved plastic bags law (PBL) (7153) on 10 December 2018 prohibits the free charge using of plastic bags with a double thickness of more than 15 microns. The PBL aimed to reduce the annual use of 400 plastic bags per person up to 90 units per person until 31.12.2019, and 40 units per person until 31.12.2025 [28].

MATERIAL AND METHOD

Mersin province is located at the center of the southern coast of Türkiye at the Mediterranean Sea. In 2018, the total population in Mersin reached 1814468 capita [29]. They are distributed over 13 districts. Mersin extends over an area of 15.853 km^2 [30]. Figure 1 shows the district of Mersin.

The districts were selected according to their economic status, social structure, and the number of shopping centers in the region. Erdemli district is further away from the city center than other districts. People living in this region are mostly engaged in agriculture. The number of people coming from outside migration is low. They have a more traditional lıfe way. Mezitli is a region where Mersin province has developed greatly in recent years. In Mezitli, the agricultural area has decreased by 80% in the last decade, and these have been replaced by large multi-story sites. There are many shopping centers in this area. Yenişehir district is located close to the center. In this area, there are many shopping centers as well as residences. The economic situation of the people living in this region is high. The Mediterranean district is located in the old city center of Mersin. The economic and social situation of the people living in this region is very complicated. In general, old warehouses are located in this region. Also, this region is the most region affected by migration (internal and external migration).

By applying Equation 1, the sample size for each district was obtained. In total, 1537 questionnaires were prepared and distributed over the target area. The survey lasted 10 days, the results were arranged using Excel program. Table 2 shows the population of each district and the sample sizes.

Table 2. The population and the sample size of each district

District	Population (Mersin, 2018)	Sample size
Erdemli	140331	383
Mezitli	194019	384
Yenişehir	258694	385
Mediterranean	264618	385
Total		1537

Effect of Plastic Bags Law on the People Habits Exploration

The effect of the PBL on the people habits was explored in the target area by field surveys for the period from 20/4/2019-01/05/2019 face to face by students

Figure 1. Mersin province (Turkish State Meteorological Service, 2019).

Table 3. The prepared questionnaire

Question	Answer			
Gender	**Male**		**Female**	
Age	18-25	25-35	35-50	>50
Education	Reading/Writing	Primary sch.	High Sch.	University
Monthly income	<1000	1100-2000	2100-4000	>4000
Family size	1-3	4-6	7-10	>10
Frequency of shopping	< weekly	weekly	2 time / week	Every day
Do you know PBL?	Yes		No	
Do you use Market bags as garbage bags?	Yes		No	
Did you buy a market bag after PBL?	No	Yes (3-5)	Yes (6-10)	Yes (>10)
Are you purchasing garbage bags?	Yes		No	
How many daily garbage bag do you waste?	1-2	3-4	4-5	>5
How much do you buy garbage bags monthly? (Pack of 20)	1-2	3-4	4-5	>5
Do you think the market bags (plastic) are harmful to the environment	Yes		No	

from Environmental Engineering department - Mersin University.

The data related to people's habits were recognized and designed as a questionnaire. It had been distributed over sample sizes that achieve a 95% confidence level with 5 confidence interval. Sample sizes were determined using equation 1 [31].

$$\text{Sample size} = \frac{Z^2 \times P \times (1-P)}{C^2} \quad (1)$$

Where, Z, P, and C are the Z-score, Percentage of the population picking a choice, and Confidence interval, respectively.

The questionnaire had 13 questions. Each question has been prepared to be clear and understandable. The results from questionnaires were analyzed for each district. Table 3 shows the questions.

SPSS software (SPSS v20.0) was used in the statistical analysis. The Pearson correlation test was used to study the relation between the different factors.

Effect of Plastic Bags Law on Shopping Center (Market)

The effect of the law on the shopping center was explored by a separate survey. The most famous and popular shopping centers (market) were selected to be the target. The shopping centers were visited separately by the surveyors. The data from shopping were used in two approaches; the first is to examine the effect of LPB on the bag consuming from market view. The second is to support the questionnaire results.

