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Cleanliness preference behind the choice of drinking water at home: an analysis of online survey results in the Tokyo area

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ABSTRACT

Do different degrees of cleanliness preference affect consumers' choice of daily drinking water at home? The purpose of the present paper is to test the validity of various hypotheses related to this question by analyzing the results of an online survey conducted in the Tokyo area. Cleanliness has an aspect of personal norm for normalcy of things. Preference of cleanliness can be divided into the following two types. One is orderly cleanliness and the other is aversive cleanliness. Orderly cleanliness is oriented toward the control of impure things, while aversive cleanliness is oriented toward retention of immaculacy. We demonstrate that each of these cleanliness preference is involved in the choice of drinking water in its own way. Our survey results suggest that orderly cleanliness encourages the choice of tap water filtered through water purifier, while aversive cleanliness urges the choice of bottled water.

Key words: bottled water, choice of drinking water, cleanliness preference, tap water, water purifier

HIGHLIGHTS

- Orderly cleanliness urges the choice of tap water filtered through a water purifier.
- Orderly cleanliness urges the choice of bottled water.
- Aversive cleanliness inhibits the choice of untreated tap water.
- Aversive cleanliness urges the choice of bottled water.

INTRODUCTION

How do consumers usually drink water when they are home? This question is related to consumers' basic lifestyle; i.e. choice of drinking water at home. Therefore, clarifying the factors that determine the choice of drinking water at home is of great importance in consideration of people's consumption patterns. In addition, due to the COVID-19 pandemic, people have come to spend more time at home since 2019. In that sense, it has become all the more important to examine the issue of the choice of drinking water at home. The insights gained from this inquiry would also provide useful suggestions for the post-COVID-19 consumer life.

Previous studies have demonstrated that a variety of factors influence choice of drinking water. Doria (2006), for instance, pointed out that factors, such as organoleptics (sensory evaluation), concern over health and risk, availability of mineral water, spring water, and other beverages substitute, and hardness of available water options influence consumers' choice. Van der Linden (2015), on the other hand, found out that, in addition to direct determinants such as organoleptics, health concern, and water quality, there are also intermediary factors such as convenience, price, lifestyle, and consideration to the environment. In particular, it is shown that the factor of health and risk concern increases anxiety about drinking tap water and urges the choice of bottled water (Anadu & Harding 2000; Dupont *et al.* 2010; Hu *et al.* 2011).

Many studies have referred to the influence of health and risk concerns on the choice of drinking water. These studies have commonly revealed the impact of anxiety about a certain kind of drinking water on consumers' choice. On the other hand, only few studies addressed the issue of the relationship between sense of uncleanliness or impurity, an emotion that is different from anxiety and choice of drinking water. The one exception is Wilk's research. Wilk argued through a qualitative study

that the choice of tap water or bottled water (mineral water) is also influenced by another criterion, i.e. cleanliness/uncleanliness, aside from the criteria of anxiety over health risk (Wilk 2006).

From an anthropological viewpoint, Wilk demonstrated that a number of consumers find tap water at home unclean. In the present paper, we intend to use this cleanliness preference as an indicator to capture the choice of consumers who find a particular type of drinking water unclean. Cleanliness preference has an aspect of a personal norm for normalcy. People generally act to rank unclean things in accordance with their uncleanliness or avoid them altogether. Cleanliness has the normative power to make people judge the normalcy of their environment and various things around them in accordance with the purity/impurity criterion. It is assumed that such normative power of cleanliness regulates consumers' choice of drinking water as an independent factor, albeit partially overlapping with the anxiety factor.

The purpose of the present paper is to demonstrate that cleanliness preference affects consumers' choice of drinking water at home. Through an analysis of the results of an online survey conducted in the Tokyo area, we intend to verify that differences in the intensity of cleanliness preference affect the choice of drinking water at home. We decided to limit our study to the choice of water at home because other factors, such as convenience, may intervene in the choice of water when outdoors. By controlling factors specific to outdoor situations, we intend to demonstrate that cleanliness preference plays a role in everyday choice of drinking water.

