

# **Different water treatments used in pools of an aquatic centre may invoke various reactions in terms of health care and economic behaviour**

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## **Abstract**

Tourists and excursionists can use different products and services in national parks, concert halls, theatres, museums, gardens, sights, sports centres, and amusement parks. Factors derived from other leisure options influence consumers' utility perception in using unique attractions. The value of consumer utilities determines attractions demand. This information can be a necessary part of pricing decisions and lead to the determination of the optimal price of goods. The subject of the research is to examine consumer behaviour in the aquatic centre concerning the method of water purification. By reviewing data on preferences in samples of aquatic centre users, we determine whether men and women prefer chemical or natural water treatment. We argue that the water treatment method is crucial for keeping water in the pool clean. As empirical literature shows, the disadvantage to consider, especially in the case of chemical water treatment, is the potential of toxic by-products. The research results indicate that natural water purification is usually preferred among respondents regardless of age and gender.

**Key words:** utilities, water attraction, questionnaire

**JEL Code:** D11, L83

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## **Introduction**

Tourism is inextricably linked to water use for various purposes, such as cooking, maintenance, laundry, attractions, etc. However, due to the growing need to use water, it can be observed that water quality may be affected mainly by contaminants, thermal, and physical properties. Primarily, it is connected with water use for various forms of water attractions (such as swimming pools, whirlpools, thermal baths, etc.) (Gössling et al., 2015).

As reported by Teo et al. (2015), chlorine-based disinfectants, bromine-based disinfectants, and other water disinfection methods (e.g. ozone or ultraviolet) are used to purify water swimming pools and other water attractions. Last but not least, there are also new

methods such as magnesium salts. Different forms of water purification theoretically can affect the quality of the water, i.e. whether the water may contain by-products of the disinfection method used. Forms of water purification matter for users, and it is the main reason for understanding the reactions of pool users in water centres. The paper's subject is examining consumer behaviour in the water centre concerning the method of water purification.

The paper is divided into several parts. A Review of the literature follows the Introduction. Then, the Data and methodology are presented, followed by a Results and discussion section. The paper is closed with a section Conclusion.

## **1 Review of the Literature**

Water attractions are among the popular leisure activities used by tourists and excursionists. However, water use is associated with the risk of transmission of bacteria, which can cause disease or other organisms or impurities that can be introduced into the water by swimmers. To avoid these risks, it is necessary to regularly use disinfectants that oxidize contaminants in the water (Wojtowicz, 2000). Various methods of water purification and especially their impact on human health are discussed in the empiric literature.

As (Endinger et al., 2004) argues, water pool users can take up various disinfection by-products. They tried to find out to what extent users inhaled chloroform, which they consider the worst for human health. Their results based on blood tests showed that trihalomethanes enter the body mainly through the respiratory tract and from one-third of the skin. The findings showed that only the presence near the pool is sufficient for the intake of trihalomethanes into the body. Disinfection by-products are also pointed out (Teo et al., 2015), which further states other chemicals from cosmetics and body of people may be present in swimming pools. Their findings show that the presence of these chemicals varies according to the type of disinfectant, water temperature, pH of the water in the pool and bather loads. (Teo et al., 2015) consider raising awareness, improving the hygienic habits of swimmers (shower before and after entering the pool) and research into alternative methods of water treatment as effective ways to reduce the level of contaminants.

Similarly, (Teo et al., 2015) also (Weng et al., 2014) emphasize the need to shower before entering the pool. This measure should contribute to less transfer of undesirable substances into the pool water. Their findings indicate the presence of N,N-diethyl-met-atoluamide, caffeine and tris(2-carboxyethyl) phosphine in water pools. Unwanted substances such as N-nitrosopyrrolidine were found in swimming pools (five as a sample in Pozzi et al.,

2011). Probably the N-nitrosopyrrolidine is a by-product of chemical disinfection, and it was detected in all instances, five swimming pools. The revealed concentration was more than 50 ng / L (ng = nanograms per litre). They rated it very risky because the California Department of Public Health sets a ten ng / L as a limit.

There are also studies analyzing the impact of other water purification methods, such as the use of ozone and bromide as new disinfectants (Teo et al., 2015). (Hoffmann, 2015) investigated the composition of water in a chlorine-free swimming pool. No contaminants were present in the water treated with bromic acid (ozone oxidation) for three years. The research also did not show the presence of by-products as known from chlorination. (Hoffmann, 2015) argues that ozone-bromine treatment demonstrates new ways to treat water in public swimming pools.