RESULT AND DISCUSSION

Effect of the Consumer Gender on the Plastic Bags Consumption

It had been thought that the application of the law is affected by consumer gender. It had assumed that males purchased plastic bags more than females.

In Erdemli district, 55% of the sample was male, and the percentage of females was 45%. In Mezitli and Akdeniz males recognized 51.5% and 62% of the sample respectively. In Yenişehir the percentage of males reached 45% of the sample. Figure 2 shows the gender size within the sample in each district.

From the target sample, 159 males and 128 females had not bought the PB after the law. Whereas 184 males and 178 females had bought PB 10 times or more. The largest female and male part had bought PB 3-5 times. The number of males and females who had bought PB 6-10 times

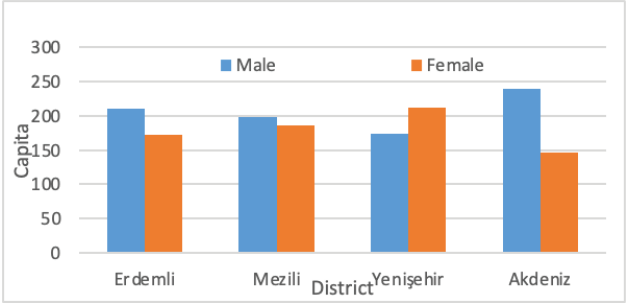

Figure 2. Gender size within the sample.

was 169, 161 respectively. Figure 3 shows the PB purchase times according to gender along the target area.

Effects of the Monthly Income and Family Size on the Plastic Bags Consumption

The monthly income and the family size effects on the PB purchase were studied over the four districts. Over the random sample, there were 211 questionnaires with income less than 1000 Tl, and 384 for the income level between 1000-2100. The most statement about income range was 2200-4000 with 531 answers. There were 338 questionnaires for income larger than 4000 TL. Table 4 shows the families' sizes corresponding to their income levels.

The families with sizes of 1-3 comprised 45% of the total families who participate in the survey in Akdeniz. While in Erdemli, Mezitli, and Yenişehir it is about 40%. In Mezitli, and Yenişehir 50% of the families were 4-6 per capita. The families with a size of 7-10 formed percent of 7-12%. The big families (more than 10) constituted 7.8% in Erdemli. However, it composed just 1.5 % of the other districts. Figure 4 shows the family sizes in the random samples.

The study assumed that families with higher incomes would buy PB more than others. While the limited income families would save more than others. To test this assumption, the Pearson correlation test was performed and the results are shown in Table 5.

