Research Article

Investigating the Effective Factors on Household Water Consumption Using Spss Software in a Case Study of Mashhad

Rahman Abizi [a]

[a] Department of environmental engineering, Faculty of Engineering, Khavaran Institute of Higher Education, Mashhad, Iran.

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Abstract: Water is a valuable and irreplaceable commodity in the economic and social development of countries. Water in the economic value chain plays a very important role. In the first study, the pattern of consumption was determined and based on field research, it was found that the average consumption rate for the first group who was dissatisfied is 123.7 for spss software and 173.23 for the second group, which means that the satisfaction with the effect of the eye Intake is in use and increases with satisfaction. It is estimated that 56% of the relative quality of water is satisfied with the price of water and 46% of this quality is low. Given that the coefficient of sig in the spss is0.393, then There is not a meaningful relationship between the two variables of the income level and the amount of consumption of each person, so according to the result, the income level parameter does not have a significant effect on household consumption. Given that the sig coefficient in the spss results was 0.491 Therefore, age parameter has no significant effect on household consumption. Due to the fact that the coefficient here is 0.456, there is no significant relationship between the two variables of education and the average consumption of each person. The relationship between the number of households and the level of consumption of each person is determined by considering the coefficient sig, 0.078 which is very close to 0.05. Therefore, it is concluded that our relationship between the number of households is significant And according to the relationship obtained with the increase in the household population, the average consumption of each person is reduced. In other words, with the addition of each person to the family, the amount of 12.697 liters is lower than the average consumption of each individual in the family, therefore, households will be reduced by increasing household consumption.

Keywords: pricing, water tariff, consumption patterns, household consumption, cost estimation

1. Introduction

Water is a valuable and irreplaceable commodity in the economic and social development of countries. Water plays an important role in the economic value chain. Determining urban water demand and consumption management depending on time, location, is the most important element of urban planning in the field of water. Implement proper demand management techniques, including reducing demand and consumption and reducing water losses, employing new methods and optimizing water distribution, and most importantly improving public awareness and adopting deterrent laws and increasing tariffs for water. Special subscribers can greatly improve the pattern of water use. Considering the above, serious consideration of the issue of water as a cross-cutting issue and requiring extensive inter-device coordination is of particular importance. Therefore, it is necessary to consider the effective factors in reducing water consumption.

Factors affecting water demand are the three main factors of climate, population and water prices. These factors generally determine the amount of water demand in an area, other factors such as water supply pressure, water quality, availability of metering meters, access to the sewer network, ease of water supply, consumption level Donor, level of health and culture of people, type of housing, and industrial or non-industrial city can also be added. Components of total water per capita are: domestic consumption, public consumption, commercial and industrial consumption, green space, and water losses. The most important type of consumption per capita is for domestic consumption.

Therefore, in view of the above, it is necessary to examine the status of the existing tariffs and identify the problems associated with these tariffs. This study also tries to compare water tariffs in Iran with some countries with different climatic conditions and to point out the role of pricing in the amount of consumption. In terms of water pricing, conditions such as fairness, efficiency allocation principle, income adequacy and sustainability principle, income redistribution principle, water resource conservation principle, social welfare principle, general acceptability, simplicity and transparency and ease of implementation It should be taken into account. For a better understanding of these cases and their use in comparison to methods, let us destail them.

(2005), in a study measuring parameters related to water consumption per capita in 96 Brazilian cities in three social categories, by proposing three important parameters: water percentage, water cost and energy consumption for supply activities. And water supply was considered to be the most important factor contributing to the per capita water consumption in urban communities.

(2008), Schlich and Heilen Brand in a study on the need for domestic water consumption in Germany found that the water consumption of the highest income households was three times the water consumption of the lowest income household. In this study, ambient temperature had no effect on water consumption. (2007),Goodwill and Urbanism in their study estimated the demand function of drinking water in Zahedan during

the period of 78-85. The results showed that the price elasticity of water demand is -0.6 and the income elasticity of its demand is 0.026 and the minimum water requirement of a Zahedan citizen is 95 liters per day. (2014),Adibpour and Shirashtani estimated domestic water demand function of Golestan province using Stone-Gray function and combined data method for 78-90 time period and determination of minimum water requirement for livelihood. The results of their research showed that the price elasticity of water demand is -0.26% and the elasticity of cross-elasticity is -0.09595. They obtained the minimum amount of water needed by a Golestan joint for 678 liters per day.

