

Potable water. Consumption preferences among the population of Mureș County, Romania

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Abstract: Background: Water covers 75% of the Earth's surface and is essential for drinking, hygiene, agriculture, and industry. An individual requires roughly 5 liters daily to survive in moderate climates with minimal physical activity. Globally, about 4 trillion cubic meters of freshwater are consumed annually, yet drinking water distribution and consumption vary significantly. Consumer preferences, such as tap versus bottled water, have implications for public health and sustainability. Objective: This study aimed to evaluate drinking water consumption behaviors in Mureș County, Romania, focusing on preferred water sources and influencing factors. Methods: A cross-sectional survey of 1,310 adults, customers of the regional water supplier, was conducted through an online questionnaire assessing water sources, consumption habits, expenditures, and quality awareness. Tap water and popular bottled waters were analyzed for quality differences using statistical tests. Results: The majority of respondents (61%) bottled water, while 37% chose tap water; 15% consumed both. Tap water was mainly used for cooking (89%) and washing (93%). Many respondents (59%) spent an additional 10–50 RON monthly on bottled water. Younger adults favored bottled water. Conclusions: Although tap water met safety standards, bottled water remained popular, suggesting a need for public awareness initiatives promoting sustainable tap water usage.

1. Introduction

75% of our planet surface is covered by water, that is why it is called the Blue Planet, but 97.5% of the water is salty water, only 2.5% of the water is fresh, is (drinking) water. Moreover, 10 billion tons of fresh water are used around the world every day.

A lot of organizations and ecologists warn about the decrease in the potential of supplying humanity with drinking water (Humă, 2015; Berardi et. al, 2022).

More than a billion people in developing countries do not have access to safe drinking water. The US, on the other hand, uses 14.74 trillion liters of water per month (Patel et. al, 2017).

According to the World Health Organization, 80% of all diseases in the developing world are water related. By 2025, the United Nations estimates that 30% of the world's population living in 50 countries will face water scarcity (Humă, 2015).

Water scarcity is a bigger problem today than ever before. Not only are available resources being depleted, but the world's population continues to grow, increasing demand. Climate change is exacerbating the problem. There is a risk that the Blue Planet could end up without a drop of water safe to drink (Zhang et. al, 2021; Voda et al., 2019).

In addition to drinking, water is used for personal hygiene, washing clothes, maintaining households cleanliness. A person will need an average of 5 liters of drinking water per day to survive in a moderate climate with little activity. Globally, around 4 trillion cubic meters of fresh water are consumed per year (Humă, 2015). Water consumption is not only the water we directly use in households, but also “virtual water” – the water embedded in producing the goods and food we consume (Whitney *et al.*, 2018). For example, daily *per capita* water use including food production is estimated at 3,496 liters when accounting for virtual water. Efforts to reduce water consumption in various sectors will have limited impact if we ignore the significant amount of virtual water in our consumer products (Sun *et al.*, 2022).

Housing expenses include water expenses in addition to electricity and gas. Outside of these, there are no precise calculations for the water consumption needed for a minimum decent living; existing data are only indicative (National Institutes of Statistics), regarding households expenses in the urban environments (Voda *et al.*, 2018).

According to the recommendations of the International Health Organization, the daily requirement of water to meet all daily needs is estimated at ~100 liters per person—about 12.2 per month for a household of four. The European average is 144 L/person/day, which could be reduced to ~129 L with responsible use (European Environment Agency, 2018). Indeed, humans can survive without food for weeks (using stored energy), but lack of water is life-threatening within days. All systems and organs depend on water for optimal functioning (Feru, 2012). Hydration, along with nutrition, exercise and rest are the most important determinants of a healthy and balanced body, energetic and strong for every day in all stages of life and to vulnerable groups such as children, the elderly, pregnant women (Popkin *et al.*, 2010, Voidazan *et al.*, 2018).

Access to drinking water in Romania is provided either through a centralized system or from private sources (wells, springs) or by purchasing bottled water from the market. The public water supply service (Law no. 241/2006) operates in municipalities, towns, and communes (Government of Romania, 2006). In the studied area, access to public drinking water is facilitated by a local water company. However, anecdotal evidence suggests that many residents prefer bottled water for drinking, even though the tap water supplied to the network can be safely consumed.

This behavior is not unique to Romania; in developed countries, bottled water is often perceived as a healthier and tastier product than tap water.

The result has been a rapidly growing bottled water market worldwide (a 73% increase from 2010 to 2020, with sales expected to almost double by 2030).

Understanding these consumption preferences is important for public health, resource management, and sustainability. Our study addresses this issue by providing new data on water consumption preferences in an Eastern European population, thus contributing to international knowledge on drinking water behavior.

The main objective was to evaluate the drinking water consumption behavior among adults in Mureș County. We specifically aimed to identify the preferred sources of water for hydration, analyze how socio-demographic factors (such as age, residence type, and household size) influence these preferences, assess related aspects like household water expenditures and label-reading habits, and compare the quality of the local tap water supply with that of bottled water. By doing so, we seek to clearly articulate the regional challenges and inform strategies to promote safe and sustainable water consumption.

2. Materials and Methods

Study design and population: We conducted a questionnaire-based survey to evaluate drinking water consumption habits among the population in the service area of the Mureș County drinking water company. The investigated population comprised adults (age ≥ 18) who are customers of the public water supply in Mureș County (Appendix 1 details the service areas). The questionnaire was completed voluntarily and

anonymously, using the Google Forms online platform. A total of 1,310 complete responses were recorded. The questionnaire included questions about the use of tap (mains) water, preferences for water used in hydration (drinking), monthly expenses related to water consumption, use of water filters, and the habit of reading the information on bottled water labels.

In addition, we collected and analyzed samples of drinking water from the public network as well as several popular bottled waters. These samples were tested in the laboratory for key physico-chemical parameters (turbidity, pH, conductivity, mineral content such as bicarbonates, sulfates, chlorides, etc.) using standard analytical methods. This allowed a direct comparison of tap water quality versus bottled water quality under local conditions. Figure 1 presents a schematic overview of the study on water consumption and the physicochemical analysis of the water consumed by the adult population in Târgu Mureş County.