Based on the above, it is clear that water chlorination by-products may not be medically desirable. Therefore, the next part of the paper focuses on primary data analysis that examines differences in gender and age in the four different ways of water treatment. On top of it is combined with part of the sample who like swimming the most. Detailed analysis is possible, but it is beyond the extent of this paper.

## **2 Data and Methodology**

The sample for answering the questionnaire was a group of college students studying in the city of Prague. They were approached to evaluate water treatment in aquatic centres they may visit. These centres were identified in the pilot survey as the most well known and most preferred aquatic centres in Prague.

Even though 157 respondents took part in the water treatment evaluation, there were three incomplete answers to specific questions that were deleted from the dataset completely. Nonetheless, for the assessment of questions on water treatment, the Likert scale was used, which allows for missing values to be included in the sample. As deleting them would mean a loss of valuable answers. Sample description statistics are in Tab. 1. As can be seen, 49 women and 24 men in the middle-age category (i.e. 31 years and over) answered the questionnaire. While from the group of young people (i.e. up to 30 years), 55 responses were obtained from women and 26 responses from men. We also emphasize that a smaller sample size does not allow for generalization. It only sheds light on possible attitudes in the evaluation of water treatments.

As (Joshi et al., 2015) argue Likert scale is one of the most fundamental and frequently used psychometric tools in educational and social sciences research. (Likert, p. 42, 1932) shows that the Likert scale using has some advantages. *"First, the method does away with the use of raters or judges and the errors arising from there. Second, this method is less laborious to construct an attitude scale. Third, the method yields the same reliability with fewer items"*. The more uncomplicated technique is based on assigning consecutive numeric values to different alternatives in the questionnaire. After setting numerical values to the various possible answers, the score for each individual is determined by finding the average or sum of the numerical values of the alternatives he has selected in the questionnaire (Likert, 1932).

**Tab. 1: Sample in water treatment evaluation (N=154)**

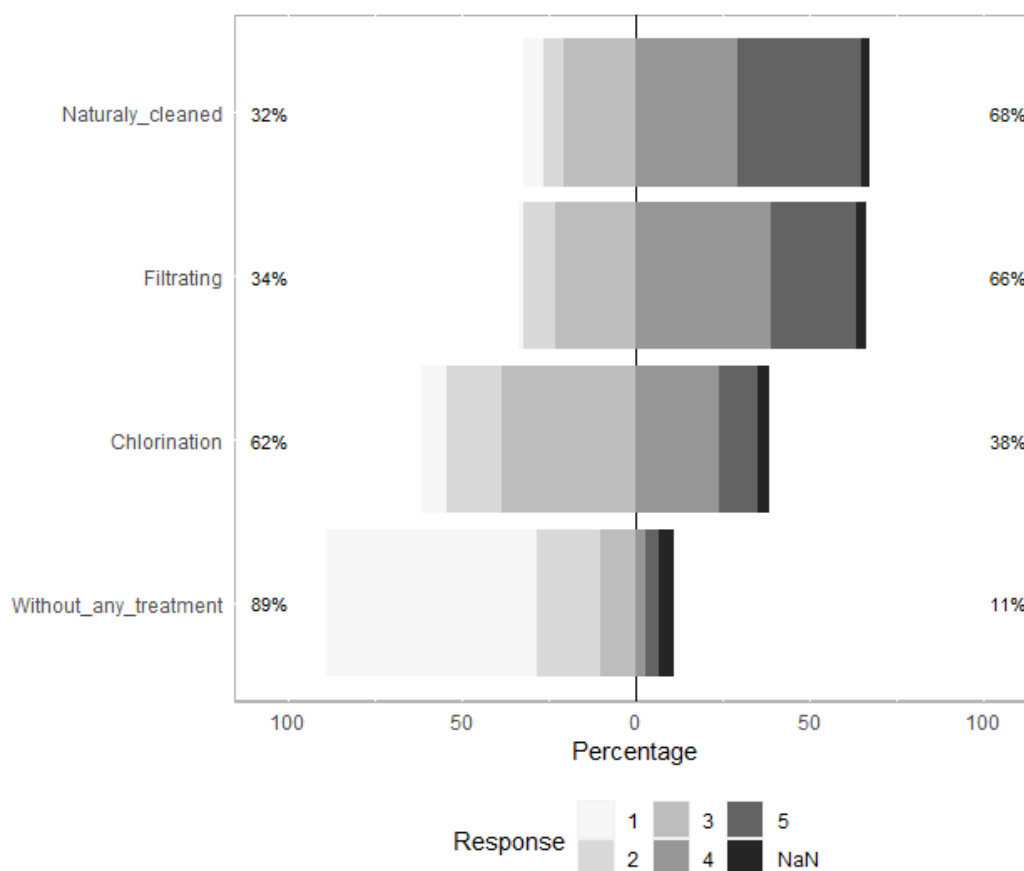
Gender	Persons of an age group in total (in decimals)	
	Middle-aged group	Young group
Female	49 (0.6712329)	55 (0.6790123)
Male	24 (0.3287671 )	26 (0.3209877)

Source: own, based on primary data collected in 2020.