(2012), Alikhani and Ahmadloo studied the impact of price on demand and water consumption of Markazi province. They conclude that the increase in water prices will significantly reduce its consumption.

(2012), In Dagtio's study for the southwestern region of Ethiopia, the factors influencing water demand in the form of water resources in the city, household income, household head education, household size, gender, housing, and water price were considered. The results showed that monthly costs, residential home ownership, and educational status of household heads were determinants of water demand, while other factors used in this study were not statistically significant.

2. Analysis Method

In this section, it is attempted to describe the methods used to determine water prices according to studies and statistics and to address the methods used in Iran. Then we introduce the proposed method of this research and with the obtained information, we will analyze the results in the next chapter. A questionnaire and field survey were used to obtain information due to the apparent deficiency of water company information as well as confidentiality of the information and to analyze the statistical results the IBM SPSS STATISTICS statistical software was used which are explained in detail below.

Water Pricing Term

In terms of water pricing, conditions such as fairness and efficiency, the principle of efficient allocation, the principle of income adequacy and sustainability, the principle of income redistribution, the principle of conservation and conservation of water resources, the principle of social welfare, general acceptability, simplicity and transparency and ease of implementation It should be taken into account. For a better understanding of these cases and their use in comparison to methods, let us detail them.

Fairness and justice: Water is the basis of human survival and development. Therefore, pricing should be such that everyone, regardless of income, has the ability to meet their needs. Generally, costs vary with the amount of supply, so prices for users with different values should vary. The principle of fairness requires examination of the ability, financial standing and willingness to pay consumers.

The principle of efficient allocation: Water is a scarce resource; efficient allocation of water should be a priority when determining prices. That is, only when water prices reflect the true economic cost of water can water be efficiently and effectively allocated to different users. Economically, efficiency happens when every user pays a price that reflects the cost of water.

The Principle of Revenue Redistribution: Pricing should usually be used in developing countries by looking at the redistribution of income between different groups of customers so that by imposing higher prices on these large consumer groups. Water (which pays above average income) Commit small consumer subsidies.

Principle of Conservation and Conservation of Water Resources: Proper pricing of water often avoids improper use of water.

Principle with regard to social welfare: Prices must be set in such a way as to maximize social welfare, one of the ways to achieve this is to find the best price discrimination principle for different consumers.

General acceptability: Successful tariff is a tariff that is not controversial or in protest of the water supply unit.

Simplicity and transparency: A tariff plan should be easy to understand.

Ease of implementation: There should be no obstacles in the enforcement of the approved price, such as excessive stringency of authorities, information requirements or financial issues.

3. Results and Discussion

in Figure (3-1). The following questions and objectives are addressed in this questionnaire. This section attempts to introduce the method of data collection. For this purpose, questionnaires were prepared in this regard and this questionnaire was distributed to households and in addition to the questionnaires, subscribers were asked to attach their bill. An example of this questionnaire is given

"Name your city and region of residence." The purpose of this question was to determine the city and location of individuals to rank according to the city and neighborhood of the subscribers introduced so as to measure the impact of the point on consumption rate due to the limited information coming from different locations in this study. Commented.

"How many households are there?" The purpose of this question is to obtain the number of households to calculate the average consumption per person in the family and to find out the household consumption category.

"The number of family members holding a bachelor's degree or higher". This question was raised because of families' ratings of education and the role of education in consumption.

"The number of households who are over 60 or under 10 years old" The purpose of this question was to classify families by age and the effect of age on consumption, and criteria for age over 60 and below 10 The pattern of consumption of these two age groups is based on World Bank statistics.