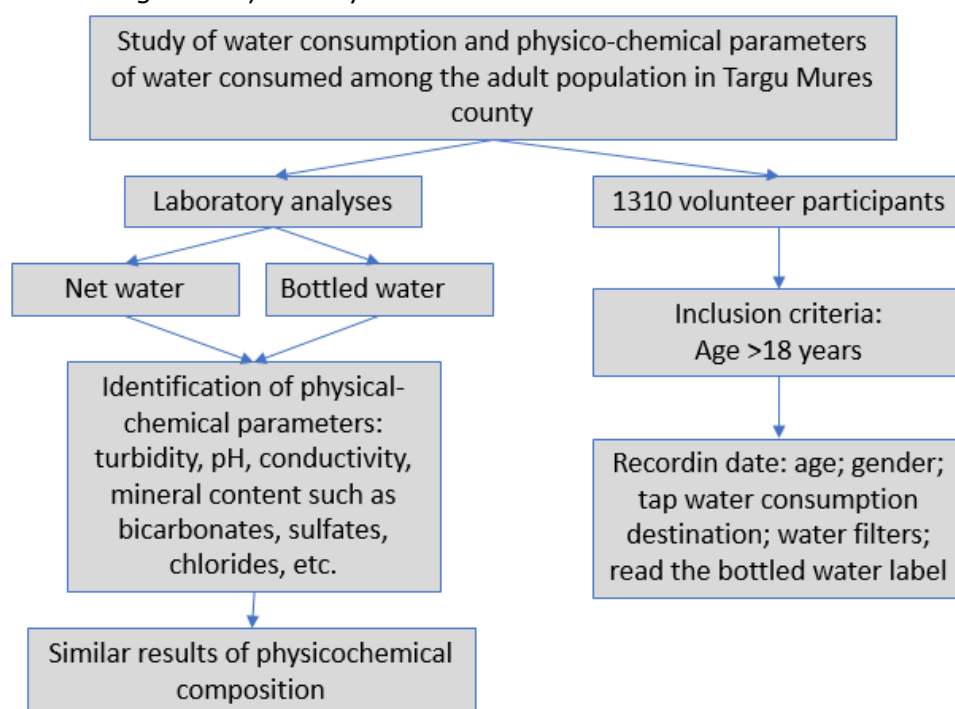


Figure 1. schematic presentation of the methodology

Statistical analysis: To identify associations between respondents' use of tap water and various factors, we applied the Chi-square test for categorical variables. The Chi-square test was also used to examine associations between socio-demographic characteristics and water source preferences (tap vs. bottled). For numerical variables, we calculated frequencies and percentages, as well as means and standard deviations. Data distribution normality was tested to inform the choice of parametric or non-parametric tests. The comparison of water quality parameters between the tap water samples and bottled water samples was performed using the appropriate statistical test (*t*-test for normally distributed parameters marked with * in tables, or Mann–Whitney U test for non-normal data marked with **). The statistical analyses were carried out using GraphPad Prism (v.9), with a significance threshold set at $p < 0.05$.

3. Results

Water usage patterns: Most respondents (44%) reported that they use water from the public supply system for all purposes – their own consumption (drinking/hydration), cooking, and washing. Meanwhile, 21% of respondents use tap water only for cooking and washing (not for drinking). Another 14% of the population use tap water not only for

personal consumption, cooking, and washing but also for other needs such as garden irrigation.

Preferred water source for drinking (hydration): The majority of respondents – 43.13% – prefer bottled water purchased from stores for drinking, followed by 25.34% who prefer tap water, and 9.85% who use water from natural springs for drinking. A notable share of users reported using multiple sources for drinking: 9.01% said they drink both bottled water and spring water, and 8.09% said they drink both tap water and bottled water. In total, about 61% of respondents include bottled water among their drinking sources (either exclusively or in combination), whereas about 37% include tap water for drinking (with some overlap between these groups due to multiple sources).

Monthly water expenditures: Almost half of the respondents (49%) reported monthly expenses between 50–100 RON for tap water from the public supply (this includes water used for all purposes, billed by the utility) (Figure 2). Amount paid monthly

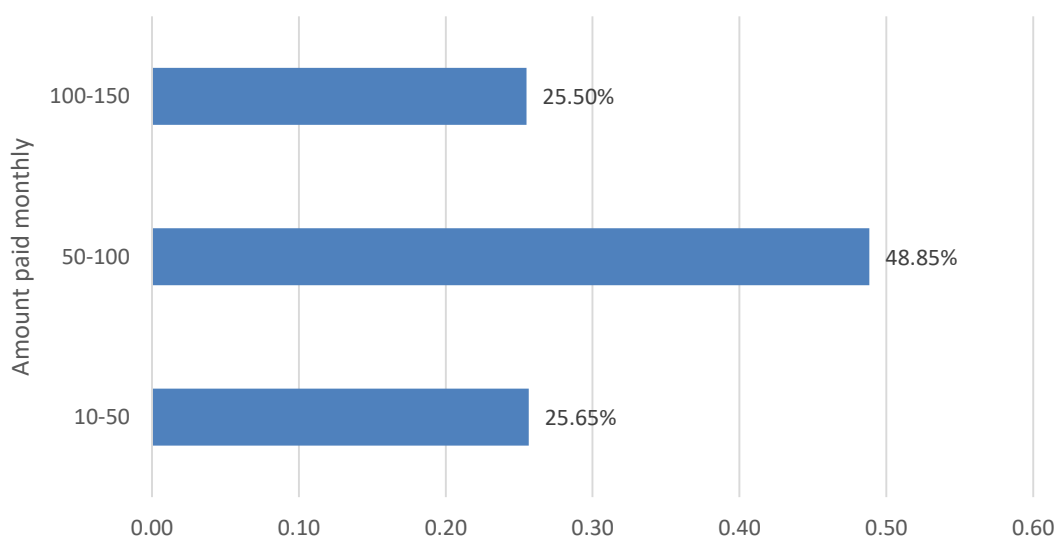


Figure 2. Monthly expenses for tap water consumption

Most respondents (50.63%) reported monthly expenses between 10–50 RON for bottled drinking water – expenses that are **in addition** to what they pay for the tap water supply (Figure 3). In other words, many households incur extra costs to purchase bottled water on top of their utility bills for tap water.

