

Bottled water versus tap water: understanding consumers' preferences

Miguel F. Doria

ABSTRACT

The consumption of bottled water has been increasing consistently over the last decade, even in countries where tap water quality is considered excellent. This paper discusses some of the reasons why people decide for an option that is often more expensive and less comfortable than tap water. Consumer surveys usually stress two main factors: dissatisfaction with tap water organoleptics (especially taste) and health/risk concerns. However, many other factors are involved, including demographic variables and the perceived quality of the water source. Trust in tap water companies also seems to influence public behaviour. A clearer picture of bottled water consumption can be achieved when different aspects are considered.

Key words | bottled water, organoleptics, risk perception, tap water

Miguel F. Doria
Centre for Environmental Risk,
University of East Anglia,
Norwich NR4 7TJ, UK
Tel: +44 1603 591343
Fax: +44 1603 591327
E-mail: M.Doria@uea.ac.uk

There has been a growing interest, particularly since the early 1990s, to provide drinking water that has the trust of consumers (e.g. “Bonn Charter for Safe Drinking Water”) and to understand the factors that contribute to the use of tap water alternatives. The demand for bottled water has consistently increased during the last decade. This trend has been observed worldwide, but the rates of increase vary accordingly to the country (see [ASDA 2004](#)). For example, in New Zealand, per capita consumption of bottled water has increased at a rate of 20% per year (from 1997 to 2004). In Eastern European countries and in the Asia–Pacific region, the consumption increased by about 13% per year, and in the USA and Western Europe, this rate was about 6% per year (from 1997 to 2004). As a result, bottled water has become the fastest growing segment of non-alcoholic beverages, representing a market worth \$22 billion (about £12 billion ([Ferrier 2001](#))). This situation may seem paradoxical as tap water standards and quality have also steadily improved over the last decade in many countries (e.g. [DWI 2003](#)). Moreover, a relatively large proportion of bottled water (between 40–60% globally) consists of packaged tap water, which in some cases may have been reprocessed ([Canadean 2004](#)). Why do an increasing number of people decide to pay up to

ten thousand times more for bottled water? (For the prices ratio, see [Olson \(1999\)](#).)

From a strictly objective perspective, bottled water is not necessarily “better” or “worse” than tap water – it depends on the specificity of the particular cases. Several studies, which compared bottled and tap water, concluded that, while some bottled waters have better quality than tap waters, this is not always the case (e.g. [Hunter 1993](#); [Olson 1999](#); [Lalumandier & Ayers 2000](#), [Saleh *et al.* 2001](#)). There is a large debate in the media and scientific literature about the merits and faults of each alternative (see [Foltz 1999](#)). Some pointed out that tap water is controlled by more rigorous standards and is more frequently analysed than bottled water ([Olson 1999](#)). Others argue that bottled water is submitted to more advanced treatments and/or is less exposed to contamination during distribution, being a safer alternative ([DWRf 1999](#)).

The reason for the increase of bottled water consumption is not straightforward and consumer surveys often indicate diverse possibilities. [Table 1](#) summarises the findings of several surveys regarding consumers' reasons for choosing bottled water. These reasons will be discussed in detail in this paper. National differences suggest that

Table 1 | Reasons for drinking bottled water in USA, Canada, and France

	US (1993) ^a (%)	Canada (1999) ^b (%)	France (1989) ^c (%)	France (1995) ^c (%)	France (2000) ^c (%)
Organoleptics	7	71	54	43	47
Health and risk	47*	25	13	19	23
Prefers mineral or spring water	–	–	28	19	16
Substitute for other beverages	47*	–	–	–	–
Hardness	–	–	–	14	23
Other reasons (unspecified)	11	3	6	4	5
Don't know	–	1	–	–	–

*12% of respondents responded that they were both worried about tap water safety and that they used water as a substitute for other beverages. "Health and risk" include safety concerns and fears of toxic products.

Sources: ^aAWWA-RF (1993). ^bMean values of four Canadian communities – adapted from Levallois *et al.* (1999). ^cAdapted from IFEN (2000) ("organoleptics" include flavour (approx. 95% of the frequency presented in the table) and colour (approx. 5%); IFEN provides the reasons for rejecting tap water).

cultural factors may also play a role, but point-by-point comparisons of different countries' results may be inadequate due to variations in the survey instruments (e.g. some studies omitted the use of bottled water as a substitute for other beverages) and to the time spanning that separates some of the surveys. Thus, cross-national comparisons are only possible at a general level, taking into account the relative relevance of each factor and the time when the data was collected.