"How big is the total household income?" The purpose of this question was to determine how income impacts consumption, for which low income households with less than rials 30 million per month, middle income households with between R 30 and 50 million per month, and high income households. Of the 5 million a month are classified in the high-income category. The criterion for determining these amounts is the government's announcement of 7million R for absolute poverty and 30 million R for relative poverty line by economic analysts. "What is the consumption per liter?" The purpose of this question is to obtain the average consumption per person and to rank them according to the world standard.

"The bill period has been several days." The purpose of this question is to find the average daily intake as well as the monthly intake per person.

"What month is the bill for?" In order to classify consumption in 4 seasons, it required months of issuance of the bill, which was attempted to obtain it, but due to irregular periods of issuance, it was not successful.

"Are you satisfied with the quality of water provided?" In order to find out the effect of satisfaction on consumption of this question in the questionnaire was mentioned.

"Do you want to reduce the amount of household consumption by doing things like cooling down the roof and using the downsides and so on." The purpose of this question was to assess the readiness of people to conserve water and to express their views on the results of these systems.

Questionnaire on drinking water consumption pattern in households in Mashhad

Introduction: This questionnaire is designed to investigate the relationship between drinking water consumption by number of households and household income, and is simply a research paper entitled "Investigating the Factors Affecting Household Water Consumption to Save Using Spss statistical software for case study will be used in Mashhad" and will not be used for financial or computer purposes, so thanks in advance for the accuracy of the information provided in the questionnaire.

Instructions: In answer to some questions this questionnaire requires some water bill information so please answer these questions for more accuracy using the latest bill issued.

Please attach your course bill if possible.

1. Name your area of residence. …….
2. How many households are there? ……..
3. How many households hold a bachelor's degree or higher? ……..
4. How many households are over 60 and children under 10? ……..
5. What is the total monthly income of the household (in RIALS)?

To 10 ☐ 10-30 ☐ 30-50 ☐ 50 ☐ more than 70 ☐

6. What is the household consumption per liter? ……
7. How many days has the bill been? …….
8. What months of the year are the bills in question? ……
9. Are you satisfied with the quality of the water provided? …….....
   Yes ☐ No ☐
10. Want to reduce your household consumption by doing things like cooling down, using reducing milk, and so on?
    Yes ☐ No ☐

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Figure 3-1 The questionnaire presented to the subscribers.

By collecting questionnaires, studies on the number of households, the number of bachelors and above, the number of elderly and children, the amount of household consumption and the rate of consumption per person continued. For this purpose, households were categorized into different classes for each study. Regarding the behavior of each class on water consumption, results including the effect of classification parameter on water consumption were obtained.

Excel

Due to data fragmentation and the need to categorize the use of categorization software was inevitable, so the Excel 2016 version software was used to categorize and sort data. In this software, the data in the desired classes are grouped in a column, depending on the ranking requirements, and then to analyze the outputs, the charts for each class against the average water consumption per person per household are plotted. Can.

IBM® SPSS® STATISTICS statistical software

IBM® SPSS® STATISTICS version 23 software was used to analyze the output data from the graph as well as the Excel output data. For this purpose, two independent regression methods, ANOVA and T, were used. In the ANOVA the independent variable contains several groups and in the independent T method the independent variable contains only two groups.

Determining one of the most complete methods available will also be determined.

Therefore, independent data classified in more than two groups are analyzed by ANOVA and independent data classified in two groups are analyzed by independent T-test.

The relationship between education and water consumption.

In this section, we examine the impact of education on water consumption and measure how water consumption changes in relation to changes in household education.

For this purpose, in the questionnaires provided to the subscribers, they were asked to determine the number of households and then the number of people with a minimum bachelor's degree and above the bachelor's degree. Now that the number of households and the number of their pupils varies, it is first attempted to group them together and then examine the relationship between education and water consumption.

To match the number of persons with a bachelor's degree and above, the total number of households divided and the percentage of educated households is determined. Then according to the percentages of subscribers' education in the 0%, 16.66%, 20%, 25%, 33.33%, 40%, 50%, 60%, 66%, 66.66%, 75% and 100% classes Were.