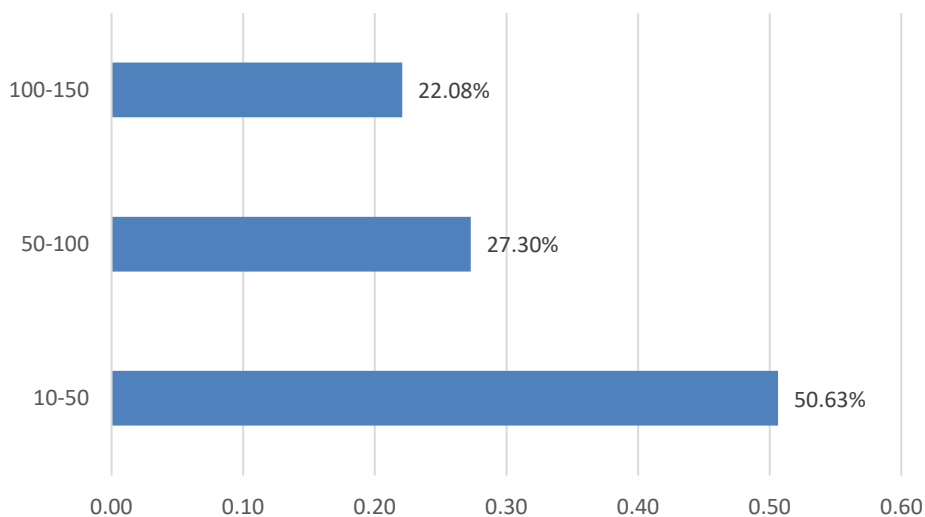


Figure 3. Monthly expenses with water from the network

Reading of bottle labels: We asked respondents whether they read the informational labels on bottled water (and other non-alcoholic drinks). Most respondents (68.8%) indicated that they *do* read the labels on bottled water. However, a considerable number of respondents (22.0%) admitted that they do *not* read the information on the product labels. The tendency not to read labels was higher among the younger population – 33.95% of those aged 18–30 and 25.50% of those aged 31–40 do not read bottled water labels, as opposed to 17.69% for ages 51–60 and only 15.11% for ages 61–99. This indicates an increasing attention to label information with increasing age (Figure 4).

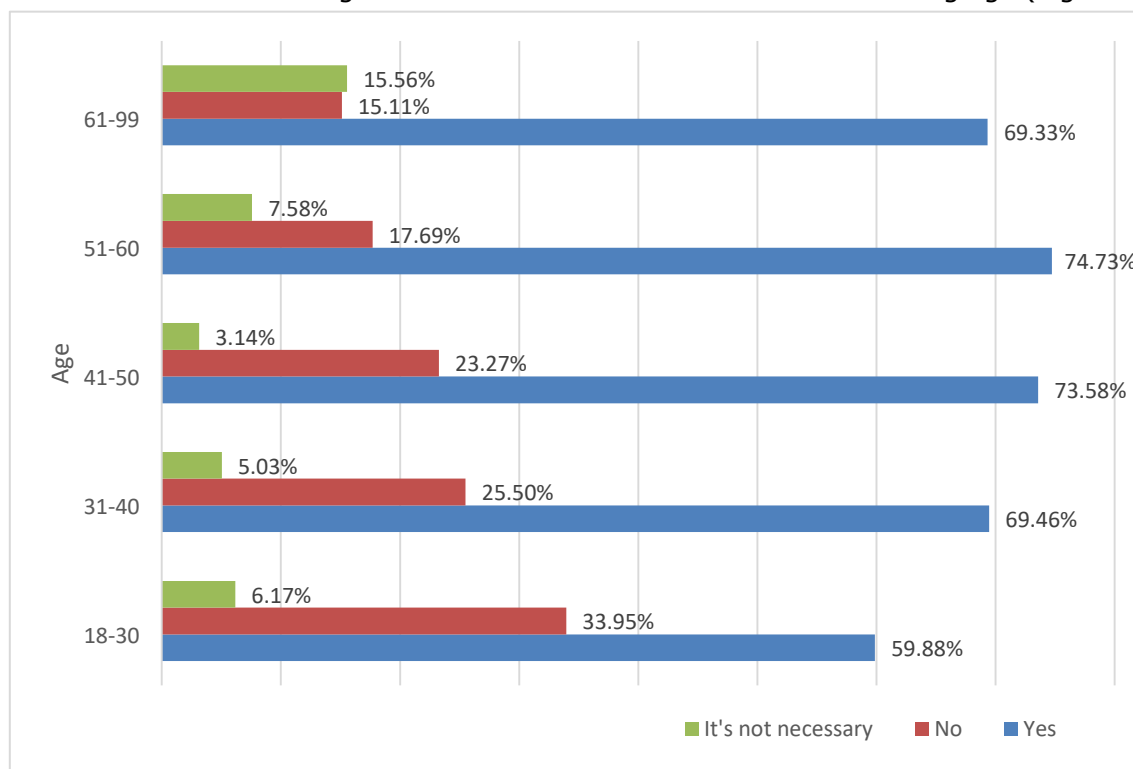


Figure 4. Reading the label on the bottled water packaging - according to age

Factors influencing tap water consumption: We examined which factors are associated with whether people drink tap water or not. The use of tap water for one's own consumption was significantly influenced by certain household characteristics and habits (Table 1). The number of people in the household was one such factor: households with more members were more likely to use tap water for drinking ($p = 0.013$). For example, in households of 4–6 people, a higher proportion reported using tap water for drinking compared to smaller households (1–3 people). The type of water primarily consumed (bottled vs. tap) was obviously strongly associated with tap water consumption ($p = 0.0001$), as was the use of water filters (those using filters were more inclined to drink tap water, $p = 0.002$) and the habit of reading bottled water labels (those who do **not** read labels were slightly more likely to avoid tap water, $p = 0.037$). On the other hand, factors such as age group, gender, urban vs. rural residence, and dwelling type (house vs. apartment) did not show statistically significant differences in tap water consumption in this sample ($p > 0.1$ for each; see Table 1).