One of the factors that contribute to the consumption of bottled water is dissatisfaction with tap water organoleptics, i.e. the water characteristics that affect the senses of taste, odour and sight. In this context, taste seems to be particularly relevant (Grondin *et al.* 1996; Abrahams *et al.* 2000). In a survey conducted by Levallois *et al.* (1999) in several Canadian regions, respondents identified organoleptics as the main reason for drinking bottled water (from 63–80%, depending on the region). The preponderant importance of organoleptics for bottled water consumers was also found in French surveys (IFEN 2000) and, although organoleptics seem to have lost some relevance during the 1989–2000 period, this change may be due to the introduction of a new category (i.e. hardness) in the survey. The relevance of organoleptics seems to be much smaller in the US (AWWA-RF 1993). However, some studies suggest that organoleptics may have become more relevant

for North American consumers during the last few years (Abrahams *et al.* 2000).

A study by Falahee & MacRae (1995), based on blind comparisons of different waters by British students, suggests that waters with high mineral content – in this case several bottled and borehole waters – are preferred over those with low mineral concentration – i.e. distilled water and a local tap water. Similar studies, with blind comparisons of different waters, are hard to find in the scientific literature. Nonetheless, the American media has carried out several basic versions of these assessments and has systematically challenged the idea that bottled water is generally preferred over tap water. For example, the show *Good Morning America* (May 2001) found that New York City tap water was preferred over bottled waters; the *Cincinnati Enquirer* (July 2001) found that the city's tap water was more highly rated than bottled waters; the *Penn & Teller: Bullshit!* show found that 75% of the public preferred tap to bottled waters in a blind test and then started to sell bottles of *L'Eau du Robinet* (French for tap water) for \$7 while recording the "victims" with a hidden camera (Shermer 2003). The differences between the conclusions of media trials and the research of Falahee & MacRae (1995) are hard to evaluate retrospectively and can be due to a variety of factors, including differences in the waters used and the panel's composition. The approaches adopted by the media

for water comparisons may suffer from methodological inadequacies and were not peer-reviewed. On the other hand, such blind tests can be misleading in one aspect: they fail to take familiarity into consideration. A blind test controlled for the familiarity of panel members with tap and bottled waters may lead to very different results.

Apart from organoleptics, other factors that may contribute to bottled water consumption are health-related reasons. In a survey conducted in the US about ten years ago, approximately half of bottled water consumers mentioned tap water risks as a major reason for using bottled water (AWWA-RF 1993). The relevance of risk concerns in the US may have decreased over the last decade, as some recent studies found satisfaction with organoleptics to be slightly more important than perceived risk (Abrahams *et al.* 2000) – nonetheless, this variation is hard to assess and can be due to different methodological approaches. In contrast, the number of French that consume bottled water due to concern about tap water risks seems to be increasing (Table 1). In Canada, about 25% of bottled water consumers justify their option with health-related concerns (Grondin *et al.* 1996; Levallois *et al.* 1999). However, a much higher proportion (44%) of the Canadian sample studied by Grondin *et al.* (1996) considers bottled water to be healthier than tap water. This suggests that health and risk considerations are not *per se* a condition for customers' behaviour. Other factors, such as the access to bottled water in terms of convenience and price, may mediate behaviour. For some customers, the perceived health benefits of bottled water may be too small to justify the difference in price or the extra effort of carrying bottles of water to their homes.

On the other hand, although “healthier option” and “risk aversion” (i.e. the positive and negative stimuli) are sometimes taken as equivalent or used interchangeably in bottled water surveys, it is not clear whether they are strictly similar. Even if perceived risks are in many cases inversely related to perceived benefits (e.g. Finucane *et al.* 2000), customers may prefer bottled water for the potential health benefits, but not because of eventual tap water risks. For example, some consumers may wish to improve their health and decide that drinking bottled water is a way to do that, thinking that bottled water is somehow healthier – but not necessarily safer – than tap water. Interestingly, the growth of the bottled water market seems to closely follow the sales of “healthy

foods”, and organic-food buyers are much more likely to drink bottled than tap water (70% organic-food buyers vs. 18% non-organic-food buyers “always” drink bottled water (Hammit 1990)). Studies with other beverages found that consumers prefer products that are presented as having higher health benefits (e.g. orange juice with added vitamins) and that perceptions of healthiness are influenced by organoleptics (Luckow & Delahunty 2004). In order to be better understood, the distinction between risk concerns and health improvement motivations needs to be further explored in the context of drinking water.