On the other hand, since the amount of consumption for subscribers varies with the number of users, the average consumption per person was calculated. For this purpose, the amount of subscribers' bill consumption was divided by the number of days of bill issuance and then multiplied by 30 days to one month to determine each subscriber's consumption per month.

Finally, the average monthly consumption per person was divided by the amount of consumption per month for each subscriber.

Then water consumption was plotted against education and IBM SPSS STATISTICS statistical software was used to analyze the graph. Using this software, the effect of these two variables on each other and how they were affected were determined.

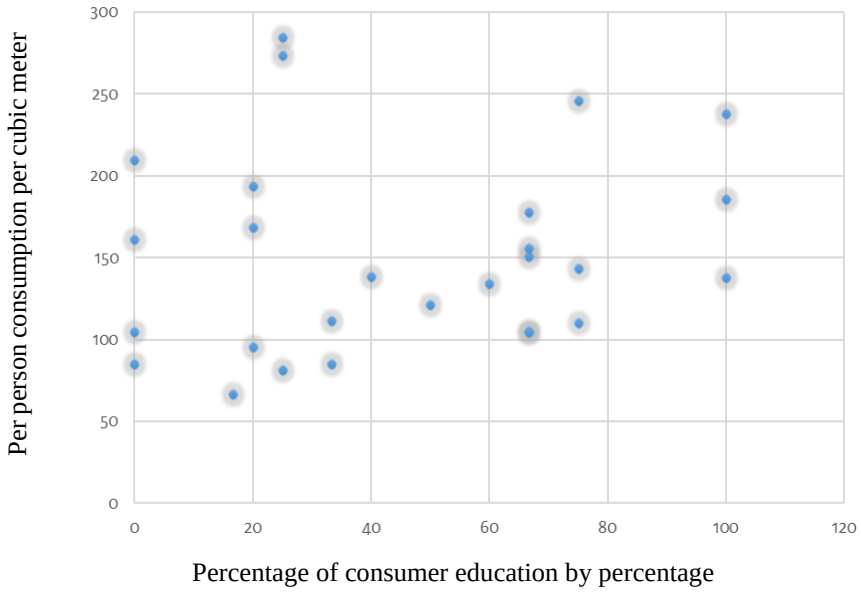

Figure 3-2 illustrates the effect of household education on water consumption

Anova linear regression test is used here to analyze the results. The reason for using this test is because of several independent variables. In this test, the level of education as an independent variable and the average consumption of each person as a dependent variable were determined.

Now by choosing linear regression the result is presented as a table (3-1)

Table (3-1) Results of linear regression between two variables of education and average water consumption per person

ANOVA						
	Model	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2060.519	1	2060.519	.572	.456b
	Residual	90035.189	25	3601.408		
	Total	92095.708	26			

The table of results shows a coefficient named sig which indicates a significant relationship between the two variables. If this value coefficient is less than or equal to 0.05, our relationship between the two variables will be significant, and if this value is higher, the relationship will not be significant and the independent parameter change will not significantly change the dependent variable. Since this coefficient is set at 0.456 here, there is no significant relationship between the two variables of education and average consumption.

Therefore, according to the results of linear regression, the level of education is not correlated with consumption per person and does not change the pattern of household and student consumption.

The relationship between age and consumption

In this section, we examine the impact of household age on water use, and place older people and children in the same category and analyze household consumption of this age category.

To this end, the questionnaires provided to subscribers were asked to determine the number of households and the number of persons under 10 and over 60. The purpose of this age group is due to the different consumption patterns of these two age groups in World Bank data. For this purpose, the percentages of people under 10 and over 60 years of age are calculated and then subscribed.

According to the percentage of people over 60 and under 10 years old, subscribers are classified in 0%, 11.11%, 20%, 25%, 33.33%, 40% and 50% classes.