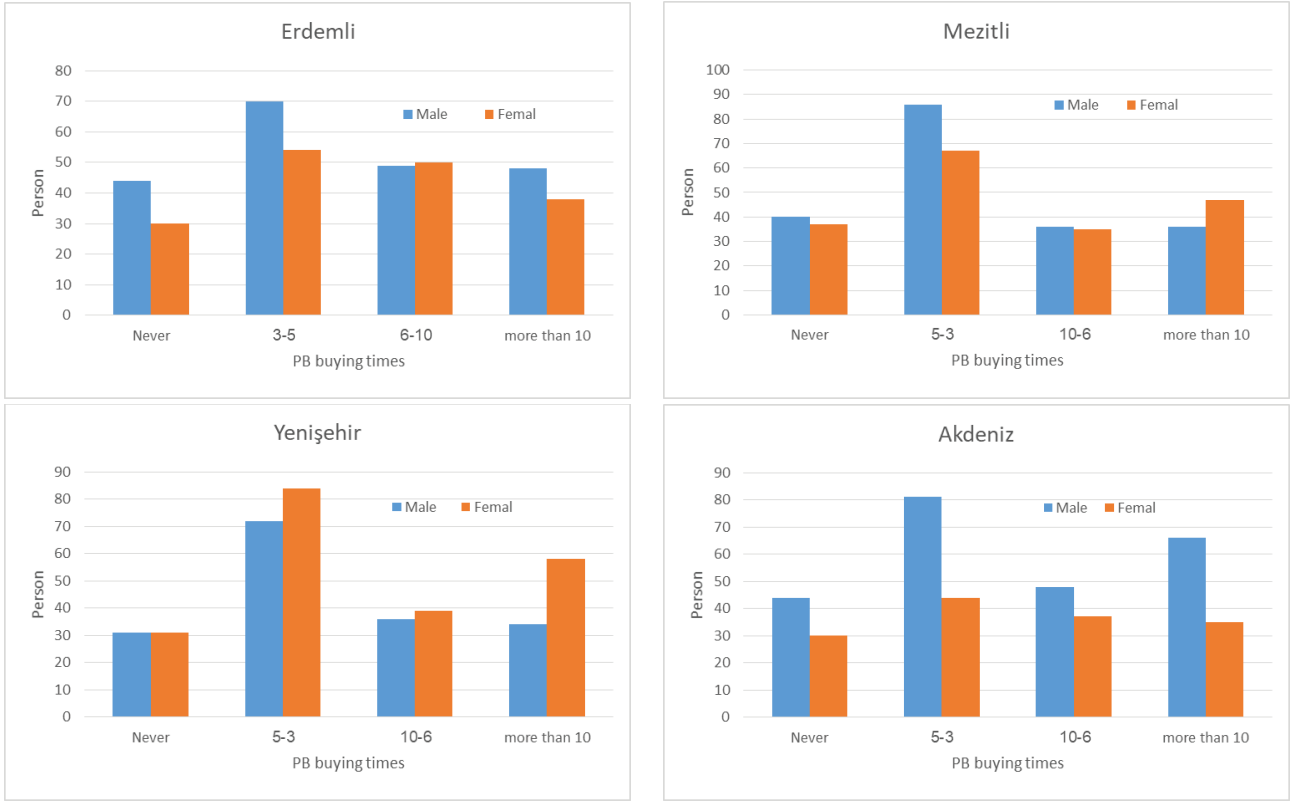

Figure 3. The PB purchase times according to gender along the target area.

Table 4. Family sizes corresponding to income level

		IncomeLevel				Total
		<1000	1000-2000	2100-4000	>4000	
Family Size	**1-3**	112	168	194	149	623
	4-6	137	160	259	135	691
	7-10	26	41	57	30	154
	>10	9	15	21	24	69
Total		284	384	531	338	1537