Not surprisingly, consumption of bottled water is sometimes higher in communities that have serious problems with their tap water (Anadu & Harding 2000). Such problems provide new opportunities for the expansion of bottled water markets, and there are claims that some companies “directly and openly market to consumers by highlighting tap water contamination problems and offering their product as a safer alternative” (Olson 1999). However, such cases may be an exception, as the International Bottled Water Association (IBWA) guidelines impede companies from directly exploring tap water deficiencies, or from comparing their products to tap water in marketing campaigns (Howard 2003).

Issues of trust and remembrance of past problems may emerge during serious accidents and can have a long-lasting impact on public behaviour (see Slovic 1993). For example, the 1998 Sydney *Cryptosporidium* and *Giardia* outbreak provided a noteworthy stimulus to the Australian bottled water market (Lonnnon 2004). Sales increased more than 40% in just one year and remained increasing over the last five years. The consequences of the Sydney incident continued to be felt long after the end of the outbreak (e.g. Sydney Water Corporation 2000). However, relatively similar episodes have also happened with bottled waters. A well-known case is that of Perrier mineral water, which was contaminated with benzene in 1990 and was recalled worldwide. Bottled water sales in the US, which have systematically increased for almost a decade until this episode, dropped slightly in 1991 just after the benzene contamination, and were almost unchanged in 1992; sustained increases only resumed after 1993. More recently, Coca-Cola decided to withdraw their bottled water “Dasani” from the UK market, after finding out that the levels of bromate, a potential carcinogen, exceeded

legal standards. Although no health problems were known, “Dasani” was voluntarily withdrawn as “a precautionary measure” (Dasani 2004).

Although organoleptics and risk/health concerns seem to be the most pertinent factors influencing bottled water consumption, a number of other reasons may also play an important role. In the early 1990s, the bottled water industry was spending about \$43m dollars per year in advertisements (Olson 1999); ten years later, a single brand would invest \$20m in a print and outdoor campaign (Petrecca & Kramer 1999). Although some campaigns present their products whilst emphasising that water is “pure” and “healthy”, other marketing strategies try to go further. For example, Dasani was promoted as a lifestyle drink and Perrier – considered by some to be one of the best mineral waters – is often presented as a status symbol. “Why is Perrier coming out with a PET bottle? Your lifestyle evolves, and Perrier follows suit.” (Perrier 2004). Packaging is a crucial component of bottled water marketing. Like the taps and distribution systems, bottles provide contextual indications about the product, which may be related to health, risk and organoleptics – but can also attract buyers by reflecting their desired or perceived personal image. Therefore, some companies design their bottles in a way that aims to “highlight [their] positioning as a brand with cutting-edge style, enjoyment and sense of fun.” (Sweney 2004).

Apart from the final container, the original context (i.e. the water source) may provide additional information about the water and eventually influence personal choice. Such a relationship may not be evident at a very specific level, e.g. when two different fluvial sources are considered (Grondin *et al.* 1996). However, at a more general level, the perceived source of tap water (e.g. mountain spring, purified toilet water) can be a significant predictor of bottled water consumption (Levallois *et al.* 1999). This may explain the use of pictures of pristine mountains on the labels of several bottled tap-water brands (Olson 1999).