Here, too, the average consumption per person was calculated as the consumption rate for subscribers varies with the number of subscribers. For this purpose, the amount of subscribers' bill consumption was divided by the number of days of bill issuance and then multiplied by 30 days to one month to determine each subscriber's

consumption per month. Finally, the average monthly consumption per person was divided by the amount of consumption per month for each subscriber.

The water consumption chart is then plotted against the percentage of people over 60 and under 10 years old and IBM SPSS STATISTICS statistical software is used to evaluate the effect of these two on each other.

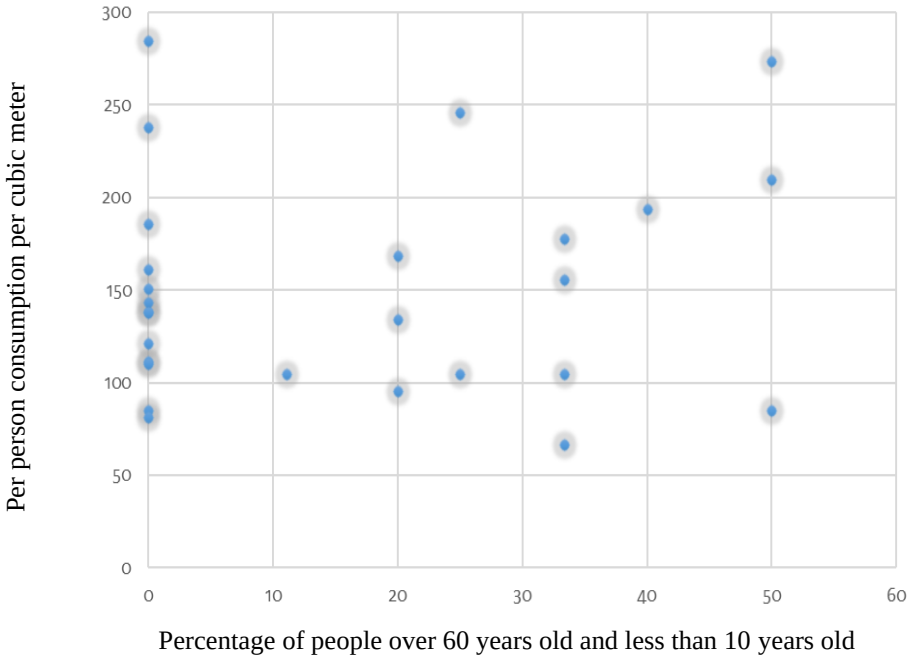

Figure 3-3 Diagram of the effect of age on consumption rate

In this case, ANOVA is used to analyze the results. The reason for using this test is because of several independent variables. In this test, the percentage of people over 60 or under 10 years is determined as independent variable and the average water consumption of each person as dependent variable.

Now by choosing linear regression the result is presented as a table (3-2).

Table 3-2. The result of linear regression between two variables of age and average water consumption of each person.

ANOVAa						
	Model	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1761.568	1	1761.568	.488	.491b
	Residual	90334.140	25	3613.366		
	Total	92095.708	26			

Since this coefficient is set at 0.491 here, there is no significant relationship between the two variables of age and average consumption of each person. The specific process does not change. Therefore, according to the results, the age parameter has no significant effect on household consumption.

The relationship between income and consumption

In this section, we examine the impact of income on water use. To this end, households with incomes of less than 3 million per month in the low-income category (bar chart 1), households with incomes of between 3 and 5 million per month in the middle-income category (bar chart 2) and households with incomes More than 5 million per month are categorized as high income (bar chart 3). The criterion for determining these amounts is the government's announcement of R 7 million for absolute poverty and R 30 million for relative poverty line by economic analysts.

Here, too, the average consumption per person was calculated as the consumption rate for subscribers varies with the number of subscribers. For this purpose, the amount of subscribers' bill consumption was divided by the number of days of bill issuance and then multiplied by 30 days to one month to determine each subscriber's

consumption per month. Finally, the average monthly consumption per person was divided by the amount of consumption per month for each subscriber. Initially, the consumption diagram for the individuals in terms of their income is drawn, then the results are analyzed with IBM SPSS STATISTICS software, and finally the diagrams of the average consumption bars of each income category are plotted and interpreted.