MATERIALS AND METHODS

Survey data used

The analysis in the present study is based on the results of our own online survey conducted in the Tokyo area in February 2021. The online survey was conducted on 2–4 February 2021, targeting men and women aged 20–69 living in the Tokyo area. The Tokyo area here is defined as all the municipalities within a 40-km radius of the JR Shinjuku Station. Only those cities, towns, and villages whose entire area is completely within the 40-km radius of Shinjuku Station were included in the survey. The sample was selected using the quota method. Based on the data from the 2015 Census, the respective ratio of each prefecture by sex by age group was obtained to determine the number of sample to be allocated to each prefecture. The total number of samples thus collected was 1,103. The survey was outsourced to Cross Marketing Inc., a private market research firm. The questionnaire was distributed online to the company's registered members from whom responses were collected. To screen out respondents who continue to choose the same option throughout the questionnaire and other inappropriate respondents, a trap question was buried in the questionnaire. The wording of the trapping question is 'Please select 'None' for this question to prove that you are following instructions carefully.'

Variables

The main variables used in the present study are cleanliness preference and drinking water. The number of variables used is two for cleanliness preference and three for drinking water. First, the variables for cleanliness preference are explained to be followed by explanations on drinking water variables.

Cleanliness has an aspect of a personal norm regarding the manifestation of the normalcy of things. An attitude and behavior that are oriented toward the norm of normalcy find expression in cleanliness. There are two aspects of cleanliness. One is the hygiene sense of medical and physical cleanliness. The other is the aesthetic and spiritual cleanliness pertaining to the reordering of one's environment, such as purification, beautification, and sophistication (Douglas [1966] 2002; Smith 2007). Cleanliness, in other words, is a normative value that is concerned about both material filth and spiritual impurity.

Cleanliness preference can be divided into two types. In the present study, we call them orderly cleanliness and aversive cleanliness. The theoretical framework which categorizes cleanliness preference into these two types is our own. However, each of these concepts has its own theoretical background on cleanliness, as shown below.

Orderly cleanliness is a personal norm for regularity in which 'normal as usual' is desirable. It is characteristic of this orderly cleanliness to aim at maintaining the state of cleanliness through intervention by giving lower ranks to unclean things. This orderly cleanliness is a concept constructed based on the aspect of cleanliness that Douglas pointed out as the logic for the organization of one's environment and systematic ordering of things (Douglas [1966] 2002).

In contrast, aversive cleanliness is a non-epideictic norm which prefers 'inconspicuousness' as the normal state. It is characterized by its orientation toward non-interventional maintenance of the state of cleanliness by evading or covering up unclean things. This is a concept constructed based on the aspect of cleanliness that Elias introduced as the logic of evasion or cover-up of unpleasant things (Elias [1969] 2000). The demarcation between 'interventional' and 'non-interventional' contrasts the

different directions of behavior toward the unclean things. The effectiveness of the theoretical framework of this typology was once verified by Suzuki (2018).

In the present analysis, each of these two types of cleanliness preference is operationally defined to be used as variables. Table 1 shows the wordings of the cleanliness statements and the values of mean (*M*) and standard deviation (*SD*). Five statements in relation to the arrangement of things at home include: 'I organize my home frequently;' 'I return used items to their original place;' 'I put clothes in order after taking them off;' 'I align the height of books on the bookshelf;' and 'I check the contents of my refrigerator frequently.' These statements are used to operationally define orderly cleanliness.

On the other hand, five statements related to the avoidance of contact with unpleasant objects include: 'I try to avoid touching the hand straps in the train or bus;' 'When touching money, I feel as if my hands are dirty;' 'I do not sit on the untreated toilet seat in public restrooms;' 'I do not sit on the untreated park bench;' and 'I do not eat food that has expired.' These statements are used to operationally define aversive cleanliness.