The use of tap water is influenced by the number of people in a household, the type of water for consumption and the use of water filters and the habit of reading the labels on water bottles (Table 1).

Table 1. Tap water consumption for drinking vs. other uses, by socio-demographic parameters.

Variables	Own consumption	Other consumption	P value
Age			
• 18-30 years	95 (11.0%)	64 (14.5%)	0,4001
• 31-40 years	174 (20.2%)	124 (28.1%)	
• 41-50years	235 (27.3%)	110 (24.9%)	
• 51-60 years	195 (22.6%)	81 (18.4%)	
• 61-99 years	162 (18.8%)	62 (14.1%)	
Gender			
• Women	475 (55.2%)	264 (59.9%)	0.106
• Men	386 (44.8%)	177 (40.1%)	
Residence			
• Rural	221 (25.7%)	111 (25.2%)	0.845
• Urban	640 (74.3%)	330 (74.8%)	
Type of residence			
• Block of flats	376 (43.7%)	182 (41.3%)	0.407
• House	485 (56.3%)	259 (58.7%)	
Number of people			
• 1-3 pers	609 (70.7%)	290 (65.8%)	0.013
• 4-6 people	239 (27.8%)	147 (33.3%)	
• 7-12 people	13 (1.5%)	2 (0.5%)	
• >12 people	0 (0.0%)	2 (0.5%)	
The type of water for consumption			
• Bottled water	390 (45.3%)	418 (94.8%)	0.0001
• Tap water	317 (36.8%)	13 (2.9%)	
• Both	154 (17.9%)	10 (2.3%)	
Water filters			
• Yes	244 28.3(%)	90 (20.4%)	0.002
• Not	617 (71.7%)	351 (79.6%)	
Read the bottled water label			
• Yes	576 (66.9%)	320 (72.6%)	0.037
• Not	195 (22.6%)	92 (20.9%)	
• It's not necessary	90 (10.5%)	29 (6.6%)	

Factors influencing preferred water source: We also analyzed which factors are associated with *preferring bottled water versus tap water* for one's drinking needs (Table 2). We found that the age of the consumers significantly influenced their preference ($p = 0.003$). In our data, younger adults (especially those 18–30) were less likely to rely solely on tap water for drinking (only 7.9% of that age group drank only tap water, Table 2), whereas older adults were more likely to consume tap water (e.g., 18.8% of those over 60 drank only tap water). At the same time, the youngest group showed the highest tendency to drink **both** bottled and tap (31.1% of 18–30-year-olds used both sources, vs. 10.4% in the oldest group), indicating that younger people often diversify their water sources. Gender did not significantly influence preference ($p = 0.437$): in both women and men, roughly 57% vs. 43% favored bottled vs. tap, respectively (Table 2). Place of residence (urban vs. rural) had no significant effect on preferences either ($p = 0.723$). However, dwelling type (house vs. apartment) showed a significant difference ($p = 0.020$): respondents living in houses were slightly more inclined to prefer bottled water compared to those in apartment blocks (perhaps due to differences in tap water pipe infrastructure or pressure). Household size was again a significant factor ($p = 0.003$); larger households (more members) had a higher likelihood of preferring tap water compared to smaller households, likely for economic reasons. As expected, the intended **use** of tap water was strongly associated with preference ($p < 0.0001$): those who reported using tap water for their own consumption overwhelmingly preferred tap water; those who used it only for other purposes favored bottled water for drinking. The use of a home water filter also influenced preference ($p = 0.0001$): people who use water filters

were more comfortable drinking tap water (and thus less likely to exclusively prefer bottled). Lastly, the habit of reading bottled water labels was associated with preference ($p = 0.0001$): those who do not read labels or think it's unnecessary showed a slightly higher tendency to stick with familiar choices (either tap or bottled), whereas those who do read labels may be more informed and open to tap water if the label information (e.g. mineral content) is favorable.

Table 2. Preferred water source for drinking (tap vs. bottled) by socio-demographic parameters

Variables	Tap water	Bottled Water	Both	P Value
Age				
• 18-30 years	26 (7.9%)	112 (13.9%)	21 (12.8%)	0.003
• 31-40 years	74 (22.4%)	195 (24.1%)	29 (17.7%)	
• 41-50 years	91 (27.6%)	203 (25.1%)	51 (31.1%)	
• 51-60 years	77 (23.3%)	153 (18.9%)	46 (28.0%)	
• 61-99 years	62 (18.8%)	145 (17.9%)	17 (10.4%)	
Gender				
• Women	193 (58.5%)	460 (56.9%)	86 (52.4%)	0.437
• Men	137 (41.5%)	348 (43.1%)	78 (47.6%)	
Residence				
• Rural	83 (25.2%)	211 (26.1%)	38 (23.2%)	0.723
• Urban	247 (74.8%)	597 (73.9%)	126 (76.8%)	
Type of residence				
• Block of flats	158 (47.9%)	322 (39.9%)	78 (47.6%)	0.020
• House	172 (52.1%)	486 (60.1%)	86 (52.4%)	
Number of people				
• 1-3 pers	240 (72.7%)	548 (67.8%)	111 (67.7%)	0.003
• 4-6 people	87 (26.4%)	253 (31.3%)	46 (28.0%)	
• 7-12 people	3 (0.9%)	5 (0.6%)	7 (4.3%)	
• >12 people	0 (0.0%)	2 (0.2%)	2 (0.5%)	
Tap water consumption destination				
• Own consumption	317 (96.1%)	390 (48.3%)	154 (93.9%)	0.0001
• Others without consumption	13 (3.9%)	418 (51.7%)	10 (6.1%)	
Water filters				
• Yes	138 (41.8%)	141 (17.5%)	55 (33.5%)	0.0001
• Not	192 (58.2%)	667 (82.5%)	109 (66.5%)	
Read the bottled water label				
• Yes	200 (60.6%)	578 (71.5%)	118 (72.0%)	0.0001
• Not	75 (22.7%)	175 (21.7%)	37 (22.6%)	
• It's not necessary	55 (16.7%)	55 (6.8%)	9 (5.5%)	