A number of demographic variables can also influence bottled water usage, although the patterns seem to vary according to the region and country. Such variables include ethnic group, age, income, occupation and gender (FWR 1996; Abrahams *et al.* 2000; IFEN 2000). The peculiar role of ethnicity in the United States is intriguing. Bottled water sales are higher amongst African–American, Asians and Hispanic

groups, which typically have lower incomes than whites. There are some suggestions that these differences may result from the geographic distribution of ethnic groups. It was hypothesised that ethnic differences mirror the variability of water system quality between urban, suburban and rural areas (Abrahams *et al.* 2000) and it was also pointed out that they might reflect the memory of past problems caused by deficient tap-water systems in deprived areas (Olson 1999). A similar geographic trend was found in France in the early 1970s, where bottled water consumption was found to be much higher in urban areas (Ferrier 2001). This finding was also explained in terms of the poor quality of urban tap water and of the bad condition of the old lead pipes in French cities. Nonetheless, while poor tap water quality may motivate the public to search for alternative sources, it alone does not necessarily lead to higher consumption of bottled water. There are other alternatives (e.g. filters) and the product has to be accessible. Moreover, some surveys found that bottled water, far from being an alternative to tap water, seems to be mostly consumed as a substitute for alcoholic and traditional soft drinks (e.g. AWWA-RF 1993; FWR 1996) – the exception being when water contamination presents serious health risks and the trust in the tap water company is highly eroded (e.g. Lonnon 2004). An alternative explanation is that the consumption of “pure” and “natural” bottled water in degraded environments may represent a symbolic purging behaviour.

There are some potential complicating factors and sources of bias that may interfere with current knowledge about public preference for bottled water. Customers’ preferences may change according to location (e.g. tap water preferred at home, bottled water preferred at work) and intended use (e.g. to drink directly or to prepare tea). Customers have little brand loyalty (FWR 1996), and only a small proportion may be able to distinguish between different types of bottled water (e.g. mineral vs. filtered). Moreover, most of the research published in international journals is based on North American and European populations. The factors that drive bottled water sales in Asia and South America may be somewhat different.

One of the conclusions of this paper is that more research is needed to corroborate and substantiate the findings of previous research. The amount of information about bottled and tap water preferences available in the peer-reviewed

literature is remarkably low, even if the interest on this topic is clear from grey literature. It should be noted that peer-reviewed publications on the chemical aspects of bottled water often get their information about the economic and social aspects of bottled water consumption from websites, grey literature and the mass media (e.g. Rosenberg 2003; Ramón Redondo & Yélamos 2005). Moreover, most studies on the social aspects have consisted of descriptive surveys. A larger diversity of methodological approaches, including blind tests and the development of regression models, can lead to a much better understanding of the factors involved and their relative contribution to consumers' preferences. Cross-national studies, where similar research instruments are applied to different countries, are also needed and can contribute to a better interpretation of national surveys.

An improved knowledge of the factors that contribute to the use of drinking water alternatives can contribute to a better understanding of the consumer's concerns and behaviours. Overall, the reasons for bottled water consumption seem to be varied. Organoleptics and health/risk concerns are the most frequently mentioned causes, but many other factors are involved. The main conclusion is that people generally value "good quality water" and some are prepared to use their wallets to consume what they perceived to be a "purer" or "healthier" product.

ACKNOWLEDGEMENTS

The author is grateful to Paul R Hunter and to the anonymous referees for their comments on previous versions of this paper. The author would like to thank Fundação Calouste Gulbenkian and the British Council for their support.