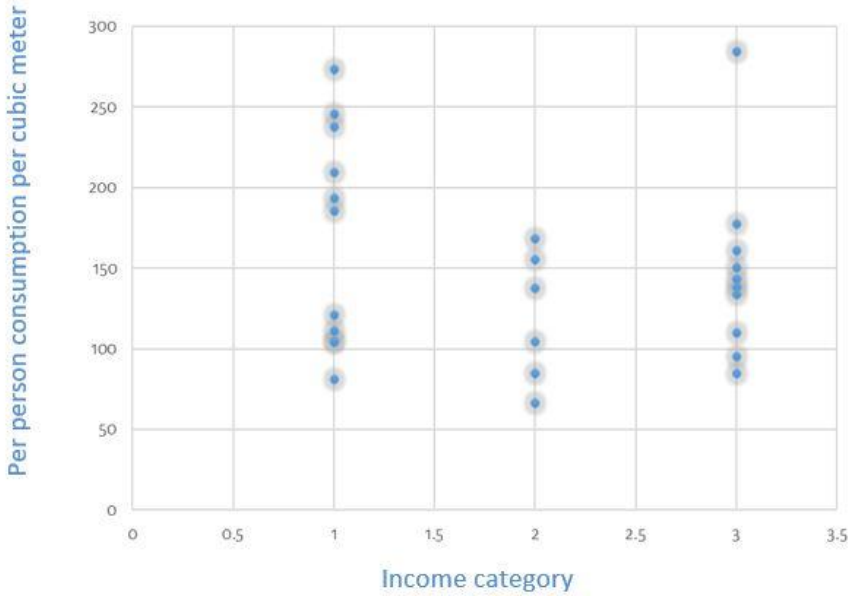

Figure 3-4 Graph of the effect of income parameter on water consumption

Anova linear regression test is used here to analyze the results. The reason for using this test is because of several independent variables. In this test, income is determined as an independent variable and average consumption per person as a dependent variable.

Now by choosing linear regression the result is presented as a table (3-3)

Table 3-3. The result of linear regression between two variables income and average water consumption per person

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2703.310	1	2703.310	.756	.393b
	Residual	89392.398	25	3575.696		
	Total	92095.708	26			

Since this coefficient is set at 0.393 here, there is no significant relationship between the two variables of income and average consumption per person. The specific process does not change. Therefore, according to the results, the income parameter does not have a significant effect on household consumption.