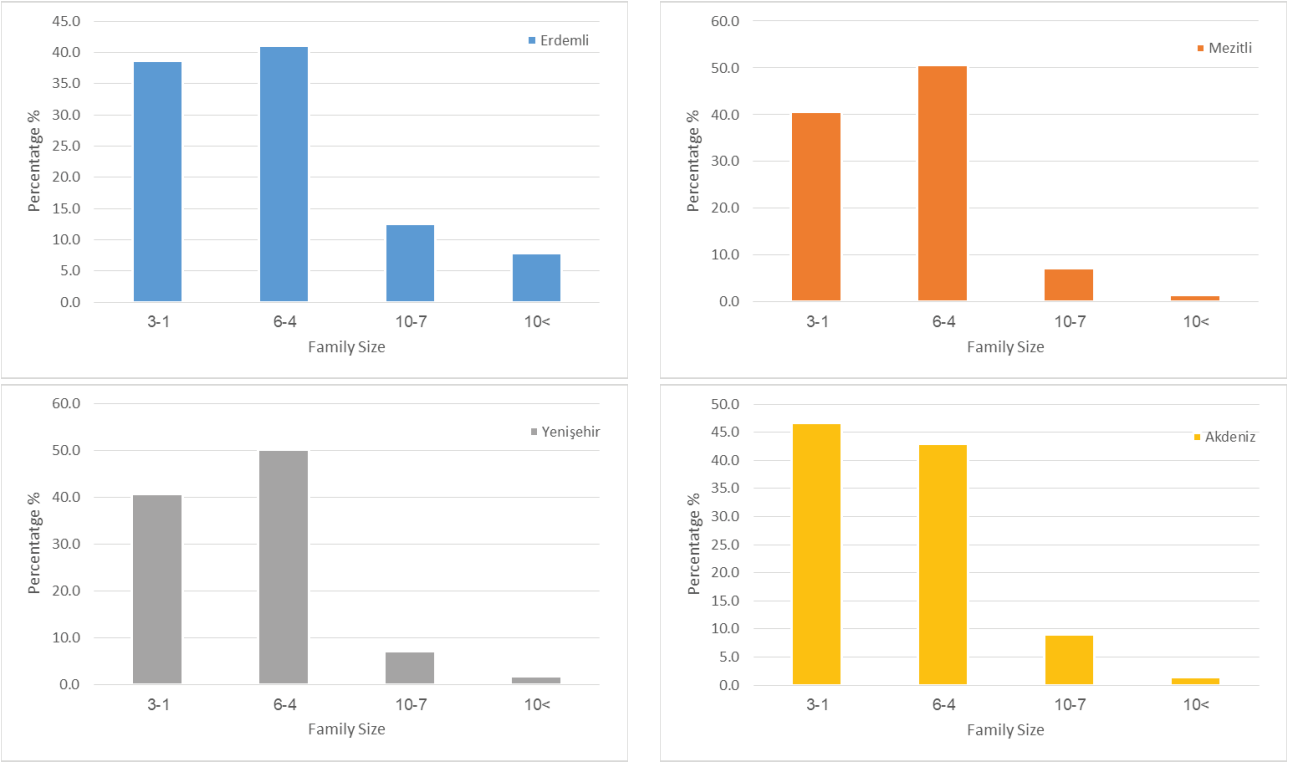

Figure 4. Families' sizes in the random sample over the four districts.

Table 5. Pearson correlation test for income level and PB purchase

Income level for each district	PB purchase
Erdemli	0.016*
Mezitli	-0.035*
Yenişehir	0.076*
Mediterranean	0.046*

PB: Plastic bags, *$p < 0.05$; **$p < 0.01$

Table 6. Pearson correlation test for family size and PB purchase

	Never	3-5	6-10	>10
Family (1-3)	-0.532	0.090	0.607	0.902*
Family (4-6)	-0.871	0.955*	0.726	0.957*
Family (7-10)	0.771	0.685	0.779	0.009
Family (>10)	-0.541	0.981*	1.000**	0.967*

PB: Plastic bags, **: Correlation is significant at the 0.01 level (2-tailed), *: Correlation is significant at the 0.05 level (2-tailed).

Correlation results between the income level and the PB purchase show a very weak correlation ($p < 0.05$) over the study area. The results reject the above assumption. These results could be explained by the price of plastic bags. The plastic bag can be bought for 0.25 TL, whereas the green bag price is 2 TL.

For the family size, it was thought that the larger family will tend to use green bags and will not buy plastic bags. While families with less capita will continue using plastic bags. The family size and the plastic bags buying were correlated by the Pearson correlation test and the results are shown in Table 6.

Pearson correlation test show a strong relationship between family size and the PB purchase. Families with 1-3 capita, 4-6 capita, and larger families who never bought plastic bags have a moderate negative correlation. While families with 4-6 capita and larger families have a significant strong positive correlation at the ($p < 0.01$). There are significant correlations at ($p < 0.05$) for the families with 4-6 capita and larger families with plastic bags purchase rates larger than 10 times. These results clearly indicate that there is a relation between family size and PB purchase.

Effects of the Age and Education Level on the Plastic Bags Consumption

The age and education level had been expected to affect the consumption of PB. To study the effect of age, four different categories were set as shown in Table 2. The average samples ages in Erdemli, Mezitli, Yenişehir, and Akdeniz were 38.13, 35.6, 35.8, and 34.9 years, respectively.

Table 7. Distribution of education levels according to age

		Education				Total
		Reading-writing	Primary	High School	University	
Age	**18-25**	22	40	71	269	402
	25-35	37	57	141	168	403
	35-50	62	92	162	169	485
	>50	52	66	58	71	247
Total		173	255	432	677	1537

The education level was categorized into; reading-writing, primary school, high school, and university. According to Table 7, there were 677 questionnaires with an education level of the university. And just 173 people can write and read level.