REFERENCES

- Abrahams, N., Hubbell, B. & Jordan, J. 2000 Joint production and averting expenditure measures of willingness to pay: do water expenditures really measure avoidance costs? *Am. J. Agric. Econ.* **82**(2), 427–437.
- Anadu, E. & Harding, A. 2000 Risk perception and bottled water use. *J. AWWA* **92**(11), 82–92.
- ASDA (Australian Soft Drinks Association) 2004 *Industry: The Australian Non-alcoholic Beverages Sector*. Available at: <http://www.softdrink.org.au> (accessed 17-07-04).
- AWWA-RF (American Water Works Association Research Foundation) 1993 *Consumer Attitude Survey on Water Quality Issues*. AWWA, Denver.
- Canadean 2004 *Global Bottled Water (Packaged Water) Report 2003*. Canadean, Hants.
- Dasani 2004 *Voluntary withdrawal of Dasani in the UK*. Available at: <http://www.dasanigb.co.uk> (accessed 17-07-04).
- DWI (Drinking Water Inspectorate) 2003 *Drinking Water for England 2002 – A Report by the Chief Inspector*. DWI, The Stationery Office, London.
- DWRF (Drinking Water Research Foundation) 1999 *Analysis of the February 1999 Natural Resources Defense Council Report on Bottled Water*. Available at: http://www.dwrf.info/nrdc_bottled_water.htm (accessed 19-06-04).
- Falahee, M. & MacRae, A. 1995 Consumer appraisal of drinking water: multidimensional scaling analysis. *Food Qual. Pref.* **6**(4), 327–332.
- Ferrier, C. 2001 *Bottled Water: Understanding a Social Phenomenon*. Report commissioned by the World Wide Fund for Nature (WWF).
- Finucane, M., Alhakami, A., Slovic, P. & Johnson, S. 2000 The affect heuristic in judgments of risks and benefits. *J. Behav. Decision Making* **13**, 1–17.
- Foltz, F. 1999 Science, pollution, and clean drinking water: choosing between tap water, bottled water, and home purification. *Br. Sci. Technol. Soc.* **19**(4), 300–309.
- FWR (Foundation for Water Research) 1996 *Tap Water Consumption in England and Wales: Findings from the 1995 National Survey*. Report No DWI0771.
- Grondin, J., Levallois, P., Moret, S. & Gingras, S. 1996 The influence of demographics, risk perception, knowledge, and organoleptics on water consumption patterns. *Proc. of the AWWA Annual Conference: Management and Regulations* A. AWWA, Denver, pp. 537–546.
- Hammit, J. 1990 Risk perceptions and food choice: an exploratory analysis of organic- versus conventional-produce buyers. *Risk Analysis* **10**(3), 367–374.
- Howard, B. 2003 Message in a bottle: despite the hype, bottled water is neither cleaner nor greener than tap water. *E/The Environ. Mag.* **XIV**(5).
- Hunter, P. 1995 A review: The microbiology of bottled natural mineral waters. *J. Appl. Bacteriol.* **74**, 345–353.
- IFEN (Institut Français de L'Environnement) 2000 La préoccupation des français pour la qualité de l'eau. *Les Données de L'Environnement* **57**, 1–4.
- Lalumandier, J. & Ayers, L. 2000 Fluoride and bacterial content of bottled water vs tap water. *Arch. Fam. Med.* **9**, 246–250.
- Levallois, P., Grondin, J. & Gingras, S. 1999 Evaluation of consumer attitudes on taste and tap water alternatives in Quebec. *Wat. Sci. Technol.* **40**(6), 135–139.
- Lonnon, K. 2004 *Bottled Water Drowns the Competition*. Available at: <http://www.ferret.com.au/articles/98/0c01fc98.asp> (accessed 18-06-04).

- Luckow, T. & Delahunty, C. 2004 Which juice is 'healthier'? A consumer study of probiotic non-dairy juice drinks. *Food Qual. Prefer.* **15**(7–8), 751–759.
- Olson, E. 1999 *Bottled Water: Pure Drink or Pure Hype?* Natural Resources Defense Council (NRDC), New York.
- Perrier 2004 *Why is Perrier Coming Out with a PET Bottle?* Available at: <http://www.perrier.com/EN/faq/rubrique16.asp> (accessed 17-07-04).
- Petrecca, L. & Kramer, L. 1999 Evian pours \$20 mil into luxury. *Advertising Age* **70**(17), 8.
- Ramón Redondo, R. & Yélamos, J. 2005 Determination of CO₂ origin (natural or industrial) in sparkling bottled waters by ¹³C/¹²C isotope ratio analysis. *Food Chem.* **92**(3), 507–514.
- Rosenberg, F. 2003 The microbiology of bottled water. *Clin. Microbiol. Newsletter* **25**(6), 41–44.
- Saleh, M., Ewane, E., Jones, J. & Wilson, B. 2001 Chemical evaluation of commercial bottled drinking water from Egypt. *J. Food Compos. Anal.* **14**(2), 127–152.
- Shermer, M. 2003 Bottled twaddle: is bottled water tapped out? *Sci. Am.* **289**(1), 33.
- Slovic, P. 1993 Perceived risk, trust, and democracy. *Risk Anal.* **13**(6), 675–682.
- Sweney, M. 2004 Perrier overhauls packaging with risqué design. *Marketing* (UK) 19 May, 3.
- Sydney Water Corporation 2000 *Five Year Drinking Water Quality Management Plan – July 1999 to June 2004*. Final version. Sydney Water Corporation, Sydney.