Aside from the household survey, we performed laboratory tests on samples of the local tap water (public supply) and several bottled waters commonly consumed by respondents. **Physico-chemical water quality:** The tap water from the public network showed generally similar physico-chemical characteristics to the bottled water samples (Table 3). The only parameter in which there was no significant difference between tap and bottled was oxidisability (an indicator of organic content). Notably, there were significant differences in a few parameters: tap water had slightly higher turbidity on average (mean 0.25 NTU vs. 0.18 NTU for bottled, $p = 0.0053$), although both are well within potable standards. Tap water also had significantly lower mineral content in terms of conductivity and dissolved salts: for example, dry residue at 180°C was much lower in tap water (118 mg/L) than in bottled (311 mg/L, $p = 0.0005$). This reflects that the bottled waters tested were mostly mineral or spring waters with higher mineralization. Table 3 summarizes these comparisons, indicating which statistical test was used for

each (parametric *t*-test or non-parametric Mann–Whitney, depending on data distribution).

Table 3. Physico-chemical parameters of local tap water vs. bottled water

Physico-Chemical Parameters Analyzed	Drinking Water from the water supply System Mean (SD)	Bottled Water Mean (SD)	P value
Turbidity	0.25 (0.046)	0.18 (0.037)	0.0053*
pH	7.51 (0.033)	7.87 (0.771)	0.0538**
Oxidability	1.43 (0.299)	1.23 (0.432)	0.2883*
Conductivity	197.1 (10.55)	468.6 (189.9)	0.0007*
Dry residue -180 grd	118 (22.80)	310.9 (127.4)	0.0005*

* Unpaired t test **Mann–Whitney test.

For the mineral content (anions), there were statistically significant differences in bicarbonates, sulfates, and chlorides between the tap water and bottled water (Table 4). The tap water was much lower in bicarbonate (60 mg/L) than the bottled waters (236 mg/L on average, $p = 0.0002$), reflecting the lower mineralization of the tap source. Chloride was higher in tap water (18.3 mg/L) than in bottled (8.33 mg/L, $p = 0.033$), though both are low in absolute terms. Sulfate levels did not differ significantly in this sample ($p > 0.3$). The only anion for which there was no significant difference was nitrate (tap ~3.5 mg/L vs bottled ~5.6 mg/L, $p = 0.3907$), indicating similar nitrate content in both sources – importantly, both well below the regulatory limit for drinking water.

Table 4. Comparison of anion content in tap water vs. bottled water.

		Drinking Water from the water supply System Mean (SD)	Bottled Water Mean (SD)	P value
Anions (mg/L)	Bicarbonate (HCO ₃)	60.20 (5.197)	236.3 (96.0)	0.0002**
	Nitrates (NO ₃)	3.52 (0.168)	5.587 (7.106)	0.3907*
	Sulphates (SO ₄)	14.14 (1.215)	26.62 (31.50)	0.3255**
	Chlorides (Cl)	18.26 (0.9221)	8.328 (12.12)	0.0330**

*Unpaired t test **Mann–Whitney test.

Regarding cations, we found significant differences in overall water hardness, calcium, and magnesium levels (Table 5). Bottled water was much harder (mean total hardness ~11.1 °dH) than tap water (~3.64 °dH, $p = 0.0148$), again consistent with higher mineral content. Calcium in bottled water (46.8 mg/L) was about three times that of tap water (16.7 mg/L, $p = 0.0193$), and magnesium was also higher (16.1 mg/L vs 5.6 mg/L, $p = 0.0033$). There was no significant difference in ammonium (NH₄⁺) levels between tap and bottled (both very low, ~0.01–0.03 mg/L, $p = 0.2846$).

Table 5. Comparison of cation content in tap water vs. bottled water.

		Drinking Water from water supply System Mean (SD)	Bottled Water Mean (SD)	P value
Cations (mg/L) entry 2	Total Durity G	3.644 (0.224)	11.10 (6.426)	0.0148**
	Calcium (Ca)	16.72 (0.855)	46.81 (34.50)	0.0193*
	Magnesium (Mg)	5.60 (0.608)	16.08 (11.81)	0.0033**
	Ammonium (NH ₄)	0.013 (0.004)	0.03 (0.033)	0.2846**

*Unpaired t test **Mann–Whitney test.

4. Discussion

A large majority (around 61%) of the surveyed population in Mureș County prefers bottled water for drinking, whereas about 37% prefer tap water supplied by the public network (the remainder use spring water). It should be noted that users' preferences for drinking water are not exclusive: about 15% of respondents reported using both tap and bottled water for drinking, and 19% reported using both bottled and spring water for hydration. Tap water from the public supply is mainly used for non-ingestive purposes – 93% of respondents use it for washing and 89% for cooking – while only 66% use it for their own consumption (drinking). In rural areas, a notable subset of users (about 19.7%) use tap water for everything including irrigation of gardens, which is expected due to the presence of yards and agriculture. About 74% of households do not use any additional filters to treat tap water (filters are used mostly in some families with many members or particular health concerns). We found that those who prefer bottled water for drinking end up paying more for water each month, since they still often use tap water for other needs (incurring the regular water bill) and then spend extra on bottled water purchases. For example, 59% of our respondents spend an additional 10–50 RON monthly on bottled water. Furthermore, 22% of the population that consumes bottled water does not read the content on the label. The proportion of those who ignore product labels is higher among the young (34.0% for ages 18–30, 25.5% for 31–40) and decreases among older consumers (17.7% for 51–60, 15.1% for 61–99). This is consistent with other studies on how Romanian consumers read food labels (Avram et al., 2020a), suggesting younger people are less interested in label details.

