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Water use efficiency of urban households in the Mediterranean region of Turkey

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ABSTRACT

Water is vital to the sustainability of life and social and economic development. Inability to substitute water scarcity and speculations that the world shall face several water crises in the long run, raises consciousness towards wise water use. Thus, countries have a focus on water supply and demand management. While average daily per capita water use differs between countries, water consumption habits bear plenty of similarities. This study aims at demonstrating water consumption and saving attitudes of households in urban settings through a sample of 965 households from western Mediterranean region of Turkey. The simple descriptive statistics obtained from Adana, Antalya and Hatay provinces showed that 25.3% of households maintain practices in order to reuse and save water. It was found that 66.7 % of waste water was used at toilet, 17.3% in plant watering and 16% in cleaning balconies or similar parts of the house. The tap water was mainly used for cooking, laundry, personal care as well as for garden irrigation (66.2%) and car washing (57.7%). The data obtained demonstrates that development of marketing activities and policies to improve conscious tap water use in households are rather important.

Keywords: Tap water; Household; Water-saving; Turkey

1. Introduction

The most common problem expected for the future is the availability of clean drinking water. This has been considered as a problem for mainly water-poor countries until now. However, reduction of daily water consumption as well as trying to save water resources is a must for water-rich countries as well, considering the change in climate conditions and increasing population and rising water demand. That is why the factors affecting extensive water use and trying to reduce water consumption in the most effective way are on the agenda of all countries.

Water use can be classified into (i) potable water, (ii) stream water, (iii) industrial or commercial use like irrigation water, water for fire extinguish and (iv) purposes for fishing, swimming or sea transportation [1]. In addition, countries are classified with respect to water stock available per capita. The limits to determine adequacy of water resources are referred by the UN [2]. The countries with 1,000 m^3 per capita consumption annually are considered as 'water poor', while the ones with less than 2,000 m^3 are considered as 'in water shortage' and the ones with more than 8,000–10,000 m^3 are considered as 'water rich'. The average quantity in the world is approximately 800 m^3/y accordingly. 20% of world population or 1.4 billion people are deprived of sufficient safe potable water today and 2.3 billion people do not have access to healthy water. It is estimated that more than 3 billion people will face water scarcity by 2025. According to Food and Agriculture Organization (FAO), while the proportion of population suffering from water scarcity and water stress was 29% and 12% in 1995, these ratios are expected to rise to 34% and 15% in 2025 [3]. Additionally, it is expected that 54 countries will experience water shortage in 2025 and around 3.8 billion people will get affected from this. Yet, 40% of the world

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population, 9.4 billion, is expected to suffer from water shortage in 2050 [4].

While average daily per capita water consumption differs in developed and developing countries, regional and geographic dispersion is also effective in the changing daily consumption. This situation requires focus on water use habits and water saving.

It is important to note that between 10–30% of total water consumption around the world can be attributed to domestic use [5]. While daily water consumption for personal needs increases in many countries as a global trend, it has stagnated in Europe and North America. Switzerland is the best example for consideration. Water use per capita has decreased over the last 25 years. Today Swiss households are consuming 160 L of water per person daily, which is 20 L lower than it was 20 years ago [6]. This declination points out the saving achieved in Swiss daily lives. Accordingly, it is intended to investigate the household consumption behaviors and attitudes on urban level through a regional sample in Turkey. The main idea is to understand how residents do consume water and what sort of activities do require more water utilization.

It is important to revise the background studies to construct a base for comparison. Renwick and Archibald [7] estimated the water demand of households in California, the USA with the data they collected from various resources (households, monthly bills and phone calls) in 1998. They discovered that the size of the household has a positive effect on water use. This information regarding the positive correlation of the family size and daily water requirements is in conformity with the expectations. Persson [8] surveyed the preferences of households in potable water springs in urban areas of one of the largest city of Philippines, Cebu in 2002. Household choices regarding water consumption and impacts of price, taste and size of household on different consumption preferences were investigated. Time cost was found out as an important determinant of household choice of drinking water-source while taste proxied by income had ambiguous effect. Domene and Sauri [9] surveyed the effects of urbanization and demographic, behavioral, housing features on water use of households in Barcelona, Spain. Daily water use per capita in urbanised parts of the city was calculated as 120 L and it was reported that 72% of this amount was used for personal hygiene (bath, shower, and toilet) in 2005. Also, consumer's manner about water use, dwelling type, gardening needs and size of the household were reported as important determinants for water use per capita in the study.