The format we used was a four-point Likert scale. All the questions asked had a common lead, i.e. 'Please choose the one that best describes you in your daily life in relation to the following thinking and behavior.' The wordings of the options given were 'agree,' 'somewhat agree,' 'partly disagree,' and 'disagree.' The responses were scored, giving four points to 'agree,' three to 'somewhat agree,' two to 'partly disagree,' and one to 'disagree.' Neither ceiling effect nor floor effect was observed in any of the questions.

Table 2 represents the correlation matrix between these 10 questions, with the values of 0.40 or higher shaded in gray. It shows that correlations between pairs of statements assuming the orderly cleanliness preference and between pairs of statements assuming the aversive cleanliness preference are high, respectively. This result endorses the validity of dividing these cleanliness questions into two groups.

Two cleanliness preference variables were created based on these cleanliness statements. For orderly cleanliness, all five related items were used and the average score of the five was adopted as the score for orderly cleanliness. On the other hand, for aversive cleanliness, four of the five related items were used, excluding the item of strict adherence to the expiration date of food. This is because when comparing Cronbach's alpha coefficients, which indicates internal consistency between variables, between the five-item case and the four-item case without the item of strict adherence to the expiration date of food, the value was higher for the four-item case. Therefore, the average score of the four-item case was used as the score for aversive cleanliness. The values of the correlation coefficients, mean (*M*) and standard deviation (*SD*) for the two cleanliness preference variables, and Cronbach's alpha coefficients (α) are shown in Table 3.

Next, let us explain three variables related to how one drinks water at home. In our questionnaire, we asked about the three ways of drinking water. Table 4 shows their wordings, as well as the values of the mean (*M*) and standard deviation (*SD*). In addition, Table 4 also shows the correlation matrix between these three questions. The values of the correlation coefficient between the three variables lead us to interpret that there is almost no correlation. Untreated tap water had a slightly negative correlation with both water purifier and bottled water. All questions were asked on a four-point Likert scale. They had a common lead of: 'How do you usually drink water at home? Choose the one that best fits your behavior.' The wordings

Table 1 | Wordings and statistics of cleanliness [$N = 1{,}103$]

Questions	Wordings	*M*	*SD*
Organizing the house (QC-1)	I organize my home frequently	2.54	.88
Maintaining the arrangement of things (QC-2)	I return used items to their original place	3.03	.82
Folding clothes (QC-3)	I put clothes in order after taking them off	2.70	.88
Organizing the height of books (QC-4)	I align the height of books on the bookshelf	2.48	.94
Managing the inside of the refrigerator (QC-5)	I check the contents of my refrigerator frequently	2.70	.89
Avoidance of hand straps (QC-6)	I try to avoid touching the hand straps in the train or bus	2.59	.98
Unpleasant contact with money (QC-7)	When touching money, I feel as if my hands are dirty	2.46	.99
Avoidance of public toilet seats (QC-8)	I do not sit on the untreated toilet seat in public restrooms	2.39	1.04
Avoidance of park benches (QC-9)	I do not sit on the untreated park bench	2.03	.88
Strict adherence to the expiration date of food (QC-10)	I do not eat food that has expired	2.22	.90

Table 2 | Correlation matrix of cleanliness [$N = 1,103$]

	QC-1	QC-2	QC-3	QC-4	QC-5	QC-6	QC-7	QC-8	QC-9	QC-10
QC-1	1.00	.56***	.59***	.48***	.47***	.24***	.18***	.22***	.22***	.23***
QC-2		1.00	.63***	.41***	.45***	.25***	.19***	.20***	.11***	.11***
QC-3			1.00	.47***	.45***	.28***	.23***	.23***	.21***	.15***
QC-4				1.00	.40***	.20***	.19***	.23***	.22***	.20***
QC-5					1.00	.29***	.20***	.21***	.18***	.11***
QC-6						1.00	.58***	.45***	.41***	.22***
QC-7							1.00	.43***	.42***	.19***
QC-8								1.00	.58***	.19***
QC-9									1.00	.30***
QC-10										1.00