A very large percentage (81%) of the surveyed population also stated that they do not read the drinking water quality reports (analysis bulletins) provided regularly by the county water supplier on its website. In the Mureș area, actively promotes the advantages of tap water consumption through public campaigns (Aquaserv, 2024). These emphasize that tap water does not generate polluting waste, is “living” water (continuously circulated and less prone to bacterial growth due to residual chlorination within safe limits), is constantly tested to meet European quality standards (Ruța et al., 2023), is ~200 times cheaper than bottled water, and has an ecological impact ~300 times smaller than bottled water (given the energy and plastic waste associated with the latter). Bottled water in plastic packaging (PET bottles) is significantly more expensive and generates large amounts of waste worldwide (Westerhoff et al., 2008). The bottling and marketing of water consume resources and produce waste through single-use bottle production. Although PET is less toxic than some plastics, its manufacture emits harmful substances like nickel, ethylbenzene, ethylene oxide, and benzene (Williams et al., 2022). Moreover, the bottled water industry indirectly wastes water: producing the plastic and the product itself requires considerable water input (Tandon et al., 2014).

PET bottles are not biodegradable; they can persist for 500–1000 years, and a significant portion end up polluting natural environments. Almost 90% of the floating garbage in the oceans is plastic (not only PET) (WHO, 2024; Mason et al., 2018). Reducing this problem requires changing harmful consumption habits – especially given that an accessible alternative (tap water) exists and is ignored by many people. It's worth noting that one liter of tap water in our region currently costs about 0.0041 RON (approximately 1 *ban* for 2.5 liters) – whereas a 2.5 L bottle of water costs roughly 200 times more.

Thus, bottled water may be a necessity in areas where safe tap water is unavailable, but in areas like ours where the public water is safe and readily accessible, bottled water represents an unsustainable alternative when considering the full resource and environmental costs.

Bottled water is subject to quality standards and regulations, but in many jurisdictions, it is not monitored as stringently or frequently as municipal tap water. Bottled water producers are often not required to publish their water quality testing results as comprehensively as public water utilities are. In fact, some well-known bottled water brands simply repackage municipal tap water, selling it at a much higher price. Various studies have occasionally found irregularities in bottled water, such as traces of

E. coli in some samples (Food Safety Authority of Ireland, 2024; Curutiu et al., 2019) or arsenic contamination (Smith et al., 2016). While these findings do not mean bottled water is generally inferior to tap water, they highlight gaps in the regulatory framework for bottled water and the need for greater transparency to assure consumers of its purity.

Other research has raised concerns about chemicals leaching from plastic bottles into the water. PET (type #1 plastic) used for most single-use bottles is intended for one-time use, but consumers often refill them. PET is more stable than other plastics, yet studies suggest that repeated reuse of PET bottles can release substances like di(2-ethylhexyl) phthalate (DEHP), a possible human carcinogen and endocrine disruptor (Xu et al., 2019). High levels of antimony (a component of PET) have also been found in bottled water that had been stored for extended periods or at high temperatures (Allafi et al., 2020). Additionally, the issue of microplastics in bottled water has gained attention (Mason et al., 2018; Schymanski et al., 2018). Although these studies do not conclude that bottled water is unsafe, they call for stricter regulation and more transparency about bottled water contents (Bollaín and Vicente, 2019). In parallel, they underscore the environmental toll of bottled water: the consumption of oil and energy for production and transportation, and the tons of plastic waste that pollute ecosystems (Aslam et al., 2023; Akhbarizadeh et al., 2020). All these factors must be considered when choosing between safe water sources.

Our findings regarding the high preference for bottled water (around 61% of respondents use it) are consistent with trends observed in other developed regions. Surveys in the United States indicate that more than one-third of Americans use bottled water as their main drinking water source, reflecting a widespread perception that bottled water is safer or better-tasting than tap water.

In Europe, many countries likewise exhibit a strong preference for bottled water – for instance, Italy's per capita bottled water consumption is over 200 liters per year, the highest in the EU. Such preferences persist even where municipal tap water is safe, which suggests that consumer perceptions and habits play a larger role than actual water quality. In our study, the objectively measured quality of the local tap water was high (meeting all safety standards, as Tables 3–5 show), yet a majority of people still avoided it for drinking. International studies have shown that subjective factors like taste and health concerns drive this behavior.

For example, Zvěřinová et al. (2024) found that an unpleasant perceived taste of tap water and worries about tap water safety significantly increase bottled water consumption.

This indicates that in Mureş County, as elsewhere, the preference for bottled water is likely rooted in perception and trust issues rather than actual differences in water quality. Addressing these perceptions – through better public information on tap water quality and perhaps campaigns that allow consumers to compare tastes – could gradually shift preferences toward the more sustainable option (tap water).

Our analysis also highlights the influence of socio-demographic factors on water source choices. Younger adults in the survey were more likely to use multiple water sources or to favor bottled water, whereas older adults showed a somewhat higher inclination to stick with tap water (for example, the oldest age group had the highest proportion of tap-water-only drinkers, as seen in Table 2). Larger households (with more members) were more prone to use tap water for drinking, presumably because the cost of buying bottled water in large quantities can become prohibitive. These patterns align with expectations: families with limited budgets and higher water needs will seek the most economical source (tap water), while younger individuals may be swayed by convenience or marketing to choose bottled water. Such insights are useful for public health messaging. For instance, educational campaigns to encourage tap water consumption could particularly target young adults – emphasizing the rigorous treatment and monitoring of public water and addressing common misconceptions about its taste or safety. At the same time, initiatives like taste tests or providing affordable home filtration

units could help overcome any palatability issues, thereby making tap water a more appealing choice for the younger demographic.

Formalizing the process is a continuation that must be considered for further research (Avram et al., 2020b; Calin et al., 2012).