### 3 Results and Discussion

Responses in the Likert scale show that naturally cleaned water is the preferable choice (4 and 5 were the most frequent answers). Filtrating has very similar results, and it can be compared with naturally cleaned water in terms of respondent choices of water for relaxation. Chlorination has 38% of proponents and 62% of opponents. In Fig. 1, the water that was not treated in any possible chemical or physical (mechanical) way is not considered for relaxation. An unanswered number of observations (under the abbreviation NaN in Fig. 1) were five responses in chlorination, four infiltrating, four answers naturally cleaned, and seven without any treatment.

**Fig.1: Water treatment evaluation as considered for relaxation use**



Source: own, based on primary data collected in 2020.

Note: reference to numbers of Responses are (1) not accepting at all, (2) dislike, (3) neutral, (4) like, (5) Strongly like.

These findings could be related to the fact that, especially in the case of chemical water treatment, there is the potential existence of toxic by-products, as empirical literature shows (see section 1 of the paper). If we consider ignorance of the possible harmful effects of chlorination by-products, the prevailing interest in the natural purity of water may also be related to ecological reasons. Even without a more profound knowledge of the possible health effects of chlorination by-products, consumers could experience some complications after bathing in chlorinated water (e.g. worsening of eczema, burning eyes)..

Furthermore, observation of the difference between genders (male, female) and ages (young and middle-aged) is provided in Fig. 2. In the beginning, we consider the respondents' affection for swimming and sports in general. Fig. 2 shows that middle-aged women like swimming 62.5% and 58.49% of young women. The opposite is true of sport, with 88% of young women in the sample enjoying playing sports, compared to 68% of middle-aged women. Chlorination is favoured at approximately the same levels (34% of young women and 37% of

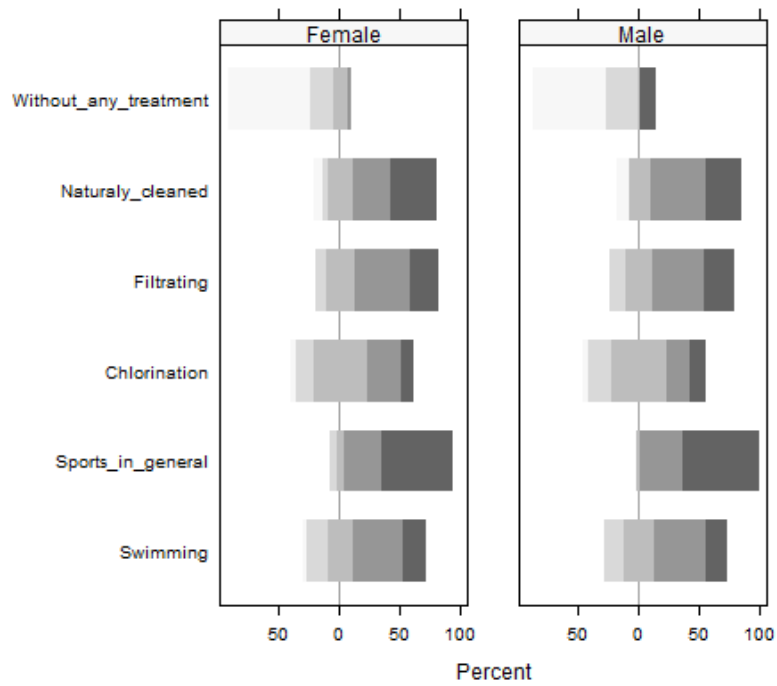
middle-aged women). Whereas there is already some difference in filtrating, 60% of middle-aged and 68.5% of younger favour this water treatment. With the rest of the water treatment, the results are not different.