However, price has been considered as the best instrument to encourage households to consume less due to evaluations of some economists even though water demand has been considered as price inelastic. The price policy was considered as a better conservation tool as supply cuts seem to result in higher welfare losses in a study conducted in Spain [10]. Besides, measurement and restriction tools were developed as alternative water saving methods. In an OECD wide study with 10,000 participants, Millock and Nauges confirmed effectiveness of water consumption measurement in accepting water conservation behavior and adoption of water-efficient tools. In their study, they pointed out declaration of water consumption amount as effective as pre-developed environmental attitudes and relevant socio-economic, attitudinal, behavioral characteristics of households [5].

It is important to note that the number of environmental behavior and environmental psychology studies conducted in order to undermine the factors affecting water consumption has been rising recently. With a sample from South Australia (410) and Victoria (205), targeted single and multiple households were surveyed by Jorgensen and his friends [11]. They found that while individual motivators affect water consumption in terms of amount and rate of change on single households and concluded that household size is a consistent estimator of the amount of water consumed. Besides, a theoretical study conducted by Jorgensen and his friends investigated the behavioral structure that affects water consumption habits [12]. The study set forward that trust in water provision and measurement agencies is another significant factor affecting water consumption in addition to demographic and housing characteristics and perceptions on water waste.

2. Material and method

Main material of the research was cross-sectional data collected via face to face surveys from urban resident households. Data of the research field was supplied from Metropolitan Municipality records of the cities that fall under the study and from the sources of the State Institute of Statistics.

The field of the study is the Mediterranean region of Turkey, which is one of the water rich regions of Turkey. Sampling frame of the research was defined as urban households of Antalya, Adana and Hatay cities from the region. Adequate sample size for the research was determined as 965 households, of which the detailed allocation is provided in the annex (Table 1) [13].

After sample size of the study was determined with regards to random sampling, it was distributed proportionally between neighbourhoods considering the population density according to the created frame list.

Table 1
Research field population and sample size

Cities	Central District urban population* (N)	Sample size (n) ± % 5	Deviation from statistical population within 95% confidence limits
Antalya	775.157	322	0.000415 < 0.05
Adana	1.366.027	322	0.000235 < 0.05
Hatay	186.243	321	0.00172 < 0.05
Total	2.327.427	965	0.000414 < 0.05

Information and data collection methods used in marketing research are survey, observation and experiment groups mainly. Among these methods most frequently used one is the survey method, which can widely be seen in the literature [14]. Micro consumer data of research collected via field study was analysed and evaluated with SPSS 13.0 statistics program. Simple descriptive statistics were used

as the data analysis method in this research in order to enable comparison.

3. Results and discussion

3.1. Social and demographic profile of households

Modern or consumer oriented marketing considers the correct determination of consumer requests and needs as very essential. This is crucial in order to develop policies and products or services to meet these needs with a higher satisfaction level than the opponents. In this direction; demographic, economic, politic, technologic, social and cultural features that effect the consumer and consumer's behavior should be described. Within this content; information about gender, age, education, marital status, household size and features of some houses of sample populace was given in this part of the study.