This study has several limitations. First, the survey was conducted online among customers of a single regional water supplier, which may introduce self-selection bias and limit generalizability. Those without internet access or those outside the service area were not captured. Second, our questionnaire relied on self-reported behavior and did not delve deeply into the psychological motivations (e.g., risk perception, taste satisfaction) behind water choices; future studies could include qualitative interviews or targeted questions to explore these aspects. Third, while we analyzed basic socio-demographic influences, we did not incorporate detailed economic data for respondents – income level could be an important factor correlating with water preferences (as some studies suggest, and this warrants further investigation). Despite these limitations, the large sample size (over 1,300 respondents) provides a robust overview of local trends in water consumption. The practical implications of our findings are significant for local authorities and the water company. On one hand, better communication strategies are needed to improve public trust in tap water – for example, simplifying and publicizing water quality reports, or launching outreach programs in schools and community centers to educate citizens about the stringent standards that tap water meets. On the other hand, there may be infrastructure or policy measures to encourage tap water use: installing public drinking fountains or bottle refill stations, promoting the use of reusable water bottles, and possibly subsidizing or providing water filters to households that are skeptical about tap water quality (as an interim solution to build confidence). By implementing such measures, communities in Mureș County could reduce unnecessary expenditures on bottled water and decrease plastic waste, contributing to both economic savings for households and environmental sustainability. In summary, our study's insights can be applied by public health officials and environmental policymakers to design targeted interventions that encourage a shift from bottled to tap water where appropriate.

5. Conclusions

Among the population of Mureș County, we found that piped network water is used primarily for domestic purposes (cooking, cleaning) and less for drinking, while bottled water is widely preferred for hydration. This behaviour leads to avoidable household expenses and plastic waste, despite the fact that the tap water is safe to drink. The reduction of global water resources and the environmental impacts of plastic pollution call for informed consumption choices. Ensuring that the public is correctly informed about the quality and advantages of tap water is essential so that people can make decisions that protect their health and their budget. The benefits of consuming water from the public supply should be promoted in a targeted manner, taking into account factors like age group, household size, and existing consumer habits (such as filter use or label reading). By doing so, authorities and water providers can help shift consumer behavior toward more sustainable water consumption, reducing both costs and environmental footprint.

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Appendix: Anexa 1

Author contributions: R.M. (conceptualization; writing—original draft preparation; writing—review and editing), C.A. (formal analysis; methodology; writing—review and editing), S.S. (writing—review and editing), L.A. (writing—review and editing), F.R. (investigation; resources; writing—original draft preparation; writing—review and editing) All authors have read and agreed to the published version of the manuscript.

References

1. Akhbarizadeh, R.; Dobaradaran, S.; Schmidt, T.C.; Nabipour, I.; Spitz, J. (2020) Worldwide Bottled Water Occurrence of Emerging Contaminants: A Review of the Recent Scientific Literature. *J Hazardous Mater*, 392, 122271. <https://doi.org/10.1016/j.jhazmat.2020.122271>
2. Allafi A.R. (2020) The effect of temperature and storage time on the migration of antimony from polyethylene terephthalate (PET) into commercial bottled water in Kuwait. *Acta bio-medica: Atenei Parmensis*, 91(4), e2020105. <https://doi.org/10.23750/abm.v91i4.8463>
3. Aquaserv Company. Available online: <http://www.aquaserv.ro> (accessed on 2 March 2024).
4. Aslam, S.; Khurram, A.; Hussain, R.; Qadir, A.; Ahmad, S.R. (2023) Sources, Distribution, and Incipient Threats of Polymeric Microplastic Released from Food Storage Plastic Materials. *Environ Monit Assess*, 195(6). <https://doi.org/10.1007/s10661-023-11242-5>
5. Avram, C.; Avram, L.; Ruta, F.; Georgescu, I.M.; Rus, V. (2020) Consumer profile in terms of food label reading in Mures county, Romania– a pilot study. *Progr Nutr*, 22(4), e2020072. <https://doi.org/10.23751/pn.v22i4.9225>
6. Avram, C.; Gligor, A.; Laura, A.E. (2020) A Formal Model Based Automated Decision Making. *Procedia Manuf*, 46, 573–579. <https://doi.org/10.1016/j.promfg.2020.03.083>
7. Berardi, M.; D'Abbicco, M.; Girardi, G.; Vurro, M. (2022) Optimizing Water Consumption in Richards' Equation Framework with Step-Wise Root Water Uptake: A Simplified Model. *Transport Porous Med*, 141(2), 469–498. <https://doi.org/10.1007/s11242-021-01730-y>
8. Bollaín, P.C.; Vicente, A.D. (2019) Presencia de microplásticos en aguas y su potencial impacto en la salud pública [Presence of microplastics in water and the potential impact on public health]. *Revista española de salud publica*, 93, e201908064.
9. Calin, A.; Adrian, G.; Laura, A.E. (2012) New approach on optimal decision making based on formal automata models. *Procedia Econ Financ*, 3, 852–857. [https://doi.org/10.1016/S2212-5671\(12\)00240-7](https://doi.org/10.1016/S2212-5671(12)00240-7)
10. Curutiu, C.; Iordache, F.; Gurban, P.; Lazar, V.; Chifiriuc, M.C. (2019) Main Microbiological Pollutants of Bottled Waters and Beverages. *Bottled and Packaged Water*, 403–422. <https://doi.org/10.1016/B978-0-12-815272-0.00014-3>
11. European Environment Agency. Available online: <https://www.eea.europa.eu/publications/eea-signals-2018-water-is-life/download> (accessed on 2 April 2024). <https://doi.org/10.2800/52469>
12. Feru, A. (2012) *Ghidul Apelor Minerale Naturale*; Risoprint, Cluj-Napoca, Romania.
13. Food Safety Authority of Ireland. *The Consumption of Bottled Water Containing Certain Bacteria or Groups of Bacteria and the Implications for Public Health*. Available online: <https://www.fsai.ie/WorkArea/DownloadAsset.aspx?id=9286> (accessed on 25 March 2024).
14. Government of Romania (2006) *Legea serviciului de alimentare cu apă și de canalizare nr. 241/2006* (Water Supply and Sewerage Service Law no. 241/2006).
15. Humă, C. (2015) *Apa – O problemă geostrategică a secolului XXI*. [Water – A geostrategic problem of the 21st century]. Editura Universitară, Bucharest.
16. Mason, S.A.; Welch, V.G.; Neratko, J. (2018) Synthetic Polymer Contamination in Bottled Water. *Front Chem*, 6. <https://doi.org/10.3389/fchem.2018.00407>
17. Patel, A.I.; Schmidt, L.A. (2017) Water Access in the United States: Health Disparities Abound and Solutions Are Urgently Needed. *Am J Public Health*, 107(9), 1354–1356. <https://doi.org/10.2105/AJPH.2017.303972>
18. Popkin, B.M.; D'Anci, K.E.; Rosenberg, I.H. (2010) Water, hydration, and health. *Nutr rev*, 68(8), 439–458. <https://doi.org/10.1111/j.1753-4887.2010.00304.x>