Pearson correlation test was performed to study the relationship between the age and the PB buying times. The results from the test are shown in Table 8. The results in general shows a weak correlation between age and PB purchasing times. In Erdemli district, the correlation was positive with a confidence of 95%. The other districts show a negative correlation between the age and the times of PB purchasing ($p < 0.01$ for Mezitli and Akdeniz, $p < 0.05$ for Yenişehir). This means that age has a relative relationship with PB purchasing in those districts.

The PB purchasing times are assumed to be affected by the education level. In order to study this side in Mersin, the data were analyzed by Pearson correlation test. The results shown in Table 9 show a positive weak correlation between the education level and the Purchasing times of PB over the four districts. In general, the environmental awareness of educated people is expected to be higher. Increased environmental awareness through education is an expected result, but the survey results do not confirm this hypothesis.

Effects of the Plastic Bags Law on the Garbage Bags

People used plastic bags (market bags) to carry baggage to their houses. After that, they usually used them as garbage bags. After the adoption of the relevant law and decreasing the use/purchase the market bags, it was expected to increase in purchasing of garbage bags. The results obtained from the Pearson correlation test show a weak positive correlation between garbage purchasing and plastic bags Table 10.

Effects of the Plastic Bags Law on the Shopping Centres (Markets)

The field survey results at the most popular market in the four districts show a decrease in PB consumption with

Table 8. Pearson correlation test for age and PB purchase

		Age	PB Purchase
Erdemli	**Age**	1	
	PB Purchase	0.03*	1
Mezitli	**Age**	1	
	PB Purchase	-0.184**	1
Yenişehir	**Age**	1	
	PB Purchase	-0.066*	1
Mediterranean	**Age**	1	
	PB Purchase	-0.193**	1

PB: Plastic bags, *$p < 0.05$; **$p < 0.01$

Table 9. Pearson correlation test for the education level and PB purchase

		Education	PB Purchase
Erdemli	**Education**	1	
	PB Purchase	0.01	1
Mezitli	**Education**	1	
	PB Purchase	0.223**	1
Yenişehir	**Education**	1	
	PB Purchase	0.057	1
Mediterranean	**Education**	1	
	PB Purchase	0.214**	1

PB: Plastic bags, *$p < 0.05$; **$p < 0.01$

Table 10. Pearson correlation test for the garbage bags purchasing and the PB purchase

		GB Purchase	PB Purchase
Erdemli	**GB Purchase**	1	
	PB Purchase	0.045	1
Mezitli	**GB Purchase**	1	
	PB Purchase	0.036	1
Yenişehir	**GB Purchase**	1	
	PB Purchase	0.022	1
Mediterranean	**GB Purchase**	1	
	PB Purchase	0.141**	1

GB: Garbage bags PB: Plastic bags *$p < 0.05$; **$p < 0.01$

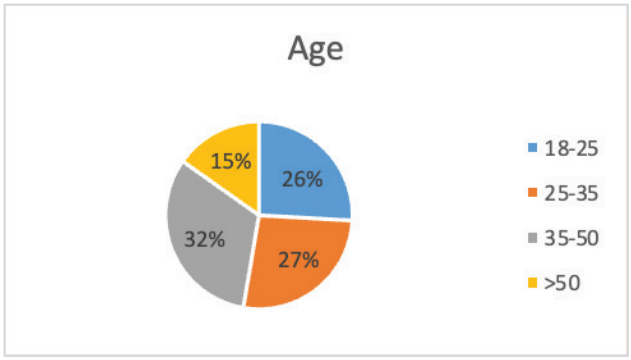

Figure 5. Age contribution to the awareness of the plastic hazards.

a ratio between (60-80%). Additionally, it does not appear to be any indication of increased purchase of garbage bags. These results support the statistical results above. Another note that should be taken into consideration when assessing the law, is the increasing in the consumption of 15-micron bags which is expected from the law.