***$p < .001$.

Table 3 | Statistics of cleanliness preference [$N = 1,103$]

	Questions added	Orderly cleanliness	Aversive cleanliness	*M*	*SD*	α
Orderly cleanliness	QC-1, QC-2, QC-3, QC-4, QC-5	1.00	.36***	2.69	.68	.82
Aversive cleanliness	QC-6, QC-7, QC-8, QC-9		1.00	2.37	.76	.78

***$p < .001$.

Table 4 | Wordings, correlation matrix and statistics of drinking water [$N = 1,103$]

Questions	Wordings	Untreated tap water	Water purifier	Bottled water	*M*	*SD*
Untreated tap water	Untreated tap water	1.00	− .14***	− .13***	2.14	1.11
Water purifier	Tap water filtered through a water purifier		1.00	.02	2.22	1.24
Bottled water	Mineral water and others			1.00	2.73	1.04

***$p < .001$.

of the options were 'often,' 'sometimes,' 'rarely,' and 'never.' In the analysis, they were converted into binary variables by dividing them into 'often' and the other three options.

Working hypotheses

The working hypotheses of the present research were constructed based on Wilk's findings in his previous study as well as the theoretical background of cleanliness preference. As mentioned earlier, there are consumers who feel tap water is unclean. Based on this proposition, it is hypothesized that consumers with a strong cleanliness preference do not drink untreated tap water. In addition, orderly cleanliness is a personal norm for normalization toward putting the unclean under control. It is assumed that consumers with strong orderly cleanliness inclination are more likely to try to control the quality of tap water using water purifiers rather than drinking it untreated.

On the other hand, aversive cleanliness is a personal norm for normalization in the direction of the avoidance of the unclean. Once tap water is found unclean, aversive cleanliness sets in to urge consumers to avoid tap water and, instead, choose water whose cleanliness is guaranteed. For this reason, it is assumed that consumers with strong aversive cleanliness inclination are likely to refrain from drinking untreated tap water and choose bottled water which is guaranteed to be sealed at the original source. Based on these inferences, it can be said that the present analysis verified the validity of the following four working hypotheses:

Hypothesis 1 (H1): Orderly cleanliness has a significant negative correlation with untreated tap water.
Hypothesis 2 (H2): Orderly cleanliness has a significant positive correlation with tap water filtered through a water purifier.
Hypothesis 3 (H3): Aversive cleanliness has a significant negative correlation with untreated tap water.
Hypothesis 4 (H4): Aversive cleanliness has a positive correlation with bottled water.

RESULTS

The logistic regression analysis was conducted with each of the three drinking water choices as the response variable. The resulting values of the partial regression coefficient (*B*), standard error (*SE*), odds ratio (OD), and significance level (*P*-value) are shown in Tables 5–7. The two explanatory variables were orderly cleanliness and aversive cleanliness. The following six demographic factors were also included in the analysis as control variables: gender (female dummy; ref. male), age (years), marital status (unmarried dummy; ref. married), with or without children (having children dummy; ref. no children), years of schooling (years), and equivalized household income (10,000 yen).

Two models, Model 1 and Model 2, were set up for each response variable regarding drinking water. The only difference between Model 1 and Model 2 was the presence/absence of 'equivalent household income' as a control variable. This is

Table 5 | Logistic regression analysis of untreated tap water

	Model 1 [$N = 821$]				Model 2 [$N = 1{,}103$]			
	B	*SE*	*OD*	*P*-value	*B*	*SE*	*OD*	*P*-value
Female dummy	−.407	.209	.666	.052	−.255	.175	.775	.145
Age	−.004	.008	.996	.611	−.002	.007	.998	.751
Unmarried dummy	−.460	.270	.631	.088	−.329	.230	.720	.152
Having children dummy	−.772**	.260	.462	.003	−.715**	.231	.489	.002
Years of schooling	.016	.054	1.016	.775	.040	.046	1.041	.382
Equivalent household income	.000	.000	1.000	.372				
Orderly cleanliness	.068	.147	1.070	.646	.043	.126	1.044	.733
Aversive cleanliness	−.334*	.138	.716	.015	−.280*	.117	.756	.017
Model χ^2	24.01**				23.20**			
Nagelkerke R^2	.048				.035			

*$p < .05$, **$p < .01$.