53.3% of interviewed subjects were female while 46.7% of them were male. Age distribution of the population was as followed: 17.2% aged 18–24, 32.6% aged 25–24, 24.7% aged 35–44, 16.6% aged 45–54 and 8.9% was aged 55 and over. With this distribution, it can be said that the sample group reflects the overall population statistics. Household population with university and higher education degree was 46.2%, while it was 41.5% with middle school and high-school education degree. The share of the population with elementary school graduation was 14.1% and with out-of-school literacy was 2.0%. A considerable part of the subjects were married with 67.6 %, while single household ratio was 28.4% and divorced-widow ratio was 3%. Approximate household size of the examined households was found as 3.51 people in the research and this result represents the elementary family model consisting of mother, father and 1 or 2 children in urban life. Residency duration plays a determinative role in the formation of urban consumer culture. According to the obtained data, approximate urban residency duration was determined as 27.52 years and ratio of households reside in the urban area for more than 20 years was determined as 67.8%.

Households of the study were evaluated in terms of their dwelling type as well. Dwelling is defined as the shelter made for the inhabitancies of one or several households, contains easiness for basic needs such as sleeping, cooking, heat-protection, bathing and lavatory that were vital for human survival. According to another definition, they're structures that correspond to the human's basic sheltering needs. Concept of dwelling is defined as 'An autonomous entity belongs to a person, family or social group and satisfies the sufficient conditions for living' while for the individual in addition to fulfilling the sheltering need, it's a social security element, a symbol of propriety right and possession feeling. Dwelling, in addition to sheltering need, is an element which responds to social respect need from Maslow's needs' pyramid. Meaning of dwelling differs from society to society and it also means a place where an alliance of values exists [15,16]. With reference to the assumption of a positive correlation is expected between dwelling type and household water use. Household's residential buildings range as 31.3% multi-storey garden house, 29.6% middle rise (4–6 storey) building, 27.2% high rise building (7 storey and above), 11.3% 1–3 storey gardenless house and 0.6% villa-type dwelling (Table 2).

Table 2
Dwelling type

	Frequency	%
High rise buildings (7 storey and above)	262	27.2
Middle rise building (4–6 storey)	286	29.6
1–3 storey garden house	302	31.3
1–3 storey gardenless house	109	11.3
Villa	6	0.6
Total	965	100.0

3.2. Household domestic water use

Access to clean potable water is a fundamental need for every individual and is the most important fact of human rights. Potable water can be defined in a strict sense as supplied water for the purposes of human consumption, food and drink preparation by some institution or person and cleaning of every material used for this preparation and consumption [17].

Water need of an individual in a society is defined as per capita and in litre for 24 h duration. A person needs 2.5 L of water physiologically per day. 0.5 L of this is obtained with solid foods. For the majority, daily functions can be maintained with 5 L. Additional water is needed for the ware used and dwelling cleaning [1].

Monthly water use of interviewed households in research field was 13.76 m^3. Monthly per capita water use was calculated as 4.37 m^3. When this amount was stated as daily per capita; 145.7 L comes up as the amount (Table 3). Water use per capita is directly linked to development level of society. This number is considerably high in developed countries while it is relatively low in developing ones. Water use per capita is 266 L in industrialized countries, 184 L in Latin America, 158 L in Arab countries 143 L in Asia and 67 L in Africa. Daily water use per capita is approximately 111 L in Turkey. This number is 141 L for Ankara and 125 L for Istanbul as a representation [18]. Along with region's development level, climatic factors like high temperature as well play a determining role in above average water use per capital of cities.

Findings regarding household tap water use are presented in Table 4. As can be seen from the results, 90.5% of the households interviewed use tap water for cooking and

Table 3
Household water use amounts

	Mean	Standard deviation
Monthly household water use (m^3)	13.76	7.425
Daily household water use (m^3)	0.459	0.274
Monthly per capita water use (m^3)	4.37	2.732
Daily per capita water use (lit)	145.7	0.091

Table 4
Usage areas of tap water of households (N = 965)

	%
Cooking	90.5
Tea, coffee making	86.1
Shower, laundry, toilet	98.1
Personal care (shaving, tooth brushing, washing hands and face, etc.)	98.7
House cleaning	98.1
Rug-carpet washing	91.5
Plant watering	88.2
Garden irrigation	66.2
Car washing	57.7
Stairs-doorstep cleaning	80.9
Balcony cleaning	91.9

86.1% for tea-coffee making with the highest ratios. Personal hygiene and household cleaning has been additional fields of use. High ratios detected for tap water use in doorstep cleaning, garden irrigation and car washing are inconsistent with water use consciousness. In fact, it's observed that 66.2% of households use tap water for garden irrigation and 57.7% use it for car washing.