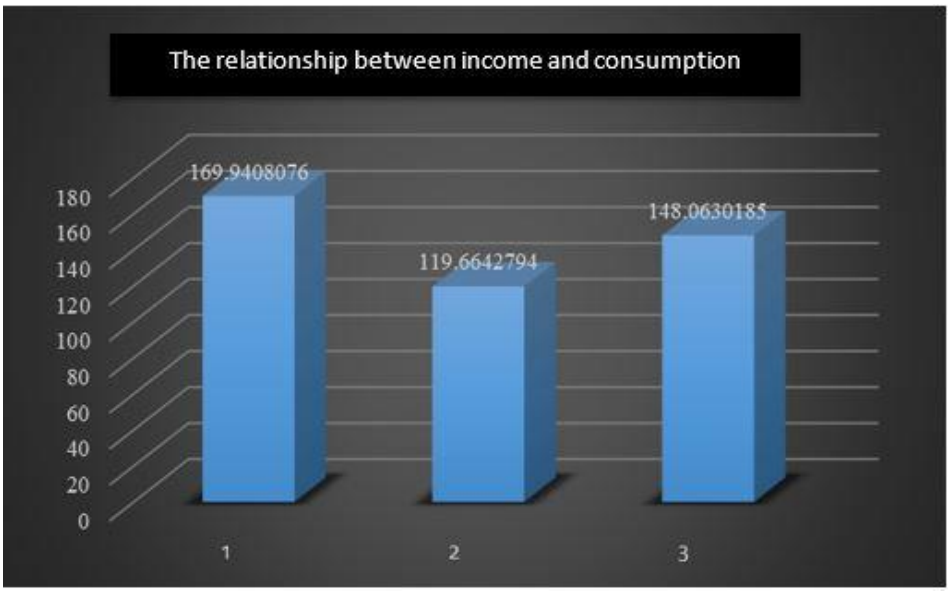

Figure 3-5 shows a bar graph of water consumption per class

To draw this graph, we first calculate the average of each person in each of the three categories and then plot the average consumption according to the income class in bars. Chart analysis shows that income has no effect on consumption and since most households are in a balanced consumption category, consumption is influenced by daily needs and is not affected by income.

General satisfaction with water quality provided

This section examines the households' satisfaction with the water provided by the Water and Wastewater Company with respect to water prices.

To this end, the questionnaire asked the respondents to express their satisfaction or dissatisfaction with the product presented. Subscriber satisfaction was then determined (Figure 3-6). On the other hand, the subscribers with relative satisfaction in one class and the subscribers in the other class were compared and their usage was evaluated and the diagram was drawn (Figure 3-7).

Here, too, the average consumption per person was calculated as the consumption rate for subscribers varies with the number of subscribers. For this purpose, the amount of subscribers' bill consumption was divided by the number of days of bill issuance and then multiplied by 30 days to one month to determine each subscriber's consumption per month. Finally, the average monthly consumption per person was divided by the amount of consumption per month for each subscriber.

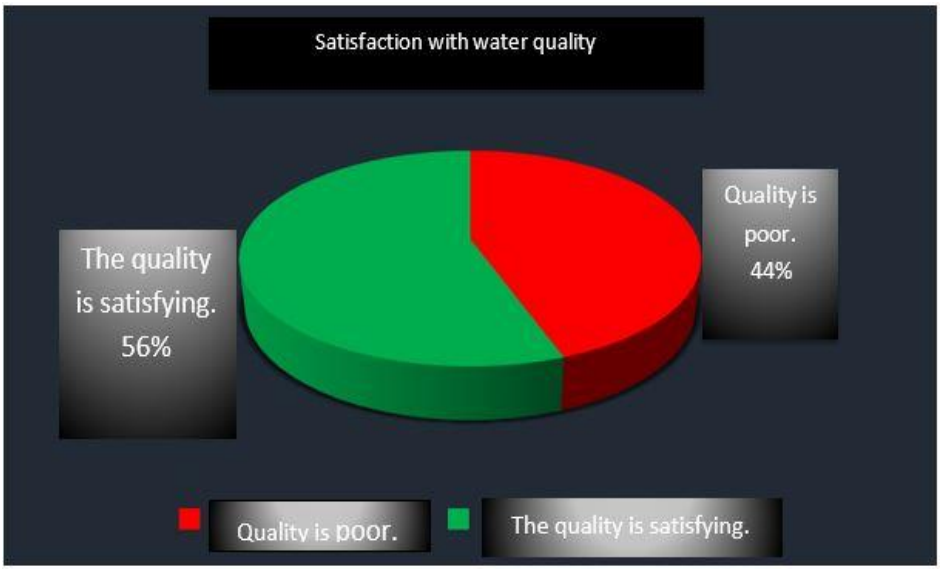

Figure (3-6). Graph of subscribers' satisfaction with the water quality provided

A survey found that 56 percent of the relative quality of water was satisfied with the price of water and 46 percent considered it poor. We will now analyze whether satisfaction has an effect on consumption and how it works if effective. For this purpose, data were classified into two groups of satisfied and dissatisfied and the consumption of each class was analyzed using IBM SPSS STATISTICS software to determine the significance of this relationship.

Table (3-4) Statistics of Independent Variable Groups in Independent T-Test for Relationship between Satisfaction with Water Consumption per Person

	VAR00001	N	Mean	Std. Deviation	Std. Error Mean
VAR00002	.00	12	123.7073	40.99108	11.83310
	1.00	15	172.2318	64.31800	16.60684

The table (3-4) shows that the average consumption rate for the first group who are dissatisfied is 123.7 and for the second group that is satisfied is 173.23. Increased satisfaction Increases consumption.