19. Ruta, F.; Avram, C.; Maior, R. (2023) Physico-Chemical and Microbiological Differences between Mains and Bottled Water, in an Area in the Central Area of Romania. *Int J Environ Res Public Health*, 20(2), 1115. <https://doi.org/10.3390/ijerph20021115>
20. Schymanski, D.; Goldbeck, C.; Humpf, H.U.; Fürst, P. (2018) Analysis of Microplastics in Water by Micro-Raman Spectroscopy: Release of Plastic Particles from Different Packaging into Mineral Water. *Water Res*, 129, 154–162. <https://doi.org/10.1016/j.watres.2017.11.011>
21. Smith, A.E.; Lincoln, R.A.; Paulu, C.; Simones, T.L.; Caldwell, K.L.; Jones, R.L.; Backer, L.C. (2016) Assessing Arsenic Exposure in Households Using Bottled Water or Point-of-Use Treatment Systems to Mitigate Well Water Contamination. *Sci Total Environ*, 544, 701–710. <https://doi.org/10.1016/j.scitotenv.2015.11.136>
22. Sun, Y.; Li, C.; Sheng, Y. (2022) Effects of Virtual Water Strategy on Water Conservation and Socioeconomic Development in Water-Scarc Regions. *J Clean Prod*, 368, 133152. <https://doi.org/10.1016/j.jclepro.2022.133152>
23. Tandon, S. A.; Kolekar, N.; Kumar, R. (2014) Water and Energy Footprint Assessment of Bottled Water Industries in India. *Nat Resour*, 5(02), 68–72. <https://doi.org/10.4236/nr.2014.52007>
24. Voda, A. I.; Sarpe, C. A.; Voda, M. (2018). Methods of maximum discharge computation in ungauged river basins. Review of procedures in Romania. *Geographia Technica*, 13(1), 130–137. https://doi.org/10.21163/GT_2018.131.12
25. Voda, M.; Sarpe, C. A.; Voda, A. I. (2019). Romanian river basins lag time analysis. The SCS-CN versus RNS comparative approach developed for small watersheds. *Water Resour Manag*, 33(1), 245–259. <https://doi.org/10.1007/s11269-018-2100-8>
26. Voidazan, S.; Tarcea, M.; Abram, Z.; Georgescu, M.; Marginean, C.; Grama, O.; Buicu, F.; Ruța, F. (2018) Associations between Lifestyle Factors and Smoking Status during Pregnancy in a Group of Romanian Women. *Birth Defects Research*, 110(6), 519–526. <https://doi.org/10.1002/bdr2.1190>
27. Westerhoff, P.; Prapaipong, P.; Shock, E.; Hillaireau, A. (2008) Antimony Leaching from Polyethylene Terephthalate (PET) Plastic Used for Bottled Drinking Water. *Water Res*, 42(3), 551–556. <https://doi.org/10.1016/j.watres.2007.07.048>
28. World Health Organization (WHO) Available online: <https://www.who.int/publications/i/item/9789241516198> (accessed 2 April 2024).
29. Williams, A.T.; Rangel-Buitrago, N. (2022) The Past, Present, and Future of Plastic Pollution. *Mar Pollut Bull*, 176, 113429. <https://doi.org/10.1016/j.marpolbul.2022.113429>
30. Xu, X.; Zhou, G.; Lei, K.; LeBlanc, G. A.; An, L. (2019) Phthalate Esters and Their Potential Risk in Pet Bottled Water Stored under Common Conditions. *Int J Environ Res Public Health*, 17(1), 141. <https://doi.org/10.3390/ijerph17010141>
31. Zhang, D.; Sial, M.S.; Ahmad, N.; Filipe, A.J.; Thu, P.A.; Zia-Ud-Din, M.; Caleiro, A.B. (2021) Water Scarcity and Sustainability in an Emerging Economy: A Management Perspective for Future. *Sustainability*, 13, 144. <https://doi.org/10.3390/su13010144>
32. Zvěřinová, I.; Ščasný, M.; Otáhal, J. (2024). Bottled or tap water? Factors explaining consumption and measures to promote tap water. *Water*, 16(20), 3011. <https://doi.org/10.3390/w16203011>

Appendix 1. Mureş County operating system regarding drinking water supply

Operating system	Administrative-territorial unit	Stable population	People benefiting from water	People insured with sewerage
TÂRGU MUREŞ	Targu Mureş	134290	132685	130900
	Ceuaşu de Câmpie	5964	4532	0
	Crăieşti	924	489	0
	Cristeşti	5824	4603	3930
	Pogăceaua	2117	1652	0
	Rîciu	3748	2800	0
	Sângeorgiu de Mureş	9304	9271	7962
	Sânpetru de Câmpie	3060	2820	0
	Sărmaşu	6942	4352	0
	Şincai	1622	536	0
	Ungheni	6945	5437	0
	Ernei	5835	1672	1451
	Corunca	2785	2776	2587
	Urmeniş	1949	641	0
	Madaraş	1299	845	0
	Silivaşu de Câmpie	1011	997	0
	Zau de Câmpie	3236	1530	0
	Livezeni	3266	2519	492



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