Practices of households for the purpose of reutilization of tap water were also examined. Accordingly, a common attitude or action hasn't been observed in households for the purpose of reutilization of water. Ratio of households that reutilizes water was 25.3%. This situation draws attention to developing water usage consciousness, which approximately 4 out of every 10 households have.

When tap water reutilization fields of households were examined, it's understood that 66.7% of households reutilize it in toilet cleaning, 17.3% reutilize it in flower watering, 12.7% reutilize it in balcony cleaning and 3.4% reutilize it in other practices (Table 5).

Under the scope of the study, water leakage problem in households was also researched. In parallel with the approximate age of the dwelling, 19.9% of the households have a water leakage problem. This result indicates another important advantage that may come out within the scope of urban transformation is dwelling renovation projects [19]. Available water loss based on dwelling age and infrastructure is viewed as a mutual public responsibility issue where water resources are rapidly diminishing.

Table 5
Reutilization areas of water (N = 965)

	%
Yes, waste water is used for toilet cleaning	66.7
Yes, waste water is used for irrigation of flower	17.3
Yes, waste water is used for balcony cleaning	12.7
Yes, other…	3.4
Total	100.0

Water-saving device possession ratio in households was investigated as another indicator of tap water use and savings consciousness. Accordingly, households that possess water-saving device in urban area is found out as 5.9%. This means that tools and equipment for water saving are not being used widely at the household level. In the process of developing water saving consciousness, attitude and act development, there is a need for promoting and encoring the technological infrastructures. Majority of households thinks that people do not use water consciously and the society is not well informed for water usage consciousness [20]. This result supports the need for public service advertisements, public relations and social marketing practices to encourage the water consciousness.

4. Conclusion

Tap water management stands out as an important field of development in public level due to the findings of the survey, considering the tap water using attitudes. In water supply evaluation, the sufficiency of water resources, infrastructure, environmental pollution, etc. stand out as primary policy fields. However, sufficient water supply to households, water quality and hygiene and perceptions, attitudes and behaviors of people towards water use are primary concerns for demand management. Formation of sense of conscious water use is a shared responsibility in this respect. The micro data plays a significant role in developing effective and efficient policies regarding the issue. The variations between countries might also appear within the country due to geographical, demographical, economical and psychological factors.

Improvement in living conditions associated with social and economic development, with-no-doubt, increases the need for potable and tap water per capita. In addition to that, unconsciousness in household water use or tap water misuse is commonly monitored in societies. Decreases in per capita water use in developed or water poor countries can be associated with consciousness-raising and promotional activities as in the USA [21] or in Jordan [22]. As a model, especially in developing countries, need for encouraging policies and practices for conscious usage of water becomes a current issue. Price and income variable plays a determining role in sensitiveness for usage of a product. Differences between water and electricity usage habits can be associated with unit prices of subject products. Naturally; if the unit price of a product increases, demand of the product becomes more elastic as an expected outcome. Reduction of water resources, environmental pollution etc. factors, infrastructural investments with increasing costs on one hand bring forward the topic of access to sufficient water and on the other hand increases the supply cost of tap water. This means that rise in unit water price is expected in oncoming periods. Rise in prices is expected to have a limitation effect on water use especially in low and middle income groups. Consciousness level in high income groups is dependent on non-price and non-income factors comparatively.

Finally, as the population density is higher in middle and low income groups mostly in less developed and developing countries, any improvement in water saving and consciousness is expected to produce considerable outcomes. Increasing availability and access to water-efficient tools

and increasing awareness is considered as an essential process to be followed due to the findings of the survey.

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