Table 6 | Logistic regression analysis of water purifier

	Model 1 [$N = 821$]				Model 2 [$N = 1{,}103$]			
	B	*SE*	*OD*	*P*-value	*B*	*SE*	*OD*	*P*-value
Female dummy	− .193	.173	.825	.264	− .198	.151	.821	.190
Age	.015*	.007	1.015	.032	.010	.006	1.011	.092
Unmarried dummy	− .018	.244	.982	.941	− .216	.210	.806	.305
Having children dummy	− .023	.226	.977	.919	− .120	.200	.887	.551
Years of schooling	.043	.046	1.044	.350	.036	.040	1.037	.370
Equivalent household income	.000	.000	1.000	.864				
Orderly cleanliness	.400**	.130	1.492	.002	.325**	.113	1.384	.004
Aversive cleanliness	.103	.114	1.108	.368	.137	.101	1.146	.176
Model χ^2	20.80**				22.58**			
Nagelkerke R^2	.036				.030			

*$p < .05$, **$p < .01$.

Table 7 | Logistic regression analysis of bottled water

	Model 1 [$N = 821$]				Model 2 [$N = 1{,}103$]			
	B	*SE*	*OD*	*P*-value	*B*	*SE*	*OD*	*P*-value
Female dummy	−.092	.168	.912	.582	−.133	.145	.875	.358
Age	−.010	.007	.990	.145	−.003	.006	.997	.573
Unmarried dummy	.440	.244	1.553	.071	.362	.212	1.437	.088
Having children dummy	.305	.232	1.357	.189	.252	.207	1.286	.224
Years of schooling	−.018	.045	.982	.680	−.006	.038	.994	.870
Equivalent household income	.001*	.000	1.001	.022				
Orderly cleanliness	.274*	.126	1.315	.029	.327**	.110	1.386	.003
Aversive cleanliness	.201	.112	1.222	.074	.246*	.098	1.279	.012
Model χ^2	23.48**				25.82**			
Nagelkerke R^2	.040				.033			

*$p < .05$, **$p < .01$.

because the inclusion of this variable significantly decreases the sample size. As shown in Tables 5–7, the sample size for Model 1, which includes equivalized household income variable, is 821. This decrease was caused by the inclusion of the option of 'don't know/don't want to answer' in the question item asking about household income. The response rate for this option was 25.6%, which meant that about a quarter of the total sample size was excluded from the analysis. As discussed later, it was only in the bottled water model that the equivalized household income had a significant effect. Taking this into consideration, it was decided to set up Model 2, which would allow us to use a larger sample size. The sample size for Model 2 was increased to 1,103.

Table 5 shows the results of the logistic regression analysis using untreated tap water as the response variable. Among the control variables, only the 'having children dummy' resulted in a significant negative correlation at the 1% level in both models. No significant correlation was observed for orderly cleanliness in either model. On the other hand, aversive cleanliness showed a significant negative correlation at the 5% level in both models.

Table 6 shows the results of the logistic regression analysis using water purifier as the response variable. Among the control variables, only age had a significant positive correlation at the 5% level in Model 1. In Model 2, none of the control variables became statistically significant. Orderly cleanliness showed a significant positive correlation at the 1% level in both models. On the other hand, no significant correlation was obtained for aversive cleanliness in either model.