Effects of the Awareness on the Plastic Bags Consumption

The level of awareness of the hazards of plastic bags was determined. The awareness level was examined according to age and education level. Over the four districts, 84.3% of the questionnaires agreed that plastic bags harm the environment. The persons aged 35-50 years comprised the max percentage with 32.1%, whereas the lowest percentage was for the persons with ages above 50 years. Figure 5 shows the contribution of age to the awareness of plastic bags hazards. It was found that people aged 50 years and over who participated in the survey were less aware of the negative impact of bag use on the environment than younger ones.

The education level affects the awareness of plastic bags hazards. The results in Figure 6 reflect that human with high education is aware of the hazards of plastic bags. This result is consistent with those obtained by Mogomotsi et al. [8]. The survey showed that the environmental awareness gained through education has not reflected to correct behavior [32]. It was found that most of the respondents did not change the habit of using the bag while saying that the bag pollutes the environment.

CONCLUSION

The study is an attempt to evaluate the effects of the newly approved Turkish plastic bags law (PBL) on environmental behavior and people's habits in four districts of Mersin. The study was based mainly on the results of the questionnaire prepared for this purpose, the questionnaire was consisting of 13 questions and was distributed to 1537 people. Gender, age, family size, income level, and education level correlated to the rate of plastic bags purchased by the Pearson correlation test. Gender and family size were founded to affect the plastic bags purchase. Whereas the remaining factors had a very weak correlation coefficient. The garbage plastic bags consumptions correlated weakly to plastic bags consumptions ($r = 0.141$ with $p<0.01$). The managed field surveys proved this result. The results from the surveys in the four districts showed a decrease in PB consumption with a ratio between (60-80%). The same question was asked in the face-to-face survey conducted to 821 consumers in Istanbul, Türkiye's most populous city. The result obtained is similar to this study [33]. Another note that should be taken into consideration when assessing the law, is the increase in the consumption of 15-micron bags which is expected from the law. At the end of the study, it was determined that there was no increase in the sale of garbage bags offered for sale in the markets, whereas the use of bags lower than 15 microns given free of charge increased by 100-110%. The survey showed that the environmental awareness gained through education has not reflected to correct behavior. It was found that most of the respondents did not change the habit of using the bag while saying that the bag pollutes the environment. As a result of this study, it found that the Laws and prohibitions can reduce the use of plastic bags. However, it would be most effective if the laws were conducted in parallel with the conducting of an education program about the bad effects of plastic bags. According to a 2018 study in the American Economic Journal: Economic Policy, the five-cent tax on disposable bags reduced the use of disposable bags by 40 percent [34]. In our study, it was found that the targets have not been reached yet. However, it would be more effective if a training program on the law and the harms of plastic bags is carried out in parallel. According to a 2019 review of available studies, fees and taxes are expected to decrease in usage by 66% in Denmark, by more than 90% in Ireland, and by 74% to 90% in South Africa, Belgium, Hong Kong, Washington D.C., Santa Barbara. has caused. In the United Kingdom and Portugal and Botswana and China, it decreased by approximately 50% [34]. The survey research was conducted in 2019, when the tax and wage law was put into effect. The survey results show that the plastic grocery bag tax and fee in 2019 is not well understood by the people T.C. Ministry of Environment, Urbanization and Climate Change reported that with the pricing initiated in 2019, the use of plastic bags in Türkiye decreased by 75 percent, thus preventing the generation of 354 000 tons of plastic waste. When evaluated together with the survey results, the tax application has reduced the use of bags. After the law, there was an increase in the consumption of thin bags placed for weighing products in the greengrocer sections of the markets. This shows that people do not give up on their habits of using bags, instead they turn to free bags. Uniform surveys should be established and administered periodically to identify changes in people's plastic bag use habits. In this way, awareness will increase. The effect of education and information on behavior change will be determined. Markets and shopping centers that adopt the

concept of zero waste are becoming widespread in the world. Encouraging practices should be implemented for consumers to prefer these places.

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CONFLICT OF INTEREST

The authors declare no potential conflicts of interest regarding the research, authorship and/or publication of this article.

DATA AVAILABILITY

The data used to support the findings of this study are included within the article.

AUTHOR'S CONTRIBUTIONS

All authors are contributed equally to bring out this article.

ETHICS

There are no ethical issues with the publication of this manuscript.

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