In general, male attention to the sport is apparent, especially in younger who, none of the respondents claimed strongly dislike sports. Enjoying sports was true for about 18% of middle-aged men who most probably changed their view of sport as they grew older. The response "Strongly like" confirms it for young 96.15% and 63.63% of middle-aged. As an exciting fact turns out, the answer for swimming, where the ratio is 57.69% young and 75% flat in the group of middle-aged respondents. Another striking point is that zero per cent of middle-aged people are willing to use water without any treatment compared to younger who some 11.53% do not mind using it for relaxation. It is the other way around for females, who younger 13.2% do not care, and 13.04% of middle age do not mind or even enormously like to use it. The rest of the results are available upon request and the dataset for result check.

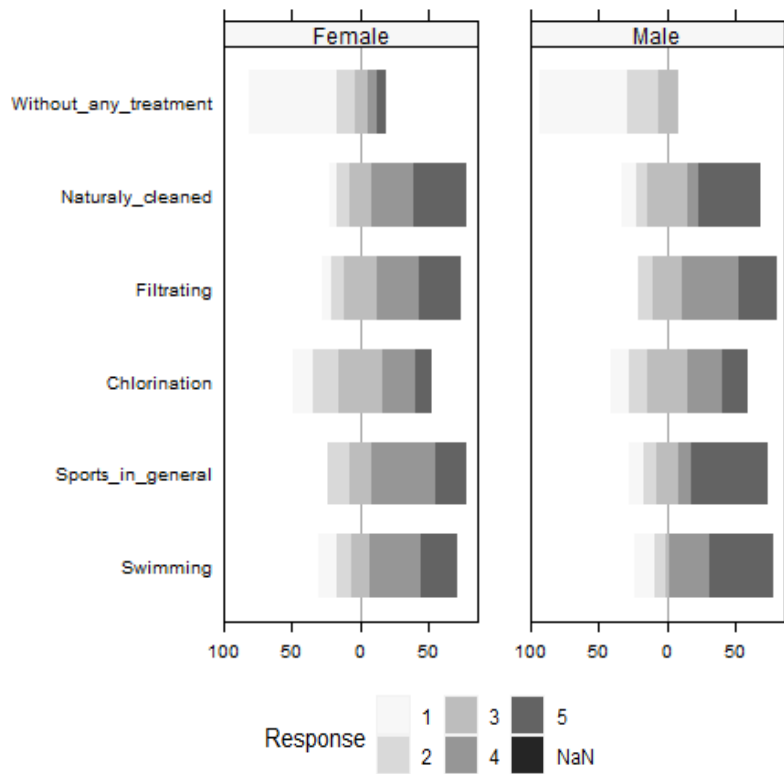
Greater interest of middle-aged respondents in swimming may be associated with possible health complications related to, for example, the profession performed (e.g. back pain). Health issues are less frequent at a younger age. Swimming is a way that can help with sore and hunch back, weak muscles, and maintaining the flexibility of the joints and spine. People with a higher body weight do not have the same load on the joints and bones as in the case of other sports (for example, running, Nordic walking, etc.). Swimming is also recommended as a form of rehabilitation after various medical procedures and as a possibility of enhancing weak muscles along the spine.

In the case of water purification methods according to gender and age category, it can be seen from Fig. 2 that there are slight differences; however, these are not drastic differences. The preference for natural water purification could be linked to the interest in ecology. It could be perceived as more health-friendly, regardless of the potential risks of chlorination by-products. On the other hand, none of the monitored groups of respondents evaluated any water treatment method very appropriately. Respondents seem to be aware of the risks associated with untreated water. Bathing in water without cleaning can make it easier to transfer bacteria from human excretion (often sweat). Furthermore, especially in the summer months, when higher temperatures characterize the water, it is prone to cyanobacteria.

**Fig.2: Water treatment evaluation by age: (A) young and (B) middle-aged**



**(A)**



**(B)**

Source: own, based on primary data collected in 2020.

Note: reference to numbers of responses are (1) not accepting at all, (2) dislike, (3) neutral, (4) like, (5) Strongly like.

## Conclusion

The subject of the research was to examine consumer behaviour in the aquatic centre concerning water purification. Research has focused on water purification methods. It is empirically proven that water chlorination is associated with chlorination by-products. Chlorination by-products could potentially harm health.

This paper did not use hypothesis testing because the sample was relatively small. However, our results show that 68% of middle-aged women prefer naturally cleaned pools, but only 52.17% of men. Similarly, 67.92% were women in the younger generation, and 73.07% were men. We discussed the possible reasons for the achieved findings above. However, these results provide a good starting point for developing other aquatic centre strategies. It means that it would be desirable to consider water purification differently than using chlorine in the future. The objection that such results can be obtained for any pool or aqua centrum is logical, however, if the query was done for other pools results may differ a little bit due to the preference for additional services available on site.

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