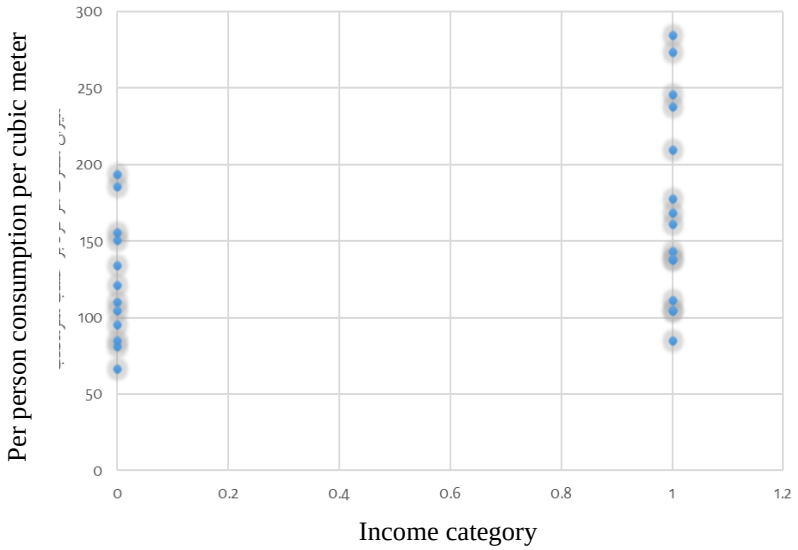

Figure (3-7) Diagram of the effect of satisfaction parameter on water consumption

Independent T-test is used here to analyze the results. The reason for using this test is because the independent variable only includes the group. In this test, satisfaction rate was determined as independent variable and average person's consumption rate as dependent variable. Now by selecting independent T, the result is presented as a table (3-5).

In order to analyze the result, we examine the (2-tailed) sig column. If the values of this column are less than 0.05, the relationship between satisfaction and water consumption will be significant, while it is significant to sig value in the column. Levene's test is considered if this value is greater than 0.05 and the first row is less than 0.05 and the second row numbers are dealt with. Now that the value of this parameter is 0.1, the first row will be the criterion for action. Then, we examine the Group Statistics table to examine the relationship between the two variables.

Table (3-5) Independent T test result between two variables satisfaction and average water consumption per person

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
VAR00002	Equal variances assumed	2.911	.100	-2.266	25	.032	-48.52446	21.41003	-92.61924	-4.42968
	Equal variances not assumed			-2.380	23.963	.026	-48.52446	20.39140	-90.61367	-6.43524

4.Conclusion

According to studies on water pricing, the principles of fairness and equity, the principle of efficient allocation, the principle of income redistribution, the principle of conservation and conservation of water resources, the principle of social welfare, general acceptability, simplicity and transparency and ease of implementation It should be taken into account.

Based on studies and surveys of subscribers, it was concluded that subscribers generally fall into the category of balanced consumption.

By examining the relationship between education level and consumption per person, it is determined that since the coefficient of sig is 0.456, there is no significant relationship between the two variables of education level and average consumption rate per person. Therefore, according to the results of linear regression, the level of education is not correlated with consumption per person and does not change the pattern of household and student consumption.

Observing the relationship between age and consumption per person is determined by considering that the coefficient of sig is 0.491, so there is no significant relationship between two variables of age and average consumption per person. It means that by changing the age independent variable, the amount of water consumed per person does not change with a certain trend. Therefore, according to the results, the age parameter has no significant effect on household consumption.

By examining the relationship between the number of households and the consumption per person, it was found that the coefficient of sig was 0.078 which is very close to 0.05. Households are meaningful and the average consumption per person decreases with the increase in household population. In other words, by adding each person to the family, the average consumption per person decreases by 12.697 liters, so the number of households per household decreases.

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