Table 7 shows the results of the logistic regression analysis using bottled water as the response variable. Among the control variables, only the equivalized household income showed a significant positive correlation at the 5% level in Model 1. In Model 2, none of the control variables was statistically significant. Orderly cleanliness was significant in both models. A significant positive correlation was obtained at the 5% level in Model 1 and at the 1% level in Model 2. On the other hand, aversive cleanliness did not show a significant correlation in Model 1, while a significant positive correlation was obtained in Model 2 at the 5% level.

DISCUSSIONS

Verification of hypotheses

Based on the results of the above analysis, we must now test the validity of the four working hypotheses presented earlier. Among the working hypotheses, H2, H3, and H4 were found to be consistent with the results of the analysis. On the other hand, the consistent result was not obtained for H1. These results of the verification testing suggest that the two types of cleanliness preference differentiate consumers' drinking water choices.

It was found that orderly cleanliness urged the choice of tap water filtered through a water purifier. This result can be interpreted as a manifestation of the cleanliness preference as a personal norm for interventional normalization. Using a water purifier, consumers would feel that they are in control of the cleanliness, or normalcy, of their drinking water. For this reason, it is presumed that consumers with stronger orderly cleanliness preference are more likely to choose and drink

tap water filtered through a water purifier. It was also found that orderly cleanliness did not lead consumers to refrain from drinking untreated tap water, but it also encouraged the choice of bottled water. These results suggest that some consumers may feel that they are actively in control of the cleanliness of their drinking water through the purchase of bottled water.

On the other hand, it was found out that aversive cleanliness inhibited the choice of untreated tap water and urged the choice of bottled water. These results can be interpreted as a manifestation of the cleanliness preference as a personal norm for the non-interventional normalization. This is because consumers who feel untreated tap water unclean would avoid drinking it. Meanwhile, bottled water allows clean drinking water to be brought home in a sealed condition. With bottled water, consumers would feel that they are avoiding the impurity of drinking water as much as possible. Therefore, it is presumed that consumers with stronger aversive cleanliness preference are more likely to choose bottled water.

Limitations of the study

In the present study, we have confined ourselves to an examination of the link between the choice of drinking water and cleanliness preference. We are aware that, in the future, it is necessary to analyze the relationship between cleanliness preference and other factors related to the choice of drinking water. It is a particularly important task to clarify the relationship between health-related factors and cleanliness preference. It must be verified that cleanliness preference still remains significant as a factor in the choice of drinking water even when health-related factors are included in the analysis as covariates. The result of this verification would allow us to more accurately specify the range as well as the degree of influence the anxiety factor and cleanliness preference have, respectively, on the choice of drinking water.

In this study, we used two concepts of cleanliness preference, i.e. orderly cleanliness and aversive cleanliness, in our analysis. All discussions and conclusions regarding the results of the present analysis are based on the premise that these typologies are valid. However, as pointed out earlier, the validity of these concepts has been tested only once so far. Although one may argue that the present analysis has the meaning of the second attempt at the verification, it still cannot be said that these two concepts have been sufficiently verified. Further verification is needed in the future.

The data used in this analysis were obtained from the Tokyo area of Japan. It is necessary to confirm in future studies whether similar results can be obtained in other regions where conditions, such as the coverage rate of water supply system and safety standards for tap water, differ greatly from those in the Tokyo area.

CONCLUSION

Through the present analysis, it was confirmed that, generally speaking, cleanliness preference affected consumers' choice of drinking water at home. It can be concluded, therefore, that cleanliness preference is likely to be one of the factors behind the choice of drinking water. Cleanliness is not just a norm of hygienic purity. It is also a norm of purity related to the organization of things in an aesthetic and spiritual sense. Therefore, when planning and drafting public policies or commercial promotions related to drinking water, it is not enough to take into account only consumers' notions of anxiety about health and risk. Consumers' notions of purity/impurity should also be taken into account. The results of the present analysis suggest the validity and importance of this inference.

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DATA AVAILABILITY STATEMENT

Data cannot be made publicly available; readers should contact the corresponding